

VOLUME 02

MAY, 2019

NUMBER 01



# **BEST EVIDENCE** *of* **Chinese Education**



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**NEWSLETTER**

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## **Does “School Transfer” Promote Students’ Achievements? - A Research Based on PISA 2015**

*By Guangjun Shi*

A STUDY published in *Social Science of Beijing* focuses on the relationship between student transfer and student academic achievement, using HLM and PSM methods to analyze PISA 2015 data. In this study, students’ academic performance and student achievement motivation are used to represent students’ academic achievement, and school transfer is the core independent variable. In the HLM model, the relationship between school transfer and academic achievement is explained from both the individual level and school level.

The main conclusions and discussions are as follows:

- At the student level, school transfer has a negative impact on students’ academic performance and achievement motivation. The study finds that students with transfer experience in the multi-layer linear model have a lower academic score of 6.97, and the scores tend to match the secondary school performance by 12.86. In general, transfer is not conducive to the improvement of students’ academic performance. The student achievement motivation will also be weakened by the transfer experience, and the two methods estimate that transferring students reduced academic motivation by about 0.06.
- At the family level, transfer should not be a mitigation of parental responsibilities, and the impact of family education has become increasingly prominent. The study found that the proportion of students’ families’ influence on their academic development has gradually expanded, and the impact on academic performance has increased from 46% to 58%, and the impact on achievement motivation has increased from 96% to 97%. In general, students and families themselves have become an important part accounting for academic change.
- At the social level, appropriate transfer can reduce the solidification of education class and promote educational equity. . The study found that although transfer has negatively affected students’ academic performance and achievement motivation, in terms of performance, the interaction between transfer and ESCS is also significantly nega-

tive, which indicates that school transfer can weaken the influence of family socioeconomic status on the development of students' academic performance to some extent. And reduce the gap in academic performance between students caused by ESCS, so that students with weak family background can obtain better educational opportunities through transfer.

- Based on the above conclusions, it is suggested that home-school co-education ecology should be constructed to awaken the educational responsibility of the family and clarify the responsibility of family education. At the same time, the school should pay attention to the guidance of transfer students and reduce the negative effects of transfer by paying attention to their academic performance and psychological adaptability. From the perspective of the government, it is necessary to coordinate policy resources, increase investment in education in weak and backward areas, and build a more equitable and benign education environment, and finally improve the distribution system and regulate the influence of family's social and economic status.

*Source: Social Science of Beijing, 2019, 189(1):77-86.*

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NEWSLETTER

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## **Parental Autonomy Support and Adolescents' Future Planning: The Mediating Role of Basic Psychological Needs and Personal Growth Initiative**

*By Dan-jia Xu, Kai Dou*

**A** STUDY published in *Psychological Development and Education*, based on the theory of self-determination, investigates the relationship between parental autonomy support and future planning of teenagers, as well as the chained mediating effect of basic psychological needs and personal growth initiative. A questionnaire survey is conducted among 562 students of four schools (2 junior high schools and 2 high schools) in Guangzhou.

The results show that:

- Parental autonomy support significantly positively predicts the future education planning of adolescents, but has no significant effect on the prediction of future career planning;
- Basic psychological needs and personal growth initiative have significant chained mediating effect on parental autonomy support for teenagers' future career planning;
- After bring the mediating effect of basic psychological needs and personal growth initiative into the relationship, parental autonomy support has significant negative residual effect on future career planning, but that on future education planning is not significant. This indicates that the influence of parental autonomy support on the future planning of teenagers may have a bad side.

Therefore, basic psychological needs and personal growth initiative are important internal factors influencing the relationship between parental autonomy support and future planning of adolescents.

*Source: Psychological Development & Education, 2019, 35(1): 26-34.*

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## **Online Parent-adolescent Communication and Depression among Adolescents: The Mediating Role of Online Social Capital and Its Gender Difference**

*By Huanyou Chai, Chunyu Chen, Changying Duan, Caifeng Zhu, Xiaojun Sun*

A STUDY published in *Psychological Development and Education* explores the impact of online parent-adolescent communication on depression, and examines the mediating effect of online social capital on the two, as well as the moderating effect of age. In this study, a sample of 549 adolescents is investigated with questionnaires, and SPSS 21.0 and SPSS macro research method compiled by Hayes (2012) are used to draw the following conclusions:

- After controlling for age, gender and offline parent-adolescent communication, online parent-adolescent communication negatively predicts adolescents' depression.
- Online social capital fully mediates the relationship between online parent-adolescent communication and adolescents' depression.
- The mediating effect of online social capital is moderated by age. Compared to early adolescents, the mediating effect is more profound in middle adolescents.
- Based on the above conclusions, the author suggests that teenagers and their parents should communicate more with each other through the Internet. At the same time, parents and teachers should communicate with teenagers online according to the age characteristics of teenagers in different periods, so that teenagers can perceive more online social capital and alleviate their depression.

*Source: Psychological Development & Education, 2019, 35(1): 112-120.*

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**NEWSLETTER**

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**Parental Involvement Styles and Children's Academic Achievement**

*By Xiaorui Huang, Guiqing An*

A STUDY published in *Preschool Education Research* analyzed the impact of parental involvement on children's learning outcomes. In this paper, the latent class analysis (LCA) was used to classify the 12,575 parents surveyed, and four types of parental participation were obtained, namely, supportive type, general type, strict type and free-range type, and it was found that the higher the socioeconomic status of parents, the higher the degree of parental involvement, and strict-type parents have the lowest and most authoritarian levels of learning support. From high to low, the learning results of children were successively supportive type, general type, free-range type and strict type, indicating that the higher the degree of parents' participation, the better the learning results of children; parents' emotional support for children is more important than their direct participation in children's learning, which means that even if parents are unable to participate in their children's learning, they can still improve their children's learning competitiveness through emotional support. The study suggests that from the preschool stage, parents should pay attention to provide learning support for children, especially to pay attention to children's learning interest and learning habits; value the quality of parent-child interaction, not just simple companionship; and attention should be paid to create a family atmosphere of democratic consultation. When there is a conflict between parents and children, children's ideas should be listened to, and emotional support should be given to children, and children's self-confidence and social adaptability should be improved.

*Source: Preschool Education Research, 2018, 11: 40-49.*

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NEWSLETTER

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## **Is the Learning Effect of Project-based Learning Happening: A Meta-analysis of 46 Experimental and Quasi-Experimental Studies**

*By Wenlan Zhang, Jiao Hu*

**A** STUDY published in *e-Education Research* explores whether project-based learning can improve students' academic achievement and what is the learning effect of project-based learning. This study uses meta-analysis method to analyze the effect of project-based learning on students' academic achievement. Through sample size, mean and standard deviation extracted from literature reading, the results of experiments in similar fields are compared and combined. This study analyzes the overall effect of project-based learning and the effect of project-based learning on multiple adjustment dimensions. The results are:

- Project-based learning has a positive effect on students' learning, which shows no difference in various types of academic achievement.
- Project-based learning has a positive impact on the learning of all phases of studying. However, there is a difference in the effects between different phases: the effect is greater in colleges and primary schools, but moderate in middle schools.
- The promotion effect of project-based learning is different in different experimental periods: the effect is the lowest after 0 to 3 months and the best over 6 months.
- Project-based learning can promote the learning of different subjects, but the effects are different. It has a significant effect on physical and chemical engineering, and a general effect on mathematical logic and other disciplines.
- The effects of project-based learning vary in the number of techniques used, and with the increase of the number of techniques used, the influence on students' learning effect increases.

The author proposes the following suggestions for project-based learning:

- Stimulate learners' interest in project exploration with challenging questions or topics as the core.
- Integrate the study of subject knowledge into the problems and activity design of project-based learning to promote students' knowledge construction and deep learning.

- Develop project-based learning earnestly and improve its effectiveness.
- Integrate various resources and technologies to realize the deep integration of information technology and course learning.
- Let learners show their knowledge, skills and abilities through diversified works or achievements.

*Source: e-Education Research, 2019, 40(2): 95-104.*

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## **Research on Learning Participation Recognition Method in Artificial Intelligence Vision-Based on a Multi-modal Data Fusion Deep Learning Experiment Analysis**

*By Xiaoming Cao, Yonghe Zhang, Meng Pan, Xi Zhu, & Hailiang Yan*

**A**N article published in *Journal of Distance Education* conducts a pilot study on how to better use artificial intelligence to assess student engagement. The study collects the image; EEG and learning log modal data of the learner during the learning process, and constructs a multi-modal fusion deep learning model for model training. Through the complete deep learning experiment, some common rules of the identification of students' learning participation are found: the recognition of learning participation and automatic recognition are highly complex, and the recognition efficiency and accuracy rate of different models vary greatly.

First, based on the learning participation recognition of students, the model based on multimodal fusion is better than the single mode model. The model of the eye image is closest to the accuracy of the multimodal fusion model, which also shows that the eye may be the most important single-modal data in learning engagement recognition.

Second, the accuracy of the image modality can reach 80%, and that of the EEG modality is about 60%. The integration of the two can achieve 87% multimodal fusion accuracy. This indicates that adding a modality, although the time consumption and computational complexity of deep learning will increase exponentially, the accuracy increase is also objective.

Third, the capacity automatic adjustment mechanism supports efficient model selection. The best model selected by the Institute has an accuracy of 81% on the test set, which indicates some basic predictive ability. At the same time, the researchers point out that the best model generalization ability obtained by the experiment may not be ideal. Building a larger data set will hopefully improve existing models.

*Source: Journal of Distance Education, 2019, 37(1): 32-44.*

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NEWSLETTER

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## **The Relationship between TV Watching Time and Infants' Language, Emotion and Social Development - A Follow-up Study**

*By Shan Lu, Ying Cui, Zhengyan Wang, Yaqing Li, Wenting Guo, Xi Liang*

**B**Y using the track design to investigate the duration of television exposure of infants between 14 and 25 months through household basic information questionnaire, a tracking study published on *Preschool Education Research* tries to assess the language and emotional social development of these infants according to Chinese Communication Development Scale and Infant Social- Emotionality Scale, so as to explore the relationship between TV time and infant language and emotional social development. The research findings are as follows:

At 14 months of age, infants who watch 30 minutes of television a day perform better on action and hand gestures than those who watch no television at all or more than 60 minutes; no association is found between TV time and language development at 25 months of age; and there is also no association between language development at 25 months and time spent watching television at 14 months.

The cross-age comparison of TV viewing time shows that infants who do not watch TV daily have more peer aggression, but they do better at paying attention than those who watch TV for less than 15 minutes or for more than 60 minutes.

Infants who watch TV for less than 15 minutes have the most implicit behavioral problems and anxious behaviors; infants who watch 30 minutes of television perform better in the areas of competence and attention than those who watch less than 15 minutes or more than 60 minutes, and this group have better empathy than the other groups.

The author suggests that since the influence of TV watching time on infant' language and emotional social development is both positive and negative, parents should attach great importance to it and adopt reasonable ways to actively guide infants to develop good TV watching habits, so as to promote the healthy development of their language and emotional social development.

*Source: Preschool Education Research, 2018, 287(11): 17-28.*

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**NEWSLETTER**

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## **The Influence of Classroom Information Technology Use on Students' Mathematics Academic Achievements: An Empirical Study Based on PISA 2012 Mathematical Test Data**

*By Zizhi Lin, Dianshun Hu*

CAN information technology promote students' achievement? A recent study published in *China Education Journal* explores the impact of classroom information technology use on students' academic performance in mathematics.

Using the PISA2012 mathematics test data, Zizhi Lin and Dianshun Hu take both teachers' and students' classroom ICT use as the independent variables and student's mathematics test results as the dependent variable, and construct the structure equation model with students' mathematical literacy and mathematical ICT ability as mediating variables to study the influence of classroom information technology on students' academic performance in mathematics. The research conclusions are as follows:

- Teachers' classroom ICT use has a direct positive effect on students' mathematical literacy (The Path Correlation Coefficient: +0.635), and an indirect effect on students' mathematics test results, and students' mathematics literacy plays a full intermediary role in teacher classroom ICT use for students' mathematics test results.
- Teachers' use of dynamic geometry mathematics software has a better positive effect. The correlation coefficients between intuitive ICT skills (T1, T3, and T7) and mathematics test scores were 0.557, 0.417, and 0.518, respectively. The correlation coefficients between students' mathematics literacy are 0.614, 0.497, and 0.588, respectively. The correlation coefficient is high and significant.
- Students' use of ICT in class has a negative effect of masking effect. Students' use of ICT in class has a significant negative impact on their mathematical literacy (The Correlation Coefficient: -0.398), but a significant positive effect on their mathematical ICT ability (The Correlation Coefficient: +0.402). The masking effect after positive and negative offset results in an insignificant negative effect on the results of the machine test. Significant negative impact (the effect value: -0.23).

- The masking effect of positive and negative offsets in the co-use of ICT between teachers and students results in an insignificant effect on students' mathematics performance. The use of ICT by teachers in class positively affects students' scores in the computer test of mathematics, while the use of ICT by students' in class negatively affects their scores in the computer test of mathematics. The comprehensive effects of the two have a mutual offsetting masking effect. (The Total Effect Value: +0.35)

Therefore, the author suggests that teachers should actively advocate the use of ICT in math class and be cautious about the use of ICT in students' math class, continuously exert the advantages of DGS, and fully exploit the teaching potential of CAS software; meanwhile, the evaluation method of students' mathematics ICT ability should be improved to play an important role in mathematics teaching.

*Source: China Education Journal, 2018, 38(12): 70-76.*

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## **What Professional Learning Community Do Chinese Teachers Need? - An Investigation on Teachers' Job Satisfaction and Teaching Efficacy**

*By Xin Zheng, Aixiang Shen, Hongbiao Yin*

A STUDY published in *Global Education* focusing on PLC (Professional Learning Community), examines whether the professional cooperation of Chinese teachers shows the core characteristics of professional learning community, and analyzes these characteristics in different genders, teaching ages, and school locations. The study selects two variables closely related to teacher's teaching – teaching satisfaction and teacher's self-efficacy, and investigates 1,008 elementary school teachers in Chongqing, Shanxi, and western Yunnan. Confirmatory factor analysis (CFA) is conducted on three groups of questionnaire: professional learning community, teaching satisfaction and teacher's self-efficacy questionnaire. The structural validity of each questionnaire is tested, and then the method of structural equation modeling is used to exam the effects of five elements of PLC (shared sense of purpose, collaborative activity, collective focus on student learning, sharing practice and reflective dialogue) on teaching satisfaction and teaching efficacy. The research finds that:

- The status of community cooperation of teachers in China is good. The teachers score relatively high on five core characteristics of the community. The highest grade is on collective focus on student learning, and teachers generally agree that promoting students' learning is the core task of the schools; The lowest grade is on deprived practice. In terms of teaching satisfaction, the average score of teachers is 3.96. In terms of teachers' efficacy, the highest score is on class management efficacy ( $M = 5.24$ ,  $SD = 0.68$ ), and the grades on teaching strategy and student involvement efficacy are similar, both 5.09.
- In the five-dimensional score and comparison of PLC, there is no significant difference in gender, discipline, and teaching age among primary school teachers in China. In the two dimensions of collaborative activity and collective focus on student learning, urban teachers score higher than rural teachers.
- PLC can positively influence teachers' teaching satisfaction and teaching efficacy, and the explained variance ( $R^2$ ) reaches extremely

significant level ( $p < .01$ ). First of all, collaborative activity and collective focus on student learning have no significant influence on teaching satisfaction and teaching efficacy. Even collaborative activity between teachers has negative effect on teaching satisfaction ( $\beta = -0.37$ ,  $p < .01$ ). Second, shared sense of purpose has extremely significant positive predictive effect on teaching satisfaction ( $\beta = 0.53$ ,  $p < .01$ ), with the largest impact coefficient in the whole model. At the same time, shared sense of purpose can also enhance the teachers' teaching strategies and student involvement efficacy. Thirdly, in terms of teachers' teaching efficacy, reflective dialogue is the only factor in the whole model that has significant positive effect on teaching satisfaction and efficacy.

