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# Education Should Respect the Nature of Children

Xiaoqiao Cheng

**H**OW to effectively deal with school violence and bullying is currently a globally recognized hot issue in the field of student management and minor protection. The UNESCO (UNESCO) report (Behind the Numbers: Ending School Violence and Bullying) released in 2019 pointed out that school violence and bullying are common problems worldwide (UNESCO, 2019). School violence or bullying has long existed in different stages of school education (Wei et al., 2019).

There are many reasons for school violence. He (2020) explored the relationship between adolescent school violence and sex hormones from a physiological perspective. He attributed school violence to "sexual instinct" and provided a physiological basis for education and intervention in violence from the perspective of dopamine antagonizing hormones.

This research gives us obvious enlightenment. For a long time, when we deal with school violence, we have made interventions on school violence from the perspective of criminology and sociology, and strengthened the punishment mechanism of school violence (Jing & Zhou, 2019). However, if we change our work mindset, start more from the nature of children and respect the nature of children, so as to help children reasonably release their nature in a variety of ways, can we prevent and reduce school violence and achieve a multiplier effect with half the effort?

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<https://doi.org/10.15354/bece.19.ar1270>

**Correspondence to:**

Xiaoqiao Cheng  
School of Education Science  
Nanjing Normal University,  
Nanjing, Jiangsu  
China  
Email: xqcheng2008@vip.163.com.

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# Is Sex Hormone the Driving Force of School Violence? The Neurobehavioral Evidence

Longjun Zhou,<sup>1,2</sup> Fuzhou Wang<sup>3</sup>

1. Jiangsu Second Normal University, Nanjing 211200, Jiangsu, China.
2. Engineering Research Center of Digital Learning Support Technology, Ministry of Education, Changchun 130000, Jilin, China.
3. Group of Neuropharmacology and Neurophysiology, Division of Neuroscience, The Bono Academy of Science and Education, Chapel Hill, NC 27510, USA

*“Returning violence for violence multiplies violence, adding deeper darkness to a night already devoid of stars.” – Martin Luther King, Jr.*

**W**HEN our students suffer school violence, we often subconsciously focus on the perpetrator’s behavior and other external factors related to it, such as family, school, and classmates. Of course, these external reasons are naturally more or less related to the behavior perpetrator’s behavior, but are there any internal driving factors that make violence uncontrollable?

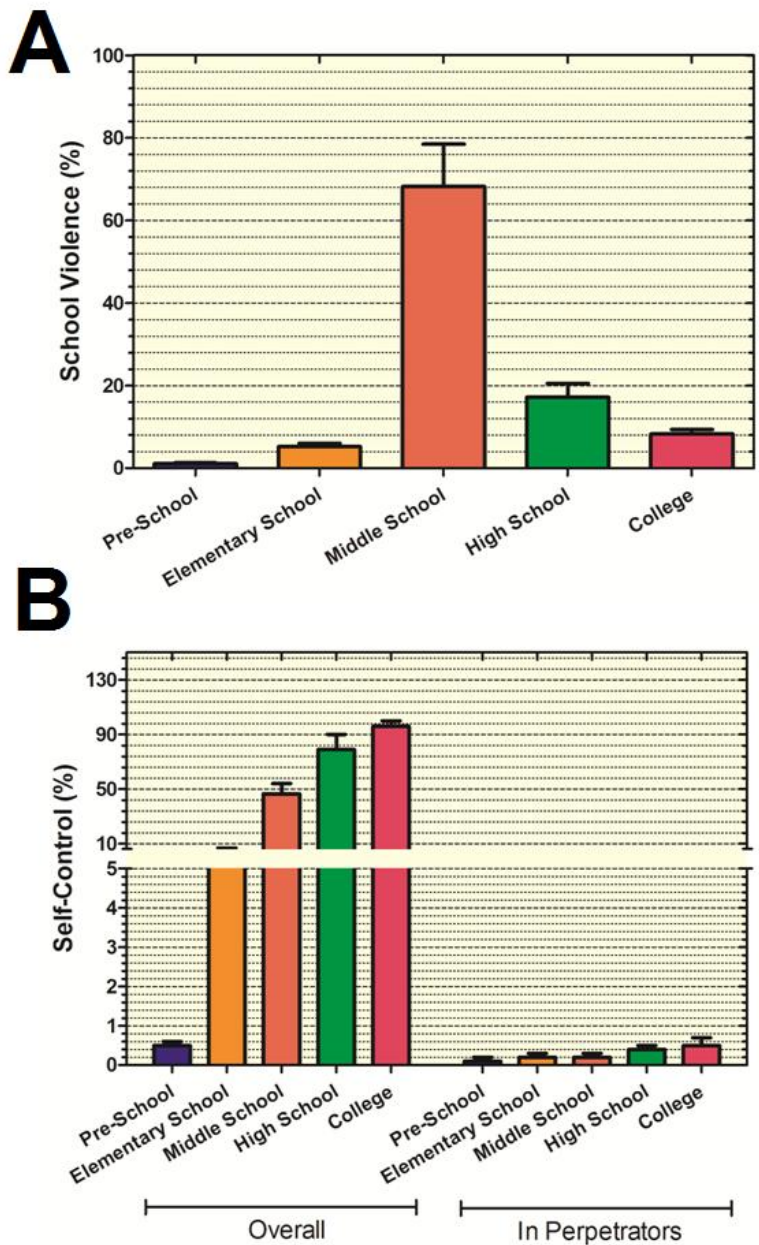
The US Department of Justice released the final report on school violence and showed that middle school is the age when violence is high, accounting for more than 70% of all violence cases (**Figure 1A**) (Zweig et al., 2013). After having perpetrated, the probability that the perpetrator will commit violence again will increase significantly (Office of the Surgeon General, et al., 2001). Among all perpetrators, the male to female ratio is 3:1, indicating that boys are more likely to perpetrate violence, but female violence methods and behaviors are more cruel and disgusting (Rivera-Rivera et al., 2007). In the later review of the perpetrators, almost 100% admitted that they were unable to control their violent behavior at that time and seemed to have an invisible impulse to urge them to commit violence, and even when they knew the harm of the violent behavior, they still committed violence without scruples (**Figure 1B**) (Willems et al., 2018). This indicates that among the 30% of middle school students prone to violence, the underlying age-related neuroendocrine changes are most likely to be the driving force leading to violence.