This research guides the development of teachers PLC in China. It shows that mere form or frequency of collaborative activity between teachers cannot effectively improve teachers' teaching satisfaction and teaching efficacy; while highlighting the shared and clear goals in the community, Formulating clear medium and long-term teaching goals and promoting in-depth and specific reflective dialogue among teachers is the key to improving teachers' satisfaction and teaching efficacy in community cooperation, and is also the main challenge for teachers' professional learning community to achieve sustainable development.

*Source: Global Education, 2018, 47(12): 77-88.*

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## Where to Go to College? - Influencing Factors of Higher Education Enrollment Choices

By Qiang Li, Yamei Sun

A STUDY published in *Education Research of Tsinghua University* analyzes the factors influencing students' location choice of higher education based on the 2017-2018 questionnaire survey of 2,767 undergraduate students from 19 universities in 14 provinces.

The investigation finds that:

- In terms of influencing subject, parents are still the most important reference person, followed by the social network of relatives and friends, and the degree of market involvement is not high.
- In the aspect of personal motivation, students pay attention to the pursuit of personal development, presenting the characteristics of practicability and value, and put forward higher international requirements.
- Regarding the choice of city, the quality of education and the level of economic development are the concerns of most students. In addition, rural students are more concerned about the cost of living, while urban students are more concerned about the internationalization of the city.
- In the selection of universities, more attention is paid to majors than to universities. University rankings and major rankings have become the most important reference indicators, and the campus living environment is also one of the important considerations for students.

Based on these, the author puts forward some suggestions for improving the enrollment work of colleges and universities:

- Government and universities: it is necessary to improve the pertinence and coverage of education consultation to provide more effective information for target students; the funding for student aid should be increased and the system of grants improved.
- Colleges and universities: improve the teaching level to cultivate students into talents.
- Pay attention to and respond to social changes.
- Set up additional international exchange and cooperation projects; and pay reasonable attention to students' requirements for living environment.

Source: *Global Education*, 2018, 47(12): 77-88.

# The Correlation of Expenditure on School Level and Students' Academic Performance: Based on the Empirical Study in Western Poor Rural China

Lili Li, Hongyu Guan, Scott Rozelle

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*Abstract.* As a means to alleviate poverty, the Chinese government has been investing in education by increasing financial resources for schools. However, scholarship on the relationship between school resources and student academic performance has not reached a consensus. This study examines the relationship between school-level expenditures, a key aspect of school resources, and student academic performance. Using data collected in 94 rural primary school in designated poverty areas of western rural China, the empirical study found that school expenditures on students and teachers account for only 12% of total expenditures, while expenditures on school administration is as high as 72%. Expenditures on students and teachers (software) are positively correlated with student academic performance. However, expenditures on school administration (hardware) were negatively correlated with academic performance. These findings have strong implications for the structure of school spending and rural education.

*Best Evid Chin Edu 2019; 2(1):145-155.*

*Doi: 10.15354/bece.19.ar1031*

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**Keywords:** *Expenditure in school level; Academic performance; Hardware; Software; Rural*

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**Funding:** Higher Education Discipline Innovation and Enlightenment Program (No. B16031); Outstanding Doctoral Dissertation Supported Project of Shaanxi Normal University (No. X2015YB08).

**Conflict of Interests:** None.

## **Research Background and Problem**

**S**INCE the 18th National Congress of the Communist Party of China (CPC), the Party Central Committee, with General Secretary Jinping Xi as the core, made a series of profound expositions and comprehensive deployment of poverty alleviation and development work, and clearly defined poverty-alleviation via education as an important way to block the transmission of poverty from generation to generation. With the implementation of a series of policies on poverty-alleviation via education, enormous achievements have been made in education investment paired with an increasing growth of the investment in government finance, school and society (China Education Daily, 2017). As the key training target for education poverty alleviation and compulsory education, the educational resources and investment obtained in rural poverty-stricken areas was an achievement of breakthrough growth. According to the statistics, during the period of the 12th Five-Year Plan, 90% of the central government educational funds for transfer payment were used in the central and western regions, part of which was mainly used in poor rural areas (Zhu, 2016).

Although the funds invested in schools in poor rural areas was continued to increase, many scholars have shown that there is an imbalance in the allocation of educational resources. When the investment is uneven, the government obviously focuses on the proportion of investment in hardware. A lot of work has been done in transforming schools with weak strengths and narrowing the gaps in school hardware facilities, but not enough attention has been paid to the construction of “software” in schools (Cheng, 2015). In the process of education poverty alleviation and development, although many schools in poverty-stricken areas have been built into “the most beautiful buildings in the rural region”, the quality of education is difficult to improve; there are still serious problems in the allocation of educational resources in poverty-stricken areas (Li and Xing, 2018).

In fact, the scholarship has paid attention to the educational investment on school level and has identified its relationship with academic performance. The earliest research can be traced back to James Coleman's Coleman Report in 1966, which reportedly has little to do with school resources and students' academic performance (Coleman et al., 1966). This conclusion has aroused widespread controversy, leading many scholars to devote themselves to study the impact of school resource allocation on students' academic performance. Three major factors of school expenditure (including school expenditure, and the scale of teachers and classes) are considered as important parts of education investment (Hanushek, 2002). Studies of the relationship between school expenditures and students' achievements has also presented an inconsistent conclusion: increasing educational facilities was not enough to improve students' academic performance demonstrated by the research results of Angrist and Lavy in 1999; but Dewey et al. (2000) found that the increase of school expenditures can do improve students' academic performance.

Why did research on the relationship between school expenditure and academic performance not reach a consistent conclusion? The reasons are as follows: First, differ-

ent scholars use different variables, and the second, statistical methods are also diverse. In addition, students' academic performance may be affected by factors such as family background, in addition to the influence of school resource allocation. If ignore these variables, the final result will be biased. At the same time, few people have conducted research and analysis on the relationship between different aspects of school expenditure and students' academic performance. The goal of this paper is to analyze the expenditure on school level and to explore the relationship between different aspects of school expenditure and students' academic performance. The rest of this paper is organized as follows. The next section of the paper describes our sample selection, data, and empirical methods. The third section presents the results. The final section discusses and concludes.

## Method

### Sampling

The data were collected from the project “Survey on Basic Situation of Primary Schools in Poor Rural Areas” conducted by the Center for Experimental Economics in Education of Shaanxi Normal University. The project was carried out in May, 2015, and implemented among the rural schools in the four provinces of Q, N, G and S in northwest China.

Stratified random sampling is used to select a total of 94 rural schools among 38 poverty-stricken counties of four provinces. There are 46 schools from G province, 16 from N, 14 from Q and 18 from S. A total of 6,497 students are randomly selected from 1-2 classes in the fourth and fifth grades of each school. In the survey, half of the students in each class are randomly selected to take standardized math test, and the other half take standardized Chinese test. The distribution of the sample in each province is shown in **Table 1**. The sample size was large and the coverage was wide. Therefore, the data obtained were representative.

**Table 1. Distribution of Study Sample.**

		# of Schools	# of Students	# of Students Taking Chinese Test	# of Students Taking Math Test
	<b>Total</b>	94	6,497	3,278	3,219
<b>Province</b>	<b>G</b>	46	2,366	1,204	1,162
	<b>N</b>	16	1,955	977	978
	<b>Q</b>	14	1,230	622	608
	<b>S</b>	18	946	475	471
<b>Gender</b>	<b>Male</b>	-	3,295	1,642	1,653
	<b>Female</b>	-	3,202	1,636	1,566
<b>Grade</b>	<b>4th Grade</b>	-	3,136	1,587	1,549
	<b>5th Grade</b>	-	3,361	1,691	1,670

*Data Source: Authors' survey (2015)*

## Data Collection

The survey was consisted of three parts: the expenditures at school level; basic information of schools, teachers, students, and parents; students' mathematics and Chinese standardization tests. This corresponds to the independent variables, control variables and dependent variables in this study, which are described in three parts as follows.

### *Expenditures at School Level (Independent Variable)*

In the questionnaire of schools' basic information, we interviewed the principals towards 10 expenditure items at school level, including: public utilities expenditure, office supplies expenditure, teaching supplies expenditure, teacher welfare expenditure, teacher training expenditure and canteen worker salary expenditure, non-teacher staff salary expenditure, student learning materials expenditure, student scholarship expenditure and the expenditure on school maintenance. On the basis of the expenditure items, we divided it into four aspects: "Expenditure on students", "Expenditure on teachers", "Expenditure on schools (administrative affairs)" and "Other Expenditure". Among them, "student learning material expenditure" and "student scholarship expenditure" are classified as "Expenditure on students"; "expenditure on teacher training" and "expenditure on teacher welfare" are categorized as Expenditure on teachers; "Public utilities expenditure" "office supplies expenditure" "school maintenance expenditure" and "teaching supplies expenditure" are classified as Expenditure on schools (administrative affairs); "canteen worker salary expenditure" and "non-teacher staff salary expenditure" are classified as Other expenditures (see **Table 2**). At the same time, the expenditures on students and teachers are regarded as the expenditures on "software" of schools in this paper, and the expenditures on school (administrative affairs) as the expenditures on the "hardware" of schools.

**Table 2. Items and Aspects of Expenditure at School Level.**

	<b>Expenditure Aspect</b>	<b>Expenditure Item</b>
<b>Expenditures at School Level</b>	Expenditure on students	Student learning material expenditure Student scholarship expenditure
	Expenditure on teachers	Expenditures on teacher training Expenditures on teacher welfare
	Expenditure on schools	Public utility expenditure Office supplies expenditure School maintenance expenditure Teaching supplies expenditure
	Other expenditure	Canteen worker salary expenditure Non-teacher staff salary expenditure

*Data Source: Authors' survey (2015)*

### ***Data on Schools, Teachers, Students and Parents (Control Variables)***

In the questionnaire, we also collected the data at the levels of schools and teachers. The school level variables mainly include: the number of students in the school, the student-teacher ratio, and the service time of the school to the farthest village; Variables at the teacher level mainly include: gender of teacher, whether the first degree is college, teaching age, and whether they are working at a public school, including Chinese teacher and math teacher. A large number of studies have shown that the variables selected above about school and teacher has impact on students' academic performance (Todd & Wolpin, 2007; Sun et al., 2009; Xue and Wang, 2009).

In the questionnaire of basic information of students and their parents, we collected variables that are at student level, including age, gender, ethnicity, grade and boarding status. At the same time, the socioeconomic characteristic variables of the parents are also collected, including: their education, whether they are migrant workers, household assets. It is found that the socioeconomic characteristics variables of individuals and families selected above have great impact on students' academic performance (Fryer & Levitt, 2004).

### ***Standardized Math and Chinese Tests (Dependent Variables)***

Data on the standardized math/Chinese scores were collected from math/Chinese tests administered as part of the survey. Each student in the sample took a standardized math or Chinese test. We selected a set of standardized Chinese and math test for students to measure their academic performance. Standardized Chinese and math tests are designed to be consistent with the syllabus and have been tested for several times so as to better gauge Chinese students' academic performance.

In this study, the scores of Chinese and math are used as dependent variables; in general, the score is well represented. Because of the different subjects tested and the difficulty of the questions between different grades, the measurement methods commonly used in previous studies, such as "parents' evaluation of children's academic performance" (Xue, 2014) and the grades reported by students themselves (Dang, 2007), may cause biased.

Standard Chinese or math scores are the result of standardizing the raw scores of Chinese or math test. This comparison is performed in two grades, making the score comparable across grades. If the standard score is higher than 0, it means that the student's Chinese or math score is higher than the average score of the student.

## **Sample Characteristics**

The descriptive statistical results of sample are shown in **Table 3**.

## **Model**

**Table 3. Variable Description and Descriptive Statistics.**

Variable level	Variable	Variable description	Mean	SD
<b>Student and Parent Level</b>	Age	Year	11.5	1.09
	Gender	1 = Female; 0 = Male	0.49	0.50
	Ethnicity	1 = Han; 0 = Minorities	0.66	0.47
	Grade	1 = 5th grade; 0 = 4th grade	0.51	0.50
	Boarding status	1 = Board at school; 0 = Not board at school	0.24	0.43
	Education of father	1 = Junior high school and above; 0 = Below junior high school	0.45	0.50
	Education of mother	1 = Junior high school and above; 0 = Below junior high school	0.28	0.45
	Father migrated	1 = Yes; 0 = No	0.54	0.50
	Mother migrated	1 = Yes; 0 = No	0.28	0.45
	Household assets	Standardized household assets	0.04	1.10
	<b>Chinese Teacher-Level</b>	Gender	1 = Male; 0 = Female	0.42
First degree is college		1 = Yes; 0 = No	0.64	0.47
Teaching age		1 $\geq$ 10 yrs; 0 < 10 yrs	0.50	0.50
Work at a public school		1 = Yes; 0 = No	0.87	0.34
<b>Mathematics Teacher-Level</b>		Gender	1 = Male; 0 = Female	0.58
	First degree is college	1 = Yes; 0 = No	0.56	0.50
	Teaching age	1 $\geq$ 10 yrs; 0 < 10 yrs	0.52	0.50
	Work at a public school	1 = Yes; 0 = No	0.89	0.31
<b>School-Level</b>	Number of students in school	Unit	401	424
	Student-teacher ratio	%	17.0	20.0
	The time from school to the farthest village	Minutes	60.3	36.8

Data Source: Authors' survey (2015)

Based on the above analysis, the econometric model to analyze the impact of different aspects of school expenditure on students' academic performance is as follows:

$$Y_{is} = \beta_0 + \beta_1 \text{Expend}_s + \gamma X_i + \eta S_s + \alpha T_s + \varepsilon_i$$

Where  $Y_{is}$  is the standardized math or Chinese score of student  $i$  at school  $s$ ,  $\text{Expend}_s$  refers to the variable of expenditures in different aspects at school level, which represents the expenditures on students, teachers and school (administrative affairs) and other aspects, respectively.  $X_i$  represents the variables of student and family, including the age, gender, ethnicity, grade, boarding status, education level of parents, whether parents are migrated and family assets.  $T_s$  represents the variables at school level, including the number of students in the school, the ratio of students to teachers, and the service time from the school to the farthest village.  $S_s$  refers to the variables at the teacher level, including the gender of the Chinese or math teacher, whether the first degree is college, teaching age and whether they are working at a public school.

Holding student/household/teacher/school characteristics constant and controlling for county fixed effect,  $\beta_1$  represents the effect of expenditures in different aspects on students' academic performance (indicating that if the expenditure in a certain aspect

increases from 0 to 1, the student's Chinese or math score will change by the standard deviations of  $\beta_1$ ).

## Results

### The Proportion of Expenditure in Each Aspect at School Level

In the survey, the research team carefully recorded the expenditure amount of each aspect at school level. Based on the expenditure amount of each aspect and the amount of total expenditure, the proportion of each aspect and its expenditure is obtained by calculating. Among the expenditures of each aspect, the ratio of expenditure on students is the lowest, 4%; the ratio of expenditure on schools (administration) is up to 72%; the ratio of expenditure on teachers is 8%, and other expenditure is 15%. It can be seen that expenditure on students and teachers is very low, but expenditure on school hardware (school administration) is very high.

### The Relationship between Expenditures of Each Aspect at School Level and Students' Chinese Academic Performance

As shown in **Table 4**, holding student/household/teacher/school characteristics constant and controlling for county fixed effect, there is a positive correlation between the expenditures on students and teachers and students' standardized Chinese scores. While the expenditures on school (administrative affairs) are negatively correlated with students' Chinese standardization scores; other expenditures have nothing to do with students' standardized Chinese scores.

**Table 4. The Correlation between Expenditures in Each Aspect at School Level and Students' Chinese Academic Performance.**

	Standardized Chinese Score			
	(1)	(2)	(3)	(4)
Expenditures on Students	1.34***(0.42)			
Expenditures on Teachers		0.83**(0.34)		
Expenditures on Schools			-0.34***(0.16)	
Other Expenditures				-0.12(0.22)
Controlling for Child and Parent Characteristics	Yes	Yes	Yes	Yes
Controlling for Chinese Teacher Characteristics	Yes	Yes	Yes	Yes
Controlling for School Characteristics	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
N	3,278	3,278	3,278	3,278
R <sup>2</sup>	0.27	0.27	0.27	0.27

*Notes: Robust standard error adjusted for clustering at the school level are reported in parentheses \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%*

*Data Source: Authors' survey (2015)*

Specifically speaking, if the expenditure on students increases from 0 to 1, the students' Chinese scores will be increased by 1.34 standard deviations, it can also be said that if the expenditure on students increases by 1 percentage point, the students' Chinese scores will be increased by 0.0134 standard deviations, the increase of scores is statistically significant at the 1% level. If the expenditure on teachers increases from 0 to 1, students' Chinese scores will be increased by 0.83 standard deviations (if the expenditure on teachers increases 1 percentage, it will lead to an increase of 0.0083 standard deviations on students' Chinese scores), the increase in scores is statistically significant at the 5%; If the expenditure on school increases from 0 to 1, the students' Chinese scores will be decreased by 0.34 standard deviations (if the expenditures on school increases by 1 percentage point, it will cause a decrease of 0.0034 standard deviations on students' Chinese scores), the reduction of score is statistically significant at the 1% level; Other expenditure have nothing to do with students' Chinese scores.

### The Relationship between Expenditures of Each Aspect at School Level and Students' Math Academic Performance

As shown in **Table 5**, holding student/household/teacher/school characteristics constant and controlling for county fixed effect, expenditures on students and on other aspects are positively correlated with student's standardized math scores; expenditures on school (administrative affairs) are negatively correlated with the student's standardized math scores; the expenditures on teachers have nothing to do with the student's standardized math scores.

**Table 5. The Correlation between Expenditures in Each Aspect at School Level and Students' Math Academic Performance.**

	Standardized Math Score			
	(1)	(2)	(3)	(4)
Expenditures on Students	2.00***( 0.47)			
Expenditures on Teachers		0.46( 0.36)		
Expenditures on Schools			-0.57***(0.17)	
Other Expenditures				0.39*(0.23)
Controlling for Child and Parent Characteristics	Yes	Yes	Yes	Yes
Controlling for Math Teacher Characteristics	Yes	Yes	Yes	Yes
Controlling for School Characteristics	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
N	3,219	3,219	3,219	3,219
R <sup>2</sup>	0.20	0.20	0.20	0.20

Notes: Robust standard error adjusted for clustering at the school level are reported in parentheses \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%

Data Source: Authors' survey (2015)

Specifically, if expenditure on students increases from 0 to 1, the student's math score will increase by 2 standard deviations. It can also be said that if expenditure on students increases by 1 percentage point, the student's math score increases by 0.02 standard deviations, the increase of scores is statistically significant at the 1% level; if the other expenditures increase from 0 to 1, the student's math score will increase by 0.39 standard deviations (if other expenditure increases 1 percentage, it will lead to an increase of 0.0039 standard deviations on students' math scores), the increase in scores is statistically significant at the 10%; If the expenditure on school increases from 0 to 1, the students' math scores will be decreased by 0.57 standard deviations (if the expenditures on school increases by 1 percentage point, it will cause a decrease of 0.0057 standard deviations on students' math scores), the reduction of score is statistically significant at the 1% level; expenditure on teachers have nothing to do with students' math scores.

### **The Relationship between the Expenditures on Software and Hardware and Students' Academic Performance**

Taking the expenditures on students and teachers as the expenditure on "software" and the expenditure on school (administrative affairs) as the expenditure on "hardware", we make a further analysis of the relationship between the expenditures on "software" and "hardware" and students' Chinese and math academic performance. The results show that, as shown in **Table 6**. Expenditures on "software" has a significant positive impact on students' Chinese and math scores, while the expenditures on "hardware" has a huge negative impact on that. Among them, if the expenditure on "software" increases from 0 to 1, students' Chinese score will be increased by 1 standard deviation, and students' math score will be increased by 0.91 standard deviations, the increase of scores is statistically significant at the 1% level. If expenditure on "hardware" increases from 0 to 1, students' Chinese and math scores will be decreased by 0.34 standard deviations and 0.57 standard deviations respectively, the reduction of scores is statistically significant at the 1% -5% levels.

### **Conclusions and Suggestions**

This study used representative data to explore the current state of expenditure on school level in poor rural primary schools and correlation to students' academic performance. According to results, primary schools in poor rural areas are over-emphasizing the expenditure on school administration ("hardware"), up to 72%, while expenditure on students and teachers ("software") accounted for only 12%. The results showed that in terms of expenditures on "software", both expenditures on students and teachers are significantly positively correlated with students' Chinese and mathematics performance, but the "hardware" expenditures of school administration are significantly negatively correlated with students' Chinese and mathematics performance. Based on the results, we propose corresponding countermeasures and recommendations.

**Table 6. The Correlation between Expenditures on Schools' Software and Hardware and Students' Academic Performance.**

	Standardized Chinese Score		Standardized Math Score	
	(1)	(2)	(1)	(2)
Expenditures on Software	1.00***(0.26)		0.91***(0.27)	
Expenditures on Hardware		-0.34**(0.16)		-0.57*** (0.17)
Controlling for Child And Parent Characteristics	Yes	Yes	Yes	Yes
Controlling for Chinese/Math Teacher Characteristics	Yes	Yes	Yes	Yes
Controlling for School Characteristics	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
N	3,278	3,278	3,219	3,219
R <sup>2</sup>	0.27	0.27	0.20	0.20

Notes: Robust standard error adjusted for clustering at the school level are reported in parentheses \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%

Data Source: Authors' survey (2015)

## To Improve and Optimize the School Expenditure and Increase the Expenditures on Students and Teachers

At present, the expenditure structure at school is of “material-oriented” model, that means investment in schools’ “hardware” is higher, and investment in school’s “software” is lower. However, there is a positive correlation between the expenditure of the school “software” and students’ academic performance. In terms of this, we need to change the existing expenditure of “material-oriented” model, and increase the proportion of expenditures on students and teachers, which is to make the transformation of the investment mode of “material-oriented” to “people-oriented” so as to stimulate the creativity of students and teachers, and jointly improve the creative vitality of talents.

## Targeted Measures Should Be Taken in the Process of Education Poverty Alleviation

In the process of implementing the strategy of targeted education poverty alleviation, attention should be paid to the “precision” and “accuracy” of fiscal policies. In order to achieve targeted poverty alleviation via education, on the one hand, the object should be targeted, and the resources of education poverty alleviation should be effectively allocated to the people who have urgent needs: the investment of software supporting service for students and teachers should be improved to maximize the efficiency of resource allocation. On the other hand, the measures should be taken precisely: improve the teaching ability of teachers in poor areas through a variety of ways to promote the professional development of teachers; the financial aid to students is transformed from

indemnificatory to all-round pattern, so that students and teachers in poor areas can be assisted in the aspects of ideology, abilities and growth (Liu & Liu, 2018).

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Received: 10 April 2019

Revised: 23 April 2019

Accepted: 05 May 2019

*The Chinese version of this article has been published in J East Chin Normal Univ (Edu Sci) 2018; 36(6):100-106,158. The English version has been authorized for being publication in BECE by the author(s) and the Chinese journal.*

李莉莉, 关宏宇, 罗斯高. 学校层面的支出和学生学业表现的相关关系—基于西部贫困农村地区的实证研究. *华东师范大学学报(教育科学版)* 2018; 36 (6):100-106, 158.



# Teacher Support, Reading Strategy and Reading Literacy: A Two-Level Mediation Model

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*Abstract.* The purpose of this study was to use the data consisted of 5,115 fifteen-year-old Shanghai students in 152 schools from the PISA 2009, by building cross-level mediation model, to explore how the influence on students' reading literacy from teachers' support through learning strategy. The results revealed that teacher support is positively directly related to students' reading literacy. Students' learning strategy (such as elaboration strategy and control strategy) and metacognition strategy were cross-level mediators between teachers' support and their students' reading literacy. But memory strategy in the learning strategy does not play a cross-level mediation effect.

*Best Evid Chin Edu* 2019; 2(1):157-170.

Doi: 10.15354/bece.19.ar1036

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**Keywords:** Teacher support; Learning strategy; Reading literacy; Hierarchical liner modeling; PISA

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## Introduction

**R**EADING comprehension is the process by which readers obtain meaning from literal symbols and is one of the most unique cognitive activities of human beings. Reading ability has great significance to students' academic success and personal development. Through reading, people can understand, use, reflect on and participate in texts in order to achieve personal goals, develop personal knowledge and potential, and participate effectively in social activities. In the Program for International Student Assessment (PISA), reading ability is also known as reading literacy.

The Program for International Student Assessment is a worldwide study by the Organization for Economic Co-operation and Development in member and non-member nations intended to evaluate educational systems by measuring 15-year-old school pupils' scholastic performance on reading literacy, mathematical literacy, scientific literacy and financial literacy (OECD, 2013).

The test sampling of PISA is scientific, and the sample have a wide coverage and high representativeness; and it has high quality control in questions design, data collection and cleaning process, so PISA has high reliability and reputation. As a result, data and results from PISA have been widely concerned by governments, educational management institutions and academic researchers (Martin, Liem, Mok, & Xu, 2012; Rogers, 2014; Zhang & Xin, 2012).

This study intends to use the data of PISA2009 to explore the influencing factors of students' reading literacy. Reading literacy is influenced by the external factors of students (such as school atmosphere, teacher support, family socioeconomic status, etc.) and internal factors (such as learning strategies, learning motivations, etc.) (Kigel, McElvany, & Becker, 2015; Netten, et al, 2014). This study focuses on the influence of teacher support and learning strategies on students' reading literacy, proposes and verifies a cross-level mediating effect model: teacher support on students' reading learning not only can directly affect students' reading literacy, but also can influence reading literacy indirectly by influencing students' learning strategies. In this hypothesis model (**Figure 1**), teacher support is a level 2 organizational variable, learning strategy and reading literacy are the level 1 individual variables, so this is a cross-level mediation model of 2-1-1 structure.

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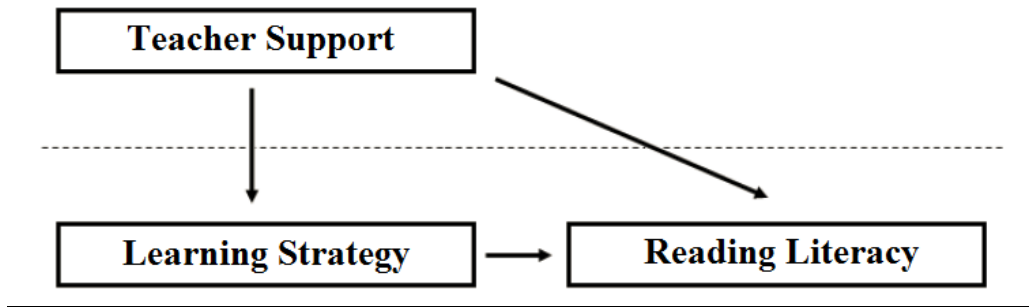
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**Funding:** This work was supported by the National Social Science Foundation of China (*The Ideas and Results of PISA and Its Implications for China's Education Examination*, CBA130127), 13th Five-Year Plan Research Project of Philosophy and Social Science in Guangdong, China (GD17XXL02), and Innovation Project of Educational Science in Guangdong, China (2016GXJK032).

**Conflict of Interests:** None.

**Figure 1. Hypothesis Model.**

### **The Influence of Teacher Support on Students' Reading Literacy**

Reading comprehension includes two aspects: vocabulary recognition and text comprehension, the former refers to the processing of vocabulary sound, font and meaning during reading, which is closely related to the reader's vocabulary knowledge and decoding ability; The latter refers to the process of encoding chapter information into memory to form a coherent representation, influenced by internal factors such as reader's prior knowledge, learning strategies, meta-cognition, and external factors such as the nature of the article and reading scenarios. Alvermann, Unrau, and Ruddell pointed out that if a part of the reading fails to function properly, the reader cannot understand the meaning of the article (Alvermann, et al, 2013). It can be seen that reading tasks have high requirements for students' cognitive processing ability and learning strategies. The improvement of students' cognitive processing ability and the use of learning strategies not only cannot be separated from school education, and also cannot be separated from the teacher support.

School education is an educational activity with a clear purpose and undertaken by professional teachers. The teacher support is considered to be an important factor affecting students' reading ability and reading comprehension (Law, 2011). It has been confirmed by a lot of research on reading teaching and teacher support. The National Reading Panel and the National Institute of Child Health and Human Development (2000) reviewed the empirical research on reading instruction for decades, and summarized 16 reading teaching methods from more than 200 studies. According to reports from various institutes, they found that monitoring comprehension, asking questions, organizing images, analyzing story structures and abstracting can effectively improve readers' reading literacy. A series of studies by Ling-po Shiu and Qishan Chen showed that students' self-regulated reading is not as effective as external feedback and support for students' reading comprehension (Chen & Shiu, 2007, 2008; Shiu & Chen, 2013). According to a survey conducted by Weihua Qian, the extracurricular reading of middle school students is most affected by teachers, because teachers are the people who have the most contact with students except parents and society, and can give students the most support. This is true for extracurricular reading outside the classroom, especially

for the development of reading literacy in the classroom (Qian, 2013). Cong Yu pointed out that language teachers should be the motivators of students' reading interest, the trainer of reading method, the evaluators of reading effects and the creators of reading atmosphere (Yu, 2016). It can be seen that for reading teaching, teacher support is crucial to students' reading literacy, teachers can use systematic, clear and direct methods to train students' basic reading ability and develop their reading literacy.

Therefore, we proposed that the hypothesis H1: Teacher support has a direct positive effect on students' reading literacy

## **The Influence of Teacher Support on Students' Learning Strategies**

Teachers are not only the professors' instructors of students' reading knowledge and reading ability, but also the promoters of their reading learning strategies. In PISA2009, the learning strategy has two aspects of contents investigated. One is the examination of the meta-cognitive strategy of reading, that is, the student's level of awareness to which is an effective reading strategy, it. It is divided into the understanding and remembering information strategies, and the generalizing information strategies; the second is the investigation of the application of three learning strategies: control strategy, memory strategy and accurate processing elaboration strategy. Reading comprehension understanding and remembering information strategies in metacognitive strategies refers to which strategies students consider to be effective in understanding and memorizing chapter content and how effective they are; the summary generalizing information strategy refers to which strategies students consider to be effective of summarizing the content of the chapter and how effective they are. Among the three strategies used in learning strategies, memory strategies and accurate processing elaboration strategies are cognitive strategies, while control strategies which are monitoring their own learning activities and are meta-cognitive strategies.

Teaching research has always emphasized the influence of teacher support on the use of students' reading strategies, emphasizing that teacher support should stimulate students' background knowledge and use various schemas to help understanding. At the same time, they should pay attention to teaching students to use various strategies to monitor their reading process and learn to use strategies accordingly to help understanding (Yuan, et al., 2015). Teacher support is an important factor influencing students' learning strategies. By presenting challenging assignments to students, teachers can motivate student's ability of exploring, interpreting, and sharing ideas and concepts, as well as the use of memory and accurate processing elaboration strategy. Teachers set cognitive cognition confliction in reading teaching, allowing students to experience different ideas, explanations and solutions, to improve their metacognitive strategies such as reading monitoring and reading control regulating. Even the communication and interaction between teach-

ers and students, and the way teachers deal with students' mistakes will affect the use of students' learning strategies (Dietrich, et al., 2015).