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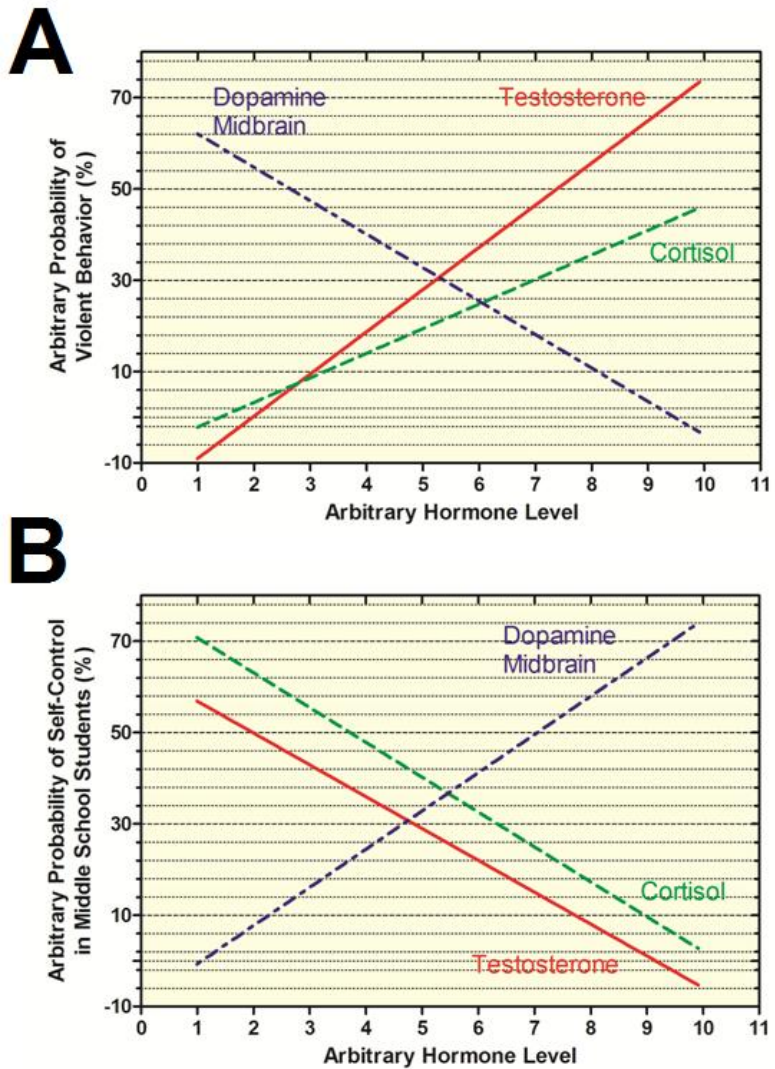


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**Figure 1. Distribution of School Violence and Self-Control Ability in Students.**