Therefore, this study proposes hypothesis H2: Teacher support has a positive effect on students' learning strategies.

### **Mediating Role of Student's Learning Strategies**

The learning strategies of reading can have a direct impact on the production of reading literacy. Readers with high cognitive and metacognitive strategies can link the information they read with existing knowledge, monitor the understanding process, and constantly adjust their cognition to improve reading literacy (De Naeghel, et al, 2012).

The learning strategy of reading has strong plasticity and can be cultivated through effective teaching support. Teaching models such as reciprocal teaching (RT) (Palinscar & Brown, 2012), transactional strategies instruction model (TSI) (Hilden & Pressley, 2007), interactive strategy training for active reading and thinking (iSTART) (Jackson, et al, 2015), concept-oriented reading instruction (CORI) (Guthrie, et al, 2012) emphasize the promoting effect of the teacher support on the students' use of various reading cognitive and metacognitive strategies, which is supported by a large amount of empirical evidence.

Therefore, it can be inferred that teacher support can improve students' reading engagement by helping students adjust their learning strategies, answering students' questions and providing positive feedback, thus affecting reading literacy. Of course, for different dimensions of learning strategies, student's response for the usefulness of teacher support is different. For example, studies have shown that asking students to read aloud and recite are generally considered by students to be incapable of arousing interest, and answering questions and discussing their own opinions on text content is the best way to let the student engage in reading (Finn & Zimmer, 2012). That is to say, teacher support affects reading literacy through learning strategies has different mechanisms. Reading comprehension can be carried out at multiple levels, either as a surface coding of reading materials or as a deep understanding of reading materials by reasoning based on surface coding. In reading teaching, the teacher support mainly focuses on how to better construct the meaning of reading materials. Teachers will use clarification, contact, summary and other methods in teaching to guide students to understand and process reading materials. Students who under teacher support will also monitor their own comprehension and control their reading process in a timely manner. In this process, memory strategies, elaboration strategies, control strategies, understanding and remembering information strategies, and generalizing information strategies may play different roles between teacher support and student reading. The more easily the strategies are influenced by the teacher support, such as elaboration and control strategies, the more obvious the cross-level mediation effect is.

In summary, this study proposes the following assumptions, H3: The student's learning strategy can positively predict reading literacy; H4: Learning strategy is a cross-level mediator between teacher support and student reading literacy.

## **Application of Cross-Level Mediation Effect Model**

Individual attitudes and behaviors are influenced by many factors from individuals, groups, and societies; this has led today's researchers to focus on the function and explanatory power of multi-level variables for dependent variables (Klein & Kozlowski, 2000; Li & Chang, 2013). In this study, students were nested in the school. The student's reading literacy and learning strategies belong to the first level of the data structure, and the teacher's reading support is the second level of the data structure. If we ignore the hierarchical structure of the data, use traditional linear models (such as analysis of variance and regression analysis) to analyze data, it will not only weaken the explanatory power of the theory, but also reduce the externality effect of the research results (Zhang, 2010). At present, there are few research reports that use multi-level perspectives to analyze the factors affecting academic literacy, especially for Chinese students. Chen et al. (2017) pointed out that PISA data has multiple levels, and different levels will affect each other. It is recommended that researchers use advanced statistical methods that are more suitable for PISA data patterns and features, such as Hierarchical Linear Models to perform data analysis and model construction. Therefore, this study uses a multi-level linear model to comprehensively examine the influence of teacher support and learning strategies on reading literacy, and has certain value in both theoretical construction and analysis methods.

## **Method**

### **Sample**

A total of 5,115 students from Shanghai city who participated in the PISA 2009 test were tested and with age between 15 years and 3 months to 16 years and 2 months. Among them, girls were 2,587 (50.6%) and boys were 2,528 (49.4%). 52 were in the 7th grade (1.0%), 208 were in the 8th grade (4.1%), 1,924 were in the 9th grade (37.6%), 2,908 were in the 10th grade (56.9%), 22 were in the 11th grade (0.4%), 1 person was in grade 12. All the students were from 152 schools in Shanghai, among them, there were 2 schools both had 21 participants, 1 school for 3 participants, and the remaining 149 schools had 30-35 participants.

### **Research Variable**

#### ***Teacher Support***

The teacher support uses the "Inspired Reading Participation Strategy" score in PISA as an indicator, which measures the teacher support on the motivating learning strategies and reading skills of the students. The frequency of the 7 teaching activities (such as "require students to explain the meaning of the text") by the teacher in the language lesson was reported by students, on a 4-point scale, from "no or almost no" to "in all

lessons”, the  $\alpha$  coefficient is 0.78. Each item score is combined with a weighted likelihood estimate to synthesize the total score. Teacher support is a variable at the school level.

### ***Learning Strategy***

Learning strategies are variables at the student level, including the use of learning strategies and reading metacognitive strategies. There are 13 items in the use of learning strategies. Among them, the memory strategy subscale has 4 items, the  $\alpha$  coefficient is 0.74; the elaboration strategy contains 4 items, and the  $\alpha$  coefficient is 0.72; the control strategy has 5 items with an  $\alpha$  coefficient of 0.72. There are 11 items for reading metacognitive strategies. Among them, understanding and remembering the information strategy contain 6 items, and the  $\alpha$  coefficient is 0.83; the generalizing information strategy has 5 items, the  $\alpha$  coefficient is 0.80. All of the above items were assessed on a six-point scale, from “not at all useful” to “very useful”.

### ***Reading Literacy***

The PISA reading test examines reading literacy by setting up four test scenarios based on personal purpose, public purpose, occupational purpose, and educational purpose, through two kinds of reading materials: continuous reading texts (such as explanatory texts, argumentations) and non-continuous texts (graphs, tables) to investigate the three levels of reading literacy: retrieving and inference, integrating and interpreting, and evaluating and reflecting. The PISA2009 reading test consisted of 13 sets of test questions, the tested students were randomly assigned to a set of questions, and the students’ original scores were transformed and estimated using the item response theory (IRT) technique. The reading literacy test score was the average of five plausible values ( $\alpha$  coefficient of 0.92) for the total score of the reading cognitive test. This variable is at the student level.

## **Data Analyses**

Data analyses and model construction were carried out using SPSS 20.0 and HLM 6.08. In this study, the teacher support is a level 2 organizational variables, and the students’ reading literacy and learning strategies belong to level 1 variables, and they have a nested relationship in the data structure. Therefore, this model is a cross-level of low-level mediation model, a 2-1-1 model. According to the recommendations of Fang (2010) and Zhang (2009), in order to separate the between-group mediation effect and within-group mediation effect, and to more accurately estimate the cross-level mediation effect, we centered mediating variables of the level 1 by group mean and at the same time, the group mean is placed in the level 2 intercept equation, then follow the steps below to perform model checking.

In the first step, a zero model (model  $M_0$ ) is tested to determine if multi-level analysis is required. The  $M_0$  decomposes the equation into intra-class variance caused by individual differences and between-class variance caused by group differences; we

examine the percentage of the variance of the dependent variable explained by the second level of variables, i.e. Intra-class Correlation Coefficient (ICC). A multi-level analysis is necessary if the ICC is greater than 0.06. In the second step, the direct effect  $c$  of the level 2 independent variable  $X_j$  on the level 1 dependent variable  $Y_{ij}$  (model  $M_1$ ) is examined. In the third step, the direct effect  $a$  of the independent variable  $X_j$  on the dimensions of the mediator  $M_{ij}$  (model  $M_2$ ) is examined. In the fourth step, the effects  $c'$  and  $b$  of the independent variable  $X_j$  and the mediator  $M_{ij}$  are simultaneously applied to the variable  $Y_{ij}$ , (model  $M_3$ ). According to the results of the significance test of each regression coefficient, it can be judged whether or not the hypothesis model is verified.

## Result

### Descriptive Statistics

The descriptive statistical results are shown in **Table 1**. Since the teacher support is a level 2 variable, there is no correlation coefficient with the variables of t level 1. In level 1 variables, except that the correlation coefficient between the memory strategy and the generalizing information strategy is not significant, the correlation coefficients among the other variables are significant at 0.01 level.

Table 1. Variable Description Statistics.									
	M	SD	1	2	3	4	5	6	7
1 Teacher Support	0.14	0.88	–						
2 Memory Strategy	-0.06	0.8	–	–					
3 Control Strategy	-0.28	0.82	–	0.54**	–				
4 Elaboration Strategy	0.16	0.82	–	0.40**	0.61**	–			
5 Understanding and Remembering Information Strategies	0.14	0.97	–	0.40**	0.15**	0.07**	–		
6 Generalizing Information Strategy	0.06	0.9	–	0.02	0.16**	0.10**	0.39**	–	
7 Reading Literacy	556.2	76.97	–	0.05**	0.29**	0.16**	0.35**	–	–

Note: \*\*  $p < 0.01$ ; 0 = Female, 1 = Male; Teacher support is level 2 data, so there is no correlation coefficient with level 1 data.

### Cross-Level Mediation Effect Model Test

First, a zero model ( $M_0$ ) test is performed. The  $M_0$  model is as follows:

$$\text{Level-1: } \text{READING}_{ij} = \beta_0 + \varepsilon_{ij}$$

$$\text{Level-2: } \beta_{0j} = \gamma_{00} + \mu_{0j}$$

The results show that  $\text{ICC}(1) = \tau_{00}/(\tau_{00} + \sigma^2) = 2,880.19/(2,880.19/3,106.36) = 0.48$ , indicating that for the total variance of reading literacy, the school level factor explains 48%, it is necessary to build a multi-level linear model.

The second step is to examine the effect  $c$  of teacher support (STIMREAD) on reading literacy,  $M_1$  model is as follows:

$$\text{Level-1: } \text{READING}_{ij} = \beta_{0j} + \varepsilon_{ij}$$

$$\text{Level-2: } \beta_0 = \gamma_{00} + \gamma_{01}^c \times (\text{STIMREAD}) + \mu_{0j}$$

The results showed that teacher support had a positive effect on reading literacy ( $\gamma_{01}^c = 107.37, p < 0.001$ ).

The third step is to test the direct effect *a* of teacher support on the dimensions of the learning strategy ( $\text{Med}_{ij}$ ). The  $M_2$  model is as follows:

$$\text{Level-1: } \text{Med}_{ij} = \beta_{0j} + \varepsilon_{ij}$$

$$\text{Level-2: } \beta_0 = \gamma_{00} + \gamma_{01}^a \times (\text{STIMREAD})_j + \mu_{0j}$$

The results showed that teacher support has a positive effect on them.

The fourth step is to examine the effects *c'* and *b* of teacher support and learning strategies on reading literacy:

$$\text{Level-1: } \text{READING}_{ij} = \beta_{0j} + \varepsilon_{ij} \times (\text{Med}_{ij} - \bar{M} \cdot j) + \varepsilon_{ij}$$

$$\text{Level-2: } \beta_{0j} = \gamma_{00} + \gamma_{01}^{c'} \times (\text{STIMREAD}) + \gamma_{02} \times (\bar{M} \cdot j) + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10}^b$$

The results (**Table 2**) showed that: (1) The within-group effect ( $\gamma_{10}^b = 14.00, p < 0.001$ ) and the between-group effect ( $\gamma_{02} = 135.09, p < 0.001$ ) of the control strategy had significant effects on reading literacy, and the influence of teacher support on reading literacy is not significant ( $\gamma_{01}^c = 22.45, p > 0.05$ ). That is, the control strategy is a cross-level mediator between teacher support and reading literacy, and the mediating effect is 27.88%. (2) Within-group effect ( $\gamma_{10}^b = 6.59, p < 0.001$ ) and between-group effect ( $\gamma_{02} = 74.92, p < 0.001$ ) of elaboration strategies were significant, and the influence of teacher support on reading literacy decreased but remained significant ( $\gamma_{01}^c = 65.60, p < 0.01$ ). The elaboration strategy is a cross-level mediator with a mediating effect of 5.24%. (3) Understanding and remembering the information strategy's within-group effect ( $\gamma_{10}^b = 17.01, p < 0.001$ ) and between-group effect ( $\gamma_{10}^b = 128.11, p < 0.001$ ) were significant, and the influence of teacher support on reading literacy ( $\gamma_{01}^c = 62.20, p < 0.001$ ) was significantly reduced but still significant. Understanding and remembering information strategy was a cross-level mediator with a mediating effect of 8.73%. (4) The generalizing information strategy also belongs to the cross-level mediator because its within-group effect ( $\gamma_{10}^b = 19.29, p < 0.001$ ) and between-group effect ( $\gamma_{02} = 140.22, p < 0.001$ ) were significant, and the influence ( $\gamma_{01}^c = 42.53, p < 0.001$ ) of teacher support on reading literacy is significant but significantly decreased, with a mediating effect of 16.95%. (5) The within-group effect of memory strategy ( $\gamma_{10}^b = 2.80, p < 0.05$ ) and teacher support ( $\gamma_{01}^c = 108.31, p < 0.001$ ) were significant, but between-group effect ( $\gamma_{02} = -4.25, p > 0.05$ ) was not significant, so no cross-level mediation effect was found.

## Discussion

### The Influence Mechanism of Teacher Support and Learning Strategies on Students' Reading Literacy

**Table 2. Test of the Effect of Cross-Level Mediation of Learning Strategies.**

	$\gamma_{00}$	$\gamma_{01}$	$\gamma_{02}$	$\gamma_{10}$	$\tau_{00}$	$\sigma^2$
M0	555.19***					3,106.36
M1	539.43***	107.37***				3,106.27
M2 (Memory)	-0.10***	0.21***				0.63
M2 (Control)	-0.37***	0.62***				0.63
M2 (Elaboration)	0.08***	0.55***				0.63
M2 (Understanding & Remembering)	0.08***	0.35***				0.64
M2 (Generalizing)	-0.10	0.45***				0.89
M3 (Memory)	539.08***	108.31***		-4.25	2.80*	0.75
M3 (Control)	590.24***	22.45		135.09***	14.00***	3,092.76
M3 (Elaboration)	534.12***	65.60**		74.92***	6.59***	2,958.13
M3 (Understanding & Remembering)	529.27***	62.20***		128.11***	17.01***	2,843.42
M3 (Generalizing)	540.86***	42.53***		140.22***	19.29***	2,824.21

Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ;  $\tau_{00}$  is the residual of the intercept, and  $\sigma^2$  is the residual of level 1.

### ***Cross-level Mediation Effects of Control, Elaboration, Understanding and Remembering Information, and Generalizing Information Strategies***

Strategies such as control, elaboration, understanding and remembering information, and generalizing information can be improved by teacher support, and as a cross-level mediator affects students' reading literacy. This provides further evidence for the theory of various learning strategies and teaching modes. On the other hand, we have a deeper understanding of the influence and mechanism of the interaction between teacher support and student learning strategies on the improvement of reading comprehension.

Learning strategies are cognitive activities that readers plan to do before, during, and after reading in order to gain a full understanding of the text, avoid and solve various problems encountered in reading (McNamara, 2007). Learning strategy teaching is an important method for students to learn to use learning strategies and improve reading literacy. For the scientific and effective learning strategy teaching, scholars have developed the reciprocal teaching, transactional strategies instruction model, interactive strategy training for active reading and thinking, concept-oriented reading instruction and many other modes. Although the specific operating methods of these teaching models are different, their theoretical and empirical studies have shown that teacher support can promote students to effectively use a variety of cognitive and meta-cognitive learning strategies to improve reading literacy.

The reciprocal teaching mode allows teachers and students to exchange roles, the "teacher" guides the "student" to use the learning strategies such as prediction, questioning, clarification and summarization to conduct teaching dialogues, jointly real-

ize the construction of the meaning of the article, and let the students learn how to use learning strategies in the teacher-student interaction to further improve reading literacy (Rosenshine & Meister, 1994). The transactional strategies instruction model advocates the interaction between students and articles, the interaction between teachers and students, and the interaction between team members to improve students' ability to use prediction, visualization, questioning, clarification, contact and summary strategies and reading literacy. The interactive strategy training for active reading and thinking mode provides interactive and appropriate training for students to flexibly and actively use learning strategies such as comprehension monitoring, interpretation, prediction, and accurate processing to improve their reading literacy through multimedia technology (Graesser, et al, 2005). The learning strategies involved in these teaching models, such as prediction, questioning, clarification and summarization, visualization, connection, comprehension monitoring, interpretation, accurate processing, etc., are all related to the elaboration strategy, understanding and remembering information strategy, generalizing information strategy in PISA evaluation. It is not difficult to understand that these strategies can play a cross-level mediation effect between reading teaching and reading literacy.

The discovery of the cross-level mediation effect of each dimension of the learning strategy in this study make us has a deeper understanding of the role of learning strategies in reading comprehension and reading literacy training.

Learning strategies can effectively promote students' reading comprehension and reading literacy. This role can be explained by a self-regulating comprehension model. When reading, the metacognitive level monitors the activity state and process of the cognitive level, helping the reader to conduct an understanding assessment, and paying attention to whether the cognitive activities of the cognitive level and the metacognitive level are consistent. If it is consistent, it will be judged that the chapter is understood, and reading will continue; if there is a difference, the reader will feel doubts and troubles, and be aware that appropriate strategies should be taken to identify and solve the problem, and to eliminate doubts and problems (Chen, 2009, 2010). The understanding of self-regulation is conditional: the reader's understanding of monitoring should be sufficiently precise. If the reader's learning strategy is based on inaccurate understanding of monitoring, its effectiveness will be greatly compromised. Unfortunately, a large number of studies have shown that the reader's understanding of monitoring is not accurate; the average of monitoring accuracy coefficient is 0.25 approximately; Moreover, such inaccurate monitoring seems to be an inherent part of human cognition inadequate (Xu & Chen, 2013). Therefore, we have to consider "when" learning strategies can effectively affect reading comprehension performance and reading literacy.

If the reader knows the "when to use", "what to use" and "how to use" learning strategies, there is naturally no problem, which can promote reading comprehension. The problem is that readers usually cannot accurately judge "when to use" or "what to use", and the "how to use" learning strategy. Fortunately, we can use the external support form of teacher support to teach students "when to use," "what to use," and "how

to use” learning strategies (Shiu & Chen, 2013). In other words, the reader’s self-regulated reading is an effective way to read; but because the reader’s understanding of monitoring is usually not accurate enough, it is not always effective; and learning strategies based on external feedback, such as teacher-led are more accurate, effective and easy to implement.

### ***Why Does the Memory Strategy Have No Cross-Level Mediating Effect?***

The student’s memory strategy will be improved by teacher support, but it is less relevant to reading literacy and does not have a cross-level mediating effect between teacher support and reading literacy. This result may be discussed in terms of the theory of reading processing and the characteristics of PISA evaluation. Reading comprehension is a process of constructing a series of simple or complex psychological representations based on the surface coding, text representation and situational models of reading texts. Understanding can occur at different levels, so the reading test can be either a surface memory based on article information or a deep understanding based on the content of the article. By setting different reading scenarios, PISA examines the reading literacy level of readers’ ability in retrieving and inference, integrating and interpreting, and evaluating and reflecting, which focus on the reader’s deep understanding of the article rather than the surface memory of the article. The memory strategies in the PISA assessment (such as “repeated reading texts”, “remembering details”, etc.) are more focused on the surface memory of the article. Perhaps for this reason, memory strategies are less relevant to reading literacy and do not play a cross-level mediating role between teacher support and reading literacy.

### **Implications**

This study explores the influence of teacher support and various learning strategies on students’ reading literacy, and finds that the various components of learning strategies play different roles. The findings of this study have both theoretical and practical implication.

From a theoretical point of view, we have deepened our understanding of the role of learning strategies between teacher support and reading literacy. Moreover, it tells us that in the empirical study of the influence of learning strategies, different strategies should be examined independently, rather than simply merging and averaging.

From a practical point of view, as Confucius said, “Don’t go to guide him until he tries to figure it out and cannot get it. Don’t inspire him until he understands it but cannot speak it.” Teacher support is not a blind infusion, but a targeted suggestion at the right time. Not all the support can promote students’ reading literacy. Teacher support is the easiest to improve their students reading literacy by promoting the use of student control strategies. It also has a certain effect on the role of elaboration strategies and metacognitive strategies, but not for memory strategies. What could we know is that only leads students to read mechanically will not produce good results, and retelling the

text simply will learn only about the text itself which may not play a great role in students' learning ability?

## Conclusion

Teacher support can directly affect students' reading literacy, and can also influence reading literacy through the cross-level mediation effect of learning strategies. The cross-level effects of learning strategies of different dimensions are different. Control strategies, elaboration strategies, understanding and remembering information strategies, generalizing information strategies have cross-level mediating effects, while memory strategies does not have it.

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*Received: 21 April 2019*

*Revised: 13 May 2019*

*Accepted: 21 May 2019*

*The Chinese version of this article has been published in Global Edu 2018; 47(12):51-61. The English version has been authorized for being publication in BECE by the author(s) and the Chinese journal.*

*陈启山, 雷雅纓, 温忠麟, 李舒彤, 李洁莹, 孔雨柔. 教师指导, 学习策略与阅读素养的关系: 基于 PISA 测评的跨层中介模型. 全球教育展望 2018; 47(12):51-61.*

# Who Are Being Bullied? – An Empirical Study on the Influence Factors of School Bullying among Chinese Middle School Students

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*Abstract.* This study used a large-scale random sampling survey data called Regional Assessment of Education Quality (RAEQ) organized by Collaborative Innovation Center of Assessment toward Basic Education Quality in 2014. The school bullying phenomenon is described from the perspective of middle school students who were bullied. Regression is used to estimate the effects of academic achievement, self-esteem, interpersonal relationship and pro-social behavior on the different types of school bullying. And the differences between urban and rural areas among the influence factors were also compared. The conclusions are as follows. First, the average frequency of verbal bullying is the highest, relational bullying is in the middle level, and physical bullying is the lowest. Second, boys are more likely to suffer school bullying weighted more in verbal and physical bullying. Third, those who are single-parent, migrant, left behind and rural origin are more vulnerable to various types of bullying. Interestingly, students from single-parent families are more likely to suffer relational bullying, while migrant and rural children are more likely to get verbal bullying. Fourth, the level of self-esteem has a U-shaped relationship with the frequencies of all kinds of school bullying, and it is more significant and clear in the relational bullying. Fifth, interpersonal relationship, including parent-child, peer-peer, and teacher-student relationship can affect the school bullying significantly, and the peer relationship has a bigger effect on the relational bullying for urban students compared with rural ones. Therefore, parents, teachers and schools should pay more attention to and even interfere with the potentially bullied students to prevent and control school bullying.

*Best Evid Chin Edu* 2019; 2(1):171-192.

Doi: 10.15354/bece.19.ar1039

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**Keywords:** Middle school students; School bullying; Relational bullying; Verbal bullying; Physical bullying; Seemingly unrelated regression

## Introduction

**T**O the frequently occurred school bullying all over the world, some countries have taken relevant preventive measures. For example, Norway has established a no-tolerance program and published the Anti-Bullying Declaration. Australia has established a special government organization to help schools solve the problem of bullying, and observe the third Friday of March every year as the national “Anti-Bullying Day”. The United States and Japan have also enacted anti-bullying laws and implemented a comprehensive anti-bullying policy. In China, the Chinese government takes into account of the importance to solve the problem of school bullying. In April 2016, the Office of the State Council’s Education Steering Committee issued the Notice on the Special Governance of School Bullying. In November 2016, The Ministry of Education and the Central Comprehensive Management Office issued the Instructions on Prevention and Control of Bullying and Violence among Elementary and Middle School Students. In April 2017, the General Office of the State Council issued the Instructions on Strengthening the Construction of Safety Risk Prevention and Control System in Kindergartens and Elementary and Middle Schools. In March 2018, during the two sessions of China (The National People’s Congress, NPC, and The Chinese People’s Political Consultative Conference, CPPCC), when interviewed by Xinhua Net and the Chinese Government Network in a program called The Voice of Ministers, the Minister of Education Baosheng Chen said that the same as the fair and quality education for migrant and left behind children being cared for, and less school bullying is one of the top ten expectations for the education. School bullying has become an urgent problem for the basic education in China. However, China has not yet conducted a comprehensive and systematic investigation of school bullying, and we still do not have accurate, comprehensive, authoritative and systematic data with in-depth professional research (Chu, 2017).

In view of these, we tried to answer following questions on the basis of the database of middle school students established by the program of Regional Education Quality and Health Examination organized by National Innovation Center on Assessment of Basic Education Quality in 2014: 1) Who is being bullied? 2) What student individual factors do affect school bullying? 3) What are the differences between urban and rural students suffering from school bullying? The eventual purpose was to provide suggestion on decision-making reference for preventing and controlling school bullying in middle school students.

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**Funding:** “2011 Plan” of Beijing Normal University, entitled “Research and Development of Related Factors Affecting Student Development” (No.: 370331321).

**Conflict of Interests:** None.

## **Literature Review**

### **The Concept and Types of School Bullying**

Studies on school bullying around the world began in the 1970s. Dan Olweus, a psychologist at the University of Bergen in Norway, known as the father of school bullying research found that bullying is the main form of aggressive behavior among adolescents on campus in elementary and middle schools in both Norway and Sweden. He believed that school bullying means the victim is deliberately, repeatedly and continuously encountered negative behavioral attack by one or more students, causing physical or psychological harm or discomfort (Olweus, 1994). Chinese scholar Wenxin Zhang also believed that bullying is a special type of attack that often occurs among children, especially in elementary and middle school students. At present, the general concept of school bullying has not yet been identified though, researchers have basically reached a consensus regarding the types of school bullying, including relational bullying, verbal bullying and physical bullying<sup>1</sup>. In recent years, there has also been a new form of cyber bullying, which uses modern information network technologies such as telephone, SMS, WeChat and email to intimidate, insult, threaten and even spread false rumors, and upload pictures or videos which shame the victim publicly.

### **Hotspots of Related Chinese and international research**

Li et al. (2017) used Knowledge Graph and other methods to analyze the literature during 2007-2016 on school bullying published in Science Citation Index Expanded (SCIE) and Social Science Citation Index (SSCI) of the Web of Science database. It found that the research hotspots of school bullying in international academic journals majorly focus on the essence and forms of school bullying, the incidence, harmfulness, causes and solutions of school bullying and so on. Chinese researchers have already introduced the experience of school bullying prevention in foreign countries. For example, Huang (2017) made a comprehensive analysis of the school bullying governance systems of seven developed countries including the United States, Britain, Australia, Sweden, Norway, Japan and South Korea. He concluded that the common features include strengthening the responsibilities of all parties, focusing on process monitoring, building various platforms to prevent and control school bullying, and paying attention to the governance of cyber bullying etc. Therefore, the causes and influencing factors have become hotspots in school bullying research, and it has strong practical significance in preventing and controlling school bullying.

### **The Theoretical Basis and Research Hypothesis of Preventing and Controlling School Bullying**

American sociologist C. W. Mills put forward a theory regarding significant characters including parents, teachers, and peers, who appear gradually in the process of individual's socialization. With the increase of children's age, the dominant type of significant

characters generally changes from parents, teachers, and peers to other surrounding people. For middle school students, their interpersonal communication refers to the psychological and behavioral communication between themselves and the surrounding people such as parents, teachers and classmates. The main interpersonal relationships for middle school students are parent-child relationship, teacher-student relationship, and peer-peer relationship. Parents, teachers and peers are often reliable subjects who can provide students effective help when they encounter difficulties. Close parent-child relationship can help children alleviate the trouble of school bullying; and the more harmonious the teacher-student and peer-peer relationship, the less likely they are to be bullied (Gage, et al., 2014). Huang (2017) found that parental emotional support, teacher support negatively correlated with school bullying based on the data of PISA 2015 China. Ma (2016) found that students who are difficult to integrate into the class and have a poor level of peer relationship are vulnerable to school bullying. Ji et al. (2012) also found that peer relationship during children's late childhood has a positive predictive effect on bullying attacks. Children with weak skills on social interactions are vulnerable to being marginalized and being bullied in their peer group (Faris et al., 2014). Therefore, we believe that the three above-mentioned interpersonal relationships have an impact on school bullying in middle school students. In addition, related studies have found that children's prosocial behavior is related to their level of interpersonal relationships that can significantly improve the peer acceptance level (Ferguson et al., 2012). Therefore, good interpersonal relationship can make it easier to succeed in academic and less likely to be bullied. Based on this, we hereby proposed the following research hypotheses to be tested in middle school students:

Hypothesis 1: The better the parent-child relationship, the lower the probability of school bullying.

Hypothesis 2: The better the peer relationship, the lower the probability of school bullying.

Hypothesis 3: The better the teacher-student relationship, the lower the probability of school bullying.

Hypothesis 4: The higher prosocial behaviors, the lower probability of being bullied on campus.

## **Individual Characteristics of Students Who Suffer from School Bullying**

Lifestyle Theory introduced by Hindelang in 1978 said some of the behaviors or life characteristics of the individual will increase the likelihood of being violated (Zhang et al., 2016). Accordingly, students' characteristics and behaviors will have an impact on the incidence of bullying. Studies have found that boys are more likely to be bullied than girls (Craig et al., 2009; Elgar et al, 2013). Huang (2017) found that the proportion of boys who suffer from various types of school bullying is greater than that of girls; children with lower socioeconomic status are more likely to be subject to discrimination and ridicule; the influence of gender and family socioeconomic status (SES) on the school bullying cannot be ignored. Therefore, our study takes these two factors as control variables.

There is little research on the difference of school bullying between urban and rural students. We only found two Chinese empirical studies currently by Huang and colleagues. They found that school bullying does not significantly differ between urban and rural schools. The variable Urban-Rural (UR) is not significant for students who often suffer from school bullying (Huang, 2017; Huang et al., 2018). However, these two studies did not estimate the effect of UR variable on students' suffering from different types of school bullying. Our study will further examine the difference and influencing factors of urban and rural middle school students who suffer from different types of school bullying. Therefore, we proposed the following assumption:

Hypothesis 5: Whether students coming from urban middle school have no significant predictive effect on suffering from school bullying.

Related to the variable UR, Teng et al. (2018) also found that boys whose parents work outside are more seriously bullied based on a survey of more than 100,000 elementary and middle school students across China. Some researchers believe that rural left-behind children, urban migrant children and children from single-parent families may be vulnerable to school bullying due to the indifference of family relationships or their parents' inability to give them enough care and love for work reasons (Zhou, 2017). In addition, some studies have found that bullied students usually have lower levels of self-esteem, which affects the probability of bullying (Malecki et al., 2015; Gu et al., 2003). Ma (2016) believed that students with poor academic performance may be ridiculed by teachers because they are not valued by teachers, and may be subject to discrimination and bullying by classmates. Lei et al. (2004) also found that students' academic performance is negatively correlated with school bullying, i.e. the better their academic performance, the lower the probability they will suffer from school bullying.

In sum, although some researchers believe that whether students are migrant or left-behind, whether they are from single-parent families, their self-esteem and other personality traits and academic achievements may affect their possibility of being bullied at school. However, there is still a lack of empirical research with systematic design from the perspective of individual characteristics of students. In addition, the analysis of the difference between urban and rural middle school students regarding the influence factors of suffering from different types of school bullying still needs to be further explored. Therefore, our study will conduct an empirical study on various factors that may affect school bullying on the individual level of the student, in order to explore the key factors affecting the various types of school bullying.

The previous studies, especially Chinese research on school bullying, were mostly based on theoretical analysis. The number of empirical studies using quantitative methods is limited, and the sample size and sample representativeness of such studies were debatable. Relevant conclusions require further testing from high-quality research using large-scale random sample. In addition, many international studies have begun to pay attention to whether the same variable has different effects on different types of school bullying. As studies have found that girls are more vulnerable to relationship bullying and verbal bullying (Veenstra et al., 2005), while boys are more likely to be physically bullied (Peets et al., 2006). In China, such kind of research is relatively lack-

ing, it is important to know that a more detailed study of the impact of the same variable on different types of school bullying will help to achieve the goal of accurately preventing and controlling bullying in China.

Based on this, our study will use a large-scale random sampling survey data called Regional Education Quality and Health Examination organized by National Innovation Center on Assessment of Basic Education Quality in 2014 to estimate the effect of whether the middle school students are from urban schools, whether they are migrant children, left-behind children, and whether they are from single-parent families and their academic performance, personality quality, interpersonal relationship, prosocial behavior and other variables to suffering from different types of school bullying and the heterogeneity of urban and rural middle school students, and test whether there is a significant difference with the effect of the same variable on different types of school bullying. It should be pointed out that our study uses the large-scale middle school students' survey data to compare the difference in school bullying between urban and rural middle school students. At the same time, it also provides empirical data for the problem of migrant, left-behind, single-parent children's school bullying. In the choice of methods, to overcome the limitations of Ordinary Least Square (OLS), the Seemly Unrelated Regression Model was used to estimate the effects of various influencing factors. Of course, due to the limitations of database design, the definition of migrant and left-behind children is not restricted with academic definitions that may affect the accuracy of results to some extent. In addition, this study has not made a quantitative causal analysis of school bullying. However, we still provided a relatively reliable conclusion for exploring the factors affecting school bullying at the individual level and the precise prevention and control of school bullying.

## **Methods**

Our data come from a project called Regional Education Quality and Health Examination organized by National Innovation Center on Assessment of Basic Education Quality in 2014. The project implemented full surveys in Ximeng, Zhengzhou and Futian, and implemented three-stage PPS tests in Zhejiang, Zhuzhou, Luoyang, Shenzhen, and Shijiazhuang, China. Specifically, in the first phase, the stratified PPS method is used to select counties and districts. In the second phase, the stratified PPS method is used to select schools. The third phase uses random equidistant sampling to select students. In the test, ninth grade students participated in Language, Mathematics, English, Science, and Humanities tests<sup>2</sup> and filled in relevant questionnaires such as mental health, moral behavior and influencing factors. A total of 178,606 ninth grade students participated in the survey, including 94,525 boys, accounting for 52.92%, with 5.48% higher than girls. The students in the city, county, and rural areas accounted for 67.64%, 24.73%, and 7.63%, respectively. The proportion of students enrolled in rural schools is relatively low, which may be related to the adjustment of the layout of rural middle schools, the gradual decline of the number of rural middle school, and the entry of many rural stu-

dents into urban middle schools in the context of urbanization in China to a certain extent.

Based on existing literature (Fu et al., 2013; Malecki et al., 2015; Huang, 2017; Chen et al., 2017), we mainly examined the influence of academic achievement, family characteristics, personality quality, interpersonal relationship, prosocial behavior and other variables on school bullying. It is proposed that the use the following econometric model to explore the key factors affecting middle school students' bullying:

$$\begin{aligned} \text{BULLY}_i = & \beta_0 + \beta_1 \text{GENDER}_i + \beta_2 \text{SES}_i + \beta_3 \text{LEARN}_i + \beta_4 \text{SINGLE}_i + \beta_5 \text{MIGRANT}_i \\ & + \beta_6 \text{LEFTBEHIND}_i + \beta_7 \text{SELFESTEEM}_i + \beta_8 \text{SELFESTEEM}_i^2 \\ & + \beta_9 \text{PEER}_i + \beta_{10} \text{TEASTU}_i + \beta_{11} \text{PARENTCHILD}_i + \beta_{12} \text{PROSOCIAL}_i \\ & + \varepsilon_i \end{aligned}$$

The dependent variables in the model, BULLY are all kinds of school bullying, including relational bullying, verbal bullying, and physical bullying. The Bullying/Victim Questionnaire compiled by Olweus is recognized as a good measurement tool. Chinese scholar Wenxin Zhang translated and revised Olweus's questionnaire. The project, Regional Education Quality and Health Examination, adapted Wenxin Zhang's revised Bullying Questionnaire to measure the frequency of students suffering from verbal bullying, relational bullying and physical bullying at school. Relational bullying includes two items: "rejected by people" and "being swearing in the back". Verbal bullying includes two items: "being teased" and "being threatened". Physical bullying includes three items: "being deliberately attacked, kicked, pushed, or bumped", "own things are intentionally damaged", and "being robbed or extorted property". Compared with the related items in PISA, the project of Regional Education Quality and Health Examination added the item "being robbed or extorted property" to the measurement of school bullying. After internal consistency analysis and confirmatory factor analysis, we found that the reliability and validity index of the school bullying scale is good, which meets the quality requirements of the measurement tool for the scale.

The description of the independent variables in the model is shown in **Table 1**. Among them, the variables, SELFESTEEM, PEER, TEASTU, PARENTCHILD, PROSOCIAL all involve corresponding scales:

Self-esteem refers to a positive or negative attitude of an individual as an independent person. This attitude is an overall emotional evaluation of one's own value, strengths and importance. It is an important component of self-experience. Regarding the measurement of self-esteem, the early self-esteem scale compiled by Rosenberg was widely used. Yifu Yu and Xin Yu (1993) translated and revised this scale into Chinese version in 1993. The project of Regional Education Quality and Health Examination further revised the Chinese version of the self-esteem scale. The final scale includes "I feel that I am a valuable person, at least on the same level as others", "I feel that I have many good qualities", "In the final analysis, I tend to feel that I am a loser", "I can do things well like most people." "I don't think I have a lot of pride." "I have a positive attitude toward myself." "Overall, I am satisfied with myself." "I hope I can win more

**Table 1. The Descriptions of Variables.**

Type	Variable	Descriptions
Dependent Variables	RELBULLY	Mean of the two items of “rejected by people” and “being swearing in the back”, ranging from 1-5.
	PHYBULLY	Mean of the two items of “being deliberately attacked, kicked, pushed, bumped” and “own things are intentionally damaged”, ranging from 1-5.
	VERBULLY	Mean of the two items of “being teased” and “being threatened”, ranging from 1-5.
Core Independent Variables	LEARN	Continuous variable. Mean of the standardized language, mathematics, English, science and humanities grades.
	SINGLE	Categorical variables, 1 means coming from single-parent family; 0 means not coming from single-parent family.
	MIGRANT	According to the item “Do you move from rural to other places with your parents or other relatives?”, if the answer is “moving from rural to this city/county” or “moving from other cities/counties to this city/county”, it will be defined as “migrant children”. Categorical variables, 1 means migrant children; 0 means not migrant children.
	LEFTBEHIND	According to the item “Are your parents not working locally for a long time?” and the item of the school’s location, non-urban (rural, county) children at least one of whose parents do not work locally are defined as left-behind children. Categorical variables, 1 means left-behind children; 0 means not left-behind children.
	UR	According to the item of the school’s location, 1 means urban; 0 means non-urban (including rural and county).
	SELFESTEEM <sup>3</sup>	Continuous variable. All items in the scale are synthesized and standardized with loads as weights.
	PARENTCHILD <sup>3</sup>	Continuous variable. All items in the scale are synthesized and standardized with loads as weights.
	PEER <sup>3</sup>	Continuous variable. All items in the scale are synthesized and standardized with loads as weights.
	TEASTU <sup>3</sup>	Continuous variable. All items in the scale are synthesized and standardized with loads as weights.
	PROSOCIAL <sup>3</sup>	Continuous variable. All items in the scale are synthesized and standardized with loads as weights.
Control Variables	GENDER	Categorical variables. 1 means male; 0 means female.
	SES	Continuous variable. Mean of the standardized maximum parental education level, highest parental status and family ownership.

respect for myself”, “I often feel that I am useless”, “I always think that I have nothing” these 10 items, using “completely inconsistent, inconsistent, more consistent, and fully consistent” four-level scoring.

Parent-child relationship refers to the interaction between parents and children. The China Children and Adolescents Psychological Development Survey Project Team has revised and adapted the Network of Relationships Inventory (NRI) scale compiled by Furman & Buhrmester in 1992 to form a parent-child relationship scale with 8 dimensions and 23 items and the reliability and validity of the scale is good. Considering

the length of the questionnaire and the limited time, the project of Regional Education Quality and Health Examination delete some items on the scale, and finally select the items with higher loads in each dimension to form a scale of 11 items, “Do you feel satisfied with your relationship with your parents?”, “Are you happy with your parents?”, “Will you share your secrets and personal feelings with your parents?” “Do you have any disagreements or quarrels with your parents?”, “Do you and your parents argue or blame each other?”, “Would you be upset when you are together with your parents?” “Do parents help you solve problems when you have problems?”, “Do parents like or praise what you do?”, “Do you and your parents get bored with each other?”, “Do your parents love you?”, “Do you have some fun together with your parents?”, using “never, occasionally, sometimes, and often” four-level scoring.

Peer relationship mainly refers to a kind of interpersonal relationship established and developed in the process of communication between individuals of the same age or the similar level of psychological development (Zou et al., 1999). The project of Regional Education Quality and Health Examination revised the Chinese version of Children’s Loneliness Scale (CLS), reflecting the peer relationship with children’s loneliness. The final scale includes 10 items in total, “I am very happy when I am with my classmates”, “My classmates often bully me”, “I am very satisfied with my relationships with my classmates”, “I often have disputes with my classmates”, “When I need it, I can find friends”, “I have many good friends”, “Classmates like me very much”, “I feel lonely in my class”, “I can hardly let other children like me”, “I feel that no one cares about me in some activities”, using “completely inconsistent, inconsistent, more consistent, and fully consistent” four-level scoring.

The teacher-student relationship mainly refers to the relationship between teachers and students in the school. It is the psychological relationship between teachers and students with emotion, cognition and behavioral communication as the main form of expression. Considering the length of the questionnaire and the limited time, the project of Regional Education Quality and Health Examination revised the teacher-student relationship scale compiled by Zhiyong Qu. The final scale includes 15 items, “The teacher treats me fairly”, “The teacher is very concerned about me”, “The teacher and I are good friends”, “The teacher cares about every student”, “The teacher allows us to have different opinions”, “The teacher listens to my opinions patiently.”, “The teacher does not ridicule me, does not dig at me.”, “When I make a mistake, the teacher will ask for the reason”, “The teacher does not ask me to accept his or her opinion”, “I admire my teacher very much”, “The teacher encourages me and praises me.” “I am willing to tell my teacher about what in my heart.” “When I encounter difficulties other than learning, I will think of asking for help from my teacher.” “I am willing to show my strengths in front of the teacher.” “The teacher trusts me very much”, using “completely inconsistent, inconsistent, more consistent, and fully consistent” four-level scoring.

Prosocial behavior refers to behaviors that bring certain benefits to others. These behaviors can make the relationship between the two parties more harmonious (Kou et al., 2007). Yasong Du, a member of Shanghai Mental Health Center revised Chinese

version of the Strengths and Difficulties Questionnaire (SDQ) compiled by American psychologist Goodman R. in 1997. Based on this, the project of Regional Education Quality and Health Examination formed a scale of 1 dimension with 5 items, “I try to be friendly to others”, “I often share things with others (such as food, games, pens, etc.)”, “If someone is hurt, sad or uncomfortable, I am willing to help him or her”, “I will be friendly to people who are younger than me.” Small children”, “I often volunteer to help others”, which use “inconsistent, somewhat inconsistent and fully consistent” as the three-level scoring.

The scales of school bullying, self-esteem, parent-child relationship, peer relationship, teacher-student relationship, prosocial behavior involved in this study have good reliability and validity. The specific indicators are presented in **Table 2**.

## Results

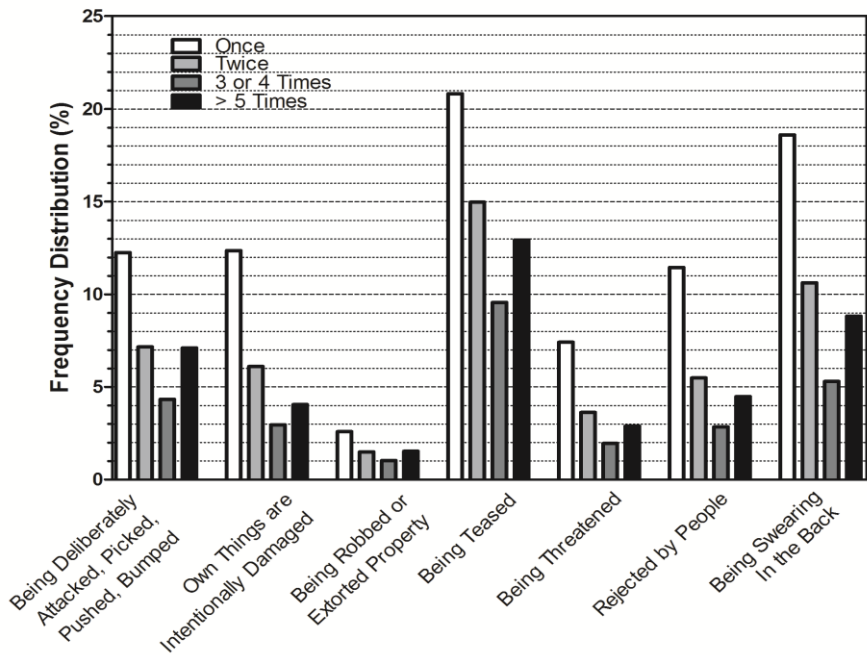
### Basic Situation of School Bullying among Middle School Students

As can be seen from **Figure 1**, among all forms of bullying, the frequency of “being robbed or extorted property” occurs at the lowest (6.64%). And for comparing with PISA results, this item was removed from the analysis below. “Being teased” occurs most frequently (58.28%), which is different from Chen et al.’s research results using PISA data. They found the lowest incidence of school bullying in these four provinces and cities in China was the form of threat of verbal bullying, and the most frequent occurrence is the deliberate destruction of private property (Chen et al., 2017). However, our results are basically consistent with the results of the China school Bullying Survey Report issued by the school Safety Professional Committee of the China Emergency Management Association. It said that the incidence of verbal bullying is significantly higher than other bullying behaviors. At least 38.55%, 58.28%, and 43.34% of middle

**Table 2. The Results of Reliability and Validity of Scales.**

Scale	# of Items	Crobach's $\alpha$	$\chi^2$	df	$\chi^2/df$	CFI	TLI	RMSEA	N
School Bullying	6	0.841	2,325.89	5	1,664.02	0.994	0.982	0.052	170,555
Self-Esteem	10	0.837	50,419.47	31	1,626.43	0.912	0.872	0.098	170,787
Parent-Child Relationship	11	0.832	57,837.8	38	1,522.05	0.921	0.885	0.094	170,466
Peer Relationship	10	0.842	37,767.3	30	1,258.91	0.933	0.900	0.086	170,779
Teacher-Student Relationship	15	0.940	96,787.97	88	1,099.86	0.938	0.925	0.080	170,758
Prosocial Behavior	5	0.805	1,982.83	5	396.57	0.992	0.984	0.048	170,638

**Figure 1. The Proportion of Middle School Students Suffering from Various Forms of School Bullying.**



school students have suffered physical bullying, verbal bullying and relational bullying, respectively (Zhang, 2017). This result was slightly higher than the results of other studies, such as Zhou et al. (2017) found that 40.7% of elementary and middle school students in Beijing had experience of being called nicknames, and 18.6% of students had experience of being isolated by classmates with a data of 12 high schools, middle schools and elementary schools in Beijing. According to a survey conducted by the China Youth Research Center of 5,864 elementary and middle school students in 10 provinces and cities in China, 32.5% of students have suffered from school bullying (Liu et al., 2015).

By calculating the average frequency of all kinds of school bullying, we found that middle school students have the highest frequency of verbal bullying ( $\bar{X} = 1.81, \sigma = 0.96$ ). The average frequency of suffering from relational bullying is in the second rank ( $\bar{X} = 1.70, \sigma = 1.04$ ). They have the lowest average frequency of physical bullying ( $\bar{X} = 1.59, \sigma = 0.98$ ). The highest average frequency of verbal bullying is consistent with the results of Liu et al. (2017). It may be due to the verbal bullying is not easy to be discovered by teachers and parents. Once a student uses insulting vocabulary to swear or ridicule classmates, if the student bullied chooses to be silent, it will encourage the bullying behavior; if the student bullied responds to it, it may cause more slick words to bully.

## **Factors Affecting School Bullying of Middle School Students**

In order to explore which students were more likely to be bullied, we use Seemingly Unrelated Regression to explore how individual academic performance, interpersonal relationships, prosocial behavior, self-esteem, migrant or left-behind status, and single-parent families influence different types of school bullying in the context of controlling gender and family socioeconomic status. Considering the influence of variables such as academic performance, interpersonal relationship, social behavior, and self-esteem on the relational bullying, physical bullying and verbal bullying, there may be some connection between the equations, such as the correlation between the disturbances. In order to improve the estimation efficiency and test whether the variables have different effects on the types of bullying, we adopted Seemingly Unrelated Regression Estimation. In addition, considering the correlation between the variables like self-esteem, prosocial behavior and peer relationship, two models are also used in the Seemingly Unrelated Regression Estimation: Model 1 does not include self-esteem and prosocial behavior variables, and model 2 does not include peer relationship variable. The residual correlation matrix coefficients of the three types of school bullying equations in Model 1 are between 0.508 and 0.661, and the BP test results reject the null hypothesis ( $H_0$ : the residuals of the equations are independent of each other,  $P = 0.000$ ). The residual correlation matrix coefficients of the three types of school bullying equations in Model 2 are between 0.552 and 0.688, and the BP test results reject the null hypothesis ( $H_0$ : the residuals of the equations are independent of each other,  $P = 0.000$ ). So it is more appropriate to use Seemingly Unrelated Regression Estimation in both Model 1 and Model 2.

In terms of interpersonal relationship, all three relationships including parent-child, peer-peer and teacher-student could significantly affect the frequency of suffering from school bullying (see **Table 3**). This conclusion is in line with the theoretical assumptions of the theory and supports the hypotheses 1-3 of this study. Through Seemingly Unrelated Regression Estimation, we found that the influence of peer relationship and teacher-student relationship on the suffering from different types of school bullying is different, but there was no significant difference between the influences of parent-child relationship on both physical and verbal bullying. In the micro-social structure of the campus field, middle school students only form a small group due to similar behavioral characteristics or spatial proximity. Some students suffering from school bullying may be difficult to be recognized and accepted by other students, and are isolated or marginalized in school and class activities. Therefore, a good peer relationship can reduce the frequency of various types of school bullying, and the impact of the relational bullying is the largest, followed by verbal bullying. We supposed that the most common occurrence of school bullying is relationship bullying. That is, bullies will first isolate and exclude bullied students, and then cause verbal bullying. In more serious cases, physical bullying will occur. Therefore, the absolute value of the effect of peer relationship has the greatest impact on relational bullying in the three types of bullying, and the effect on physical bullying is the minimal. The absolute value of the effect of teacher-student relationship also has a similar order, that is, the effect of the relational bullying

is relatively the largest, and the effect of physical bullying is the minimal. In a good parent-child relationship, parents' full emotional support for their children will make children feel being cared for, gain a sense of security, and have the courage and healthy personality to face problems, thus avoiding suffering from relational bullying, verbal bullying and physical bullying from classmates. As for why parent-child relationship has no significant difference in the effect of physical bullying and verbal bullying, it is likely that the frequency of verbal bullying and physical bullying is relatively low in families with good parent-child relationships, so the effect value is similar. Therefore, according to the standardized parent-child relationship score, we define the score greater than 0 as a good parent-child relationship. We found that the average frequency of verbal bullying with good parent-child relationship ( $\bar{X} = 1.67, \sigma = 0.88$ ) is significantly lower than the overall average at 0.001 level ( $\bar{X} = 1.81, \sigma = 0.96$ ). The average frequency of physical bullying with good parent-child relationship ( $\bar{X} = 1.45, \sigma = 0.87$ ) is also significantly lower than the overall average at 0.001 level ( $\bar{X} = 1.59, \sigma = 0.98$ ). It can be seen that the average frequency of verbal bullying and physical bullying with good parent-child relationship is relatively low, which confirms our conjecture to some extent. The prosocial behavioral does not have a significant impact on various types of bullying ( $P > 0.1$ ), which rejects the hypothesis 4. We supposed that the possible reason is that the influence of prosocial behavior on school bullying is indirect. The prosocial behavior may affect the level of interpersonal relationship, which may affect the probability of suffering from school bullying. Some studies have found that prosocial behavior may influence peer acceptance (Ferguson et al., 2012).

The academic performance has almost no impact on various types of school bullying ( $\beta = 0.000, P < 0.01$ ). But the impact of gender on three types of school bullying is significantly different. Although boys are more likely to be bullied than girls, whether it is relational bullying, physical bullying or verbal bullying, the difference is more significant in both physical and verbal bullying. This is basically consistent with the existing data (Barboza et al., 2009; Huang, 2017; Zhou et al., 2017). We supposed that due to historical and cultural factors, violence may be appreciated and even worshiped in the male group, such as the ancient Colosseum in the Western society and the Liangshan heroes in China. The male group is more likely to incite and conflict than the female group. Therefore, the male student is more likely to be the victim of physical bullying, and the combination of multiple bullying behaviors during the bullying process may also cause the male to be a victim of verbal and relational bullying.

The single-parent family status has a significant impact on relational bullying but different in the physical and verbal bullying, of which showed no significance. On the whole, students from single-parent families are more likely to suffer from various types of school bullying. The possible reason is that the middle school students coming from single-parent families are prone to be lonely because of their emotional indifference with one of their parents. They are easily mistaken by their classmates and then suffer from relational bullying. In addition, students from non-single-parent families may be immature on cognitive and emotional development and have low empathy level on others. The peers who are growing in single-parent families are understood as differ-

ent types of groups, which lead to rejection, ridicule, even insults or other bullying behaviors (Chan et al., 2015).

Compared with other types of school bullying, migrant children are more vulnerable to verbal bullying. But left-behind children have almost the same impact on suffering from different types of school bullying. Migrant and left-behind children are more vulnerable to various types of bullying, which is basically consistent with the conclusion of Zhou et al. (2017). They found that migrant students were more likely to be bullied than local students in Beijing. Left-behind and migrant children may be excluded to the edge of society due to unfair social and educational system design (Zhou et al., 2017). Wang (2016) found through qualitative research that left-behind children suffering from school bullying may be relevant to reduced sense of security caused by lack of parental care, a sense of peer attachment and manifestation of autonomy.

Self-esteem has significant differences in the impact of various types of bullying, and has a greater impact on relational bullying. Studies have found that adolescents with low levels of self-esteem are more likely to suffer from school bullying (Malecki et al., 2015; Gu et al., 2003). We found that the level of self-esteem of middle school students and the frequency of suffering from various types of school bullying showed a U-shaped relationship. The low level of self-esteem may reduce individual's self-evaluation and self-worth, and make middle school students unable to defend their legitimate rights and even their personal dignity when faced with possible bullying behaviors. Instead, they will simply confess and eventually lead to their continuous suffering from bullying. But if the middle school students' self-esteem or self-evaluation is too high, they may lead to dissatisfaction or over-sensitivity to other people's evaluation when in interacting with others, thus suffering from more school bullying, especially relational bullying. Therefore, it is necessary for middle school students to maintain a moderate level of self-esteem to avoid school bullying.

To examine the robustness of Seemingly Unrelated Regression Estimation as showed in **Table 3**, we changed the functional form to perform an unrelated biprobit regression. The results are shown in **Schedule 1**. Most of the model coefficient results are consistent with the regression results appeared in **Table 3**, except that girls are more likely to suffer from relational bullying than boys. This result is consistent with the results of Jing et al. (2009). It can be seen that the coefficient estimation of each model in **Table 3** are relatively stable.

## **Heterogeneity Analysis of School Bullying among Urban and Rural Middle School Students**

From the simple description of the statistics, compared with rural middle school students ( $\bar{X} = 1.81, \sigma = 0.98$ ), urban students ( $\bar{X} = 1.78, \sigma = 1.02$ ) suffered significantly lower frequency of verbal bullying. However, urban students ( $\bar{X} = 1.71, \sigma = 1.10$ ) were more significantly likely to suffer from relational bullying ( $t = -4.146, P < 0.01$ ) than rural students ( $\bar{X} = 1.68, \sigma = 1.02$ ). There was no significant difference in the frequency of physical bullying among urban and rural students ( $t = -1.139, P > 0.1$ ). In order to explore the difference in the impact on school bullying among urban and rural students,

**Table 3. The Results of Seemingly Unrelated Regression Estimation of Middle School Students' School Bullying Influence Factors.**

	RB		PB		VB		RB v.s. PB		RB v.s. VB		PB v.s. VB	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
GENDER	0.039± 0.006‡	0.079± 0.006‡	0.325± 0.005‡	0.35± 0.006‡	0.292± 0.005‡	0.323± 0.006‡	2807.9‡	2313.5‡	2258.4‡	1948.2‡	57.5‡	36.1‡
SES	0.05± 0.004‡	0.034± 0.004‡	0.04± 0.004‡	0.03± 0.004‡	0.011± 0.003‡	0.001± 0.004	9.03‡	1.54	127.24‡	85.64‡	102.32‡	97.74‡
LEARN	0.0‡	0.0‡	0.0‡	0.0‡	0.0‡	0.0‡	256.8‡	303.4‡	74.0‡	83.3‡	88.0‡	112.3‡
PARENT CHILD	-0.083± 0.003‡	-0.154± 0.003‡	-0.064± 0.003‡	-0.113± 0.003‡	-0.062± 0.003‡	-0.114± 0.003‡	36.3‡	165.0‡	48.4‡	169.2‡	0.9	0.04
PEER	-0.415± 0.003‡		-0.279± 0.003‡		-0.311± 0.003‡		2054.8‡		1246.7‡		169.8‡	
TEASTU	-0.027± 0.003‡	-0.110± 0.004‡	-0.027± 0.003‡	-0.085± 0.003‡	-0.034± 0.003‡	-0.096± 0.003‡	0.05	60.7‡	6.0‡	21.1‡	9.9‡	16.6‡
SELFESTEEM		-0.168± 0.005‡		-0.103± 0.004‡		-0.134± 0.004‡		233.4‡		66.8‡		81.7‡
SELFESTEEM <sup>2</sup>		0.009± 0.0‡		0.006± 0.0‡		0.008± 0.0‡		113.1‡		30.4‡		44.9‡
PROSOCIAL		-0.005± 0.003		-0.003± 0.003		-0.001± 0.003		0.6		2.4		0.8
SINGLE	0.058± 0.012‡	0.078± 0.013‡	0.029± 0.012‡	0.048± 0.012‡	0.016± 0.011	0.035± 0.012‡	5.7‡	6.0‡	13.4‡	12.9‡	2.1	1.6
MIGRANT	0.009± 0.006	0.034± 0.006‡	0.022± 0.006‡	0.04± 0.006‡	0.033± 0.006‡	0.051± 0.006‡	4.2‡	1.1	17.6‡	9.2‡	5.4‡	5.1‡
LEFTBEHIND	0.027± 0.016*	0.032± 0.018*	0.051± 0.016‡	0.05± 0.017‡	0.058± 0.015‡	0.057± 0.017‡	2.7	1.8	3.9‡	2.6	0.3	0.3
Constant	1.824± 0.022‡	1.714± 0.025‡	1.894± 0.021‡	1.843± 0.023‡	1.971± 0.021‡	1.885± 0.023‡						
R <sup>2</sup>	0.211	0.093	0.160	0.101	0.181	0.106						
RMSE	0.903	0.973	0.880	0.912	0.854	0.894						
Ch <sup>2</sup>	29218.2‡	10627.4‡	20906.0‡	11674.7‡	24120.5‡	12291.8‡						

RB: Relational Bullying; PB: Physical Bullying; VB: Verbal Bullying

On the left side of the table is the influence coefficient of variables on different types of school bullying and the robust standard error is in parentheses. The right side of the table shows the chi-square statistic of whether the coefficients of the same variable are equal on the two equations when the dependent variable is any two different types of school bullying. \*P<0.1, †P<0.05, ‡P<0.01. Data were Mean ± SEM.

we add urban and rural variable UR and their interaction variables with intervening variables like peer relationship, parent-child relationship, teacher-student relationship, prosocial behavior based on the original model. Meanwhile, considering the correlation between UR and variables like the migrant or left-behind children, we no longer include the variables like migrant or left-behind children in the model. Similarly, considering the high correlation between self-esteem, prosocial behavior and peer relationships, two models are also used in the process of Seemingly Unrelated Regression Estimation. Model 1 does not include variables like self-esteem, prosocial behavior and the interaction term between UR and prosocial behavior. Model 2 does not include the peer relationship and its interaction with UR. The residual correlation matrix coefficients of the three types of school bullying in Model 1 are between 0.540 and 703, and the BP test results reject the null hypothesis (H0: the residuals of the equations are independent of each other, P = 0.000). The residual correlation matrix coefficients of the three types of school bullying equations in Model 2 are between 0.584 and 728, and the

Schedule 1. The Unrelated Biprobit Regression Results of Whether Middle School Students Suffering from School Bullying.												
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	RB	PB	RB	PB	RB	VB	RB	VB	PB	VB	PB	VB
GENDER	-0.12± 0.008‡	0.412± 0.008‡	-0.086± 0.008‡	0.42± 0.008‡	-0.122± 0.008‡	0.299± 0.008‡	-0.087± 0.008‡	0.314± 0.008‡	0.409± 0.008‡	0.302± 0.008‡	0.417± 0.008‡	0.317± 0.008‡
SES	0.01± 0.005‡	0.015± 0.005‡	-0.003± 0.005	0.006± 0.005	0.011± 0.005‡	-0.059± 0.005‡	-0.003± 0.005	-0.067± 0.005‡	0.013± 0.005‡	-0.058± 0.005‡	0.003± 0.005	-0.066± 0.005‡
LEARN	0.0	0.0‡	0.0*	0.0‡	0.0	0.0‡	0.0*	0.0‡	0.0‡	0.0‡	0.0‡	0.0‡
PARENTCHILD	-0.111± 0.005‡	-0.089± 0.005‡	-0.165± 0.005‡	-0.137± 0.005‡	-0.112± 0.005‡	-0.067± 0.005‡	-0.165± 0.005‡	-0.109± 0.005‡	-0.09± 0.005‡	-0.067± 0.005‡	-0.137± 0.005‡	-0.110± 0.005‡
PEER	-0.407± 0.005‡	-0.329± 0.005‡			-0.407± 0.005‡	-0.345± 0.005‡				-0.33± 0.005‡	-0.345± 0.005‡	
TEASTU	-0.098± 0.005‡	-0.078± 0.005‡	-0.159± 0.005‡	-0.128± 0.005‡	-0.100± 0.005‡	-0.087± 0.005‡	-0.16± 0.005‡	-0.135± 0.005‡	-0.080± 0.005‡	-0.086± 0.005‡	-0.130± 0.005‡	-0.135± 0.005‡
SELFESTEEM			-0.152± 0.006‡	-0.114± 0.006‡			-0.153± 0.006‡	-0.156± 0.006‡			-0.115± 0.006‡	-0.155± 0.006‡
SELFESTEEM <sup>2</sup>			0.009± 0.0‡	0.007± 0.0‡			0.009± 0.0‡	0.009± 0.0‡			0.007± 0.0‡	0.009± 0.0‡
PROSOCIAL			-0.049± 0.005‡	-0.047± 0.005‡			-0.05± 0.005‡	-0.047± 0.005‡			-0.048± 0.005‡	-0.047± 0.005‡
SINGLE	0.043± 0.017‡	0.039± 0.017‡	0.05± 0.017‡	0.053± 0.018‡	0.044± 0.017‡	0.006± 0.017‡	0.05± 0.017‡	0.026± 0.018	0.040± 0.017‡	0.004± 0.017	0.054± 0.018‡	0.026± 0.018
MIGRANT	0.006± 0.008	0.022± 0.008‡	0.031± 0.008‡	0.043± 0.009‡	0.007± 0.008	0.033± 0.008‡	0.031± 0.008‡	0.05± 0.009‡	0.021± 0.008‡	0.034± 0.008‡	0.041± 0.009‡	0.051± 0.009‡
LEFTBEHIND	0.099± 0.023‡	0.07± 0.023‡	0.099± 0.024‡	0.054± 0.024‡	0.099± 0.023‡	0.06± 0.024‡	0.099± 0.024‡	0.046± 0.024*	0.072± 0.023‡	0.06± 0.032‡	0.054± 0.024‡	0.047± 0.024*
Constant	-0.013± 0.032	0.059± 0.032*	-0.113± 0.032‡	-0.002± 0.033	-0.017± 0.032	0.334± 0.032‡	-0.117± 0.032‡	0.2± 0.033‡	0.062± 0.032*	0.349± 0.032‡	-0.001± 0.033	0.209± 0.033‡
Sample Size	111,065		104,853		111,065		104,853		111,065		104,853	
Wald $\chi^2$	21891.11‡		13234.82‡		19626.48‡		11109.46‡		17169.09‡		10734.55‡	

RB: Relational Bullying; PB: Physical Bullying; VB: Verbal Bullying  
 \* $P<0.1$ , † $P<0.05$ , ‡ $P<0.01$ . Data were Mean ± SEM.

BP test results reject the null hypothesis ( $H_0$ : the residuals of the equations are independent of each other,  $P = 0.000$ ). So it is more appropriate to use Seemingly Unrelated Regression Estimation in both model 1 and model 2.

**Table 4** shows the influence of GENDER, SES, LEARN, SELFESTEEM, PEER, TEASTU, PARENTCHILD on suffering from different types of school bullying among middle school students, which is basically the same as in the **Table 3**. However, the PROSOCIAL has a significant negative impact on suffering from verbal bullying with the significance level of 0.1 ( $\beta = -0.014$ ,  $P < 0.1$ ). That is, the higher the level of prosocial behavior of middle school students, the lower the probability of suffering from verbal bullying that supporting the hypothesis 4 to some extent. In addition, significant difference was observed in the impact of single-parent status on the types of school bullying. Middle school students from single-parent families are more likely to suffer from various types of school bullying.

We paid particular attention to the impact of the variable UR and its interaction with other variables on various types of school bullying among middle school students and whether such influences are significant are presented in **Table 4**. The results showed that the variable UR only had predictive effects on the verbal bullying at the

**Table 4. Heterogeneity Analysis Results of School Bullying Influence Factors among Urban and Rural Middle School Students.**

	RB		PB		VB		RB v.s. PB		RB v.s. VB		PB v.s. VB	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
GENDER	0.062± 0.008‡	0.097± 0.009‡	0.355± 0.008‡	0.380± 0.008‡	0.309± 0.008‡	0.337± 0.008‡	1479.5‡	1288.7‡	1112.5‡	991.0‡	59.2‡	48.0‡
SES	0.044± 0.005‡	0.028± 0.006‡	0.04± 0.005‡	0.03± 0.006‡	0.018± 0.005‡	0.007± 0.005	0.47	0.06	26.8‡	17.1‡	30.6‡	29.7‡
LEARN	-0.0± 0.0‡	-0.0± 0.0‡	-0.0± 0.0‡	-0.0± 0.0‡	-0.0± 0.0‡	-0.0± 0.0‡	83.0‡	91.9‡	34.3‡	33.0‡	18.9‡	26.6‡
PARENTCHILD	-0.086± 0.008‡	-0.161± 0.009‡	-0.063± 0.008‡	-0.122± 0.008‡	-0.053± 0.008‡	-0.115± 0.008‡	8.8‡	23.9‡	18.9‡	36.1‡	2.6	1.4
PEER	-0.405± 0.008‡		-0.291± 0.008‡		-0.322± 0.008‡		220.7‡		124.9‡		25.8‡	
TEASTU	-0.006± 0.008	-0.091± 0.009‡	-0.012± 0.003	-0.074± 0.009‡	-0.022± 0.008‡	-0.085± 0.008‡	0.7	4.5‡	4.5‡	0.6	2.5	3.2*
SELFESTEEM		-0.161± 0.006‡		-0.100± 0.006‡		-0.125± 0.006‡		111.9‡		42.3‡		30.2‡
SELFESTEEM <sup>2</sup>		0.009± 0.001‡		0.006± 0.001‡		0.008± 0.000‡		49.0‡		13.6‡		19.4‡
PROSOCIAL		-0.013± 0.008		-0.010± 0.008		-0.014± 0.008*		0.14		0.03		0.45
SINGLE	0.077± 0.017‡	0.099± 0.019‡	0.051± 0.017‡	0.075± 0.018‡	0.053± 0.016‡	0.076± 0.017‡	2.43	2.06	2.20	2.13	0.02	0.00
UR	0.004± 0.009	0.006± 0.010	-0.013± 0.009	-0.014± 0.009	-0.053± 0.008‡	-0.051± 0.009‡	4.3‡	5.2‡	49.8‡	46.8‡	37.0‡	31.2‡
UR×PARENT CHILD	0.012± 0.010	0.005± 0.010	-0.001± 0.010	-0.002± 0.010	-0.007± 0.009	-0.007± 0.010	1.99	0.58	4.49‡	1.69	0.68	0.41
UR×PEER	-0.026± 0.010‡		-0.009± 0.010		-0.001± 0.009		3.06*		7.47‡		1.34	
UR×TEASTU	-0.011± .010	-0.007± 0.011	0.003± 0.010	0.008± 0.010	0.002± 0.009	0.010± 0.010	2.42	2.55	2.36	3.37*	0.01	0.06
UR×PROSOCIAL		0.018± 0.010*		0.013± 0.010		0.014± 0.009		0.33		0.16		0.06
Constant	1.989± 0.032‡	1.939± 0.036‡	2.029± 0.032‡	2.016± 0.034‡	2.151± 0.031‡	2.109± 0.033‡						
R <sup>2</sup>	0.214	0.092	0.169	0.104	0.186	0.106						
RMSE	0.923	0.994	0.914	0.951	0.879	0.922						
Ch <sup>2</sup>	14941.11‡	5377.88‡	11166.85‡	6152.90‡	12555.25‡	6300.59‡						

RB: Relational Bullying; PB: Physical Bullying; VB: Verbal Bullying

On the left side of the table is the influence coefficient of variables on different types of school bullying and the robust standard error is in parentheses. The right side of the table shows the chi-square statistic of whether the coefficients of the same variable are equal on the two equations when the dependent variable is any two different types of school bullying. \*P<0.1, †P<0.05, ‡P<0.01. Data were Mean ± SEM.

significance level of 0.01 ( $\beta = -0.05, P < 0.01$ ), which had no significant effect on the physical and relational bullying. In other words, rural students are more likely to suffer from verbal bullying than urban students. This may be related to the small size of rural schools and the influence of rural culture. Rural students are more familiar with each other and between families. They are also more likely to be exposed to impolite language in rural cultures. It is easy to make fun of classmates and teasing classmates. In addition, the interaction between UR and peer relationship ( $\beta = -0.026, P < 0.05$ ) can significantly affect the frequency of relational bullying, but it has no significant effect on physical and verbal bullying. To a certain extent, compared with rural middle school students, peer influence has a greater impact on relational bullying among urban students. Therefore, we should pay attention to the phenomenon of verbal bullying among

rural students, and also pay attention to guiding urban students to build a harmonious peer relationship.

## **Conclusions and Suggestions**

The governance path of school bullying needs to be dealt with by the after-thought crisis to early intervention and prevention. Based on the previous analysis, the main conclusions and recommendations of this study are as follows:

First, Chinese middle school students have suffering from the highest frequency of verbal bullying, followed by relational and physical bullying. Compared with the visible physical bullying, teachers and parents may hardly hear verbal bullying and hardly feel relational bullying among students. And both are more difficult to be perceived and monitored by educators and parents, but they can produce long-term harm to students' bodies and minds. Therefore, on the one hand, schools can monitor through the installation of "electronic eyes" in the public domain of the campus. On the other hand, teachers should pay attention to the daily communication with students and learn from the information reflected by the students whether anyone in the class suffering from relational or verbal bullying, so that the facts can be confirmed early and can take necessary preventive measures. For example, psychological and behavioral interventions can be carried out in students who have already committed bullying, and bullying behaviors should be interrupted in time to avoid more harm to the students that will influence their future personality, psychological and prosocial behavior. At the same time, it is necessary to protect the bullied and give necessary psychological counseling to prevent the bullied from psychological shadow.

Second, boys are more likely to suffer from school bullying than girls, and the difference between boys and girls in school bullying are more manifested in physical and verbal bullying. As boys are more prone to incitement and conflict, parents and teachers should pay more attention to the daily performance and behaviors. For parents of boys, they should pay more attention to the abnormal behaviors, such as homelessness, sleepy nightmares and reluctance to attend class reunions etc. If boys have such behaviors, parents should communicate with them in time to see if they are being bullied at school. Teachers should strengthen the education of rule awareness for students, especially boys. We can learn from the Olweus Bullying Prevention Program (OBPP) (Lazarus et al., 2012) to clearly define bullying behavior and clearly indicate to them which behaviors are not allowed. Meanwhile, teachers should try to cultivate students to form a harmonious peer relationship, and prevent small contradictions or flights among students especially the boys from developing into school bullying.

Third, students from rural area, from single-parent families, or with migrant or left-behind status are more vulnerable to suffering from different types of bullying. Especially those coming from single-parent families are more likely to suffer from relational bullying. Rural and migrant children are more vulnerable to verbal bullying. But left-behind students have almost suffered the same from different types of school bullying. Therefore, for middle school students coming from these four high-risk families,

schools should establish care archives as soon as possible. Teachers should focus on them to ensure their safety during school time. In addition, schools and families should strengthen anti-school bullying cooperation, popularize both bullying and anti-bullying knowledge through parent meetings, hand out anti-school bullying manuals to parents and strengthen communication between parents and teachers, particularly the head teachers need to keep in touch with parents of above-mentioned risk families and encourage them to keep intimate contact with their children through telephone and internet etc., and to give their children more care and help them improve their social skills, and to restore and rebuild self-esteem, confidence and trust.

Fourth, the relationship between the level of self-esteem and the frequency of different types of school bullying is U-shaped, and this effect is more significant in relational bullying. Therefore, in order to establish a good relationship between middle school students and their peers, and avoid suffering from relational bullying, it is necessary to maintain a moderate level of self-esteem. Students with low level of self-esteem are too negative or even inferior to their own estimation. Schools and teachers should encourage them to actively participate in group activities, participate in interpersonal relationship and show themselves boldly through group or individual counseling. Parents should also evaluate children correctly, trust them fully and encourage them to express themselves in the crowd to help them to build up confidence. For those whose self-esteem level is too high or even conceited, schools should pay attention to fostering their sense of cooperation and help such students treat other students with modesty and sincerity. Learning to accept and respect others should be encouraged to be the acceptable and recognizable deeds.

Fifth, the parent-child, peer-peer and teacher-student relationships will significantly affect the frequency of suffering from school bullying among middle school students, and the peer relationship has a greater impact on urban students suffering from relational bullying. Therefore, it is necessary to give more care and help to students who are relatively “weak” in social communication. Parents should enhance communication with their children, promptly ask their children about the interpersonal relationship at school and listen to the information disclosed by children during the complaining process. And they should communicate with school teachers in time, understand if the children are bullied at school and find bullying behaviors as early as possible to stop them. In addition, parents can guide their children to learn how to protect themselves and take appropriate self-defense measures, such as teaching children to resist and defend their dignity and rights. At the same time, teachers should give each student support and care fairly and can also guide students, especially those from urban area, to establish a peer support system to fight against school bullying and form an anti-bullying class atmosphere. For instance, drawing from the Finnish school anti-bullying program, through anti-bullying courses and empathy training with the theme of interpersonal relationship and group pressure, we can strengthen students’ anti-bullying attitude, increase their sympathy for vulnerable groups and take advantage of the role of bystanders<sup>4</sup> to reduce incidence of school bullying.

## Notes

1. *Relational bullying is mainly caused by people who bully others manipulates the interpersonal relationship to make the victim be isolated and feel not recognized by the group or feel excluded. Verbal bullying means that people bully others by verbal intimidation, scolding, humiliation, ridiculing or degrading, which produce psychological harm to the bullied. Although the wound is not visible to the naked eye, sometimes the psychological damage caused by it is more serious than physical injuries. In addition, verbal bullying behavior is usually accompanied by relational bullying, and both initiate physical bullying. Physical bullying refers to physical violence, looting or being stolen, or forced to do things that you do not want to do. It is the most easily identifiable form in the clinic and is one of the forms that educators concern the most.*
2. *All the testing tools of the project called Regional Assessment of Education Quality (RAEQ) were compiled by Chinese National Subject Education Experts organized by Collaborative Innovation Center of Assessment toward Basic Education Quality, Beijing Normal University. The quality of the test tools meets the measurement requirements of large-scale testing.*
3. *The load of each item in the self-esteem scale is 0.678, 0.679, 0.615, 0.662, 0.488, 0.708, 0.712, 0.451, 0.686, and 0.679. The load of each item in the parent-child relationship scale is 0.79, 0.819, 0.6, 0.349, 0.411, 0.52, 0.635, 0.668, 0.521, 0.647, and 0.747. The load of each item in the peer relationship scale is 0.635, 0.509, 0.702, 0.494, 0.684, 0.726, 0.657, 0.718, 0.661, and 0.668. The load of each item in the teacher-student relationship scale is 0.743, 0.753, 0.763, 0.783, 0.728, 0.81, 0.69, 0.726, 0.684, 0.79, 0.815, 0.692, 0.693, 0.649, and 0.785. The load of each item in the pro-social behavior scale is 0.699, 0.756, 0.812, 0.742, and 0.741.*
4. *The role of bystanders means that once the bullying takes place, bystanders' silence, acquiescence, approval and participation in bullying will encourage the bullying behaviors. But if the bystanders object and stop the bullying behaviors, it will affect the progress of the bullying to a certain extent. When school bullying occurs, the companions of the bully are usually present. If they can play a role of a bystander and form an anti-bullying class or school culture, it will reduce the incidence or harm of school bullying.*

## Acknowledgement

*We acknowledge the financial support from the Collaborative Innovation Center of Assessment toward Basic Education Quality at Beijing Normal University.*

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*Received: 18 April 2019*

*Revised: 23 April 2019*

*Accepted: 09 May 2019*

*The Chinese version of this article has been published in J Capital Normal Univ (Soc Sci Ed) 2018; 6:171-185. The English version has been authorized for being publication in BECE by the author(s) and the Chinese journal.*

*胡咏梅, 李佳哲. 谁在受欺凌? — 中学生校园欺凌影响因素研究. 首都师范大学学报(社会科学版) 2018; 6:171-185.*



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# Best Evidence of Chinese Education

Vol. 2, No. 1, 2019

<http://www.scinedu.bonoi.org/>

*pISSN: 2639-5312*

*eISSN: 2639-5320*

*DOI: 10.15354/bece*



**Best Evidence of Chinese Education**

Vol.2, No. 1, May 2019

Insights Publisher