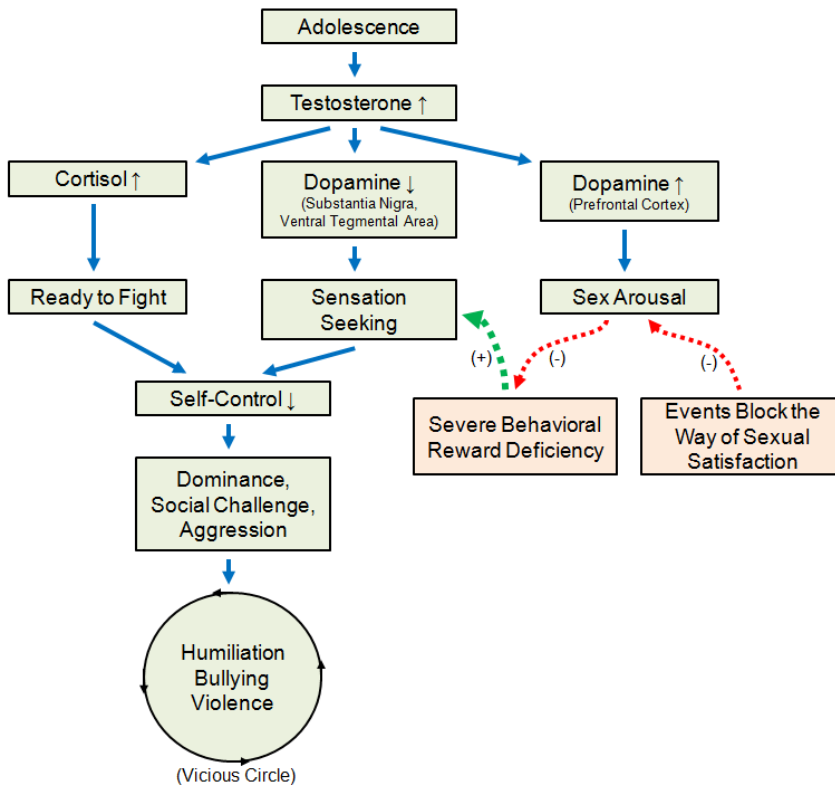
(A). Percentage of school violence in different school students. Middle school students have the highest percentage of school violence. (B). Self-control percentage of overall school violence and in perpetrators. The overall self-control increases with students' aging, but for the perpetrators, their self-control is extremely low in all age groups.



**Figure 2. Arbitrary Probability of School Violence and Self-Control in Middle School Students.**

(A). The arbitrary probability of school violence with the changes of testosterone, cortisol, and midbrain dopamine. Testosterone and cortisol show a positive correlation with the potential school violence, but dopamine, on the contrary, has a negative correlation with the possible violent behavior in middle school students. (B). The arbitrary probability of student self-control ability and the changes in testosterone, cortisol, and midbrain dopamine. Unlike violent behavior, self-control is negatively correlated with testosterone and cortisol levels but positively with the mid-brain dopamine.





**Figure 3. Neurobehavioral Network Regulation of School Violence in Adolescence.**

This is the underlying neurobehavioral connection among testosterone, cortisol, and dopamine in adolescence with school violence. A sharp increase in testosterone in adolescence markedly promotes the up-regulation of dopamine in the prefrontal cortex to arouse the sexual drive, but down-regulation of dopamine in the midbrain such as substantia nigra and ventral tegmental area to seek the reward sensation, i.e., sensation seeking. Simultaneously, testosterone significantly increases cortisol to help the student ready for a stressful situation and/or fight. Both these two conditions would substantially reduce students' self-control ability, leading to dominance, social challenge, and aggression under various environments that will eventually get into a vicious cycle expressed as repeated humiliation, bullying, or violence at school. Meanwhile, any events that can block adolescent sexual satisfaction would negatively affect the sexual arousal level regulated by a high level of dopamine in the prefrontal cortex. Subsequently, the student would get into a state of severe behavioral reward deficiency, which would significantly elevate the sensation-seeking behavior that further decreases the self-control level.

With the increase in awareness, in-depth research on middle school students' high violent behavior began to pay attention to the students' potential physiological and brain neurotransmitter changes. Among them, "Reward Deficiency" reasonably emphasizes how the lack of endogenous rewards and positive emotions causes individuals to seek rewards from the external environment through risk-taking behaviors (Blum et al., 2008). The underlying behavioral, molecular mechanism that promotes this is reducing the cerebral striatum and prefrontal cortex dopamine neurons (Blum et al., 2012; Modestino et al., 2015). However, what is more interesting is that the levels of male hormones in adolescent middle school students soared, which caused an increase in dopamine levels in the critical part of sexual arousal of the prefrontal cortex (Calabrò et al., 2019), while the substantia nigra striatum and ventral tegmental area dopamine that regulate rewards were down-regulated (**Figure 2A**) (Purves-Tyson et al., 2014). The direct result of this change is that sexual arousal is high while the sense of reward is low; the imbalance between the two will cause the individual to seek reward after the satisfaction, which will lead to a reduction in their control to achieve dominance, and then take dangerous challenging and even aggressive behavior (Chester et al., 2015). At this time, if any incident in his/her peers that he considers undesirable will arouse his impulse to commit violence, and this impulse will be temporarily terminated with the gratifying reward after his violence (**Figure 2B**) (Jarcho et al., 2013). However, the violence itself does not stop there but repeats like an addiction.

Further research found that testosterone can significantly increase the level of cortisol (Romero-Martínez & Moya-Albiol, 2016; Turan et al., 2015; van der Meij et al., 2019), while cortisol, which is used as a preparation for stress and combat, reduces the level of dopamine in the midbrain (Field et al., 2005; Kudielka et al., 2009). The increased cortisol makes the individual ready to fight, but it still lacks the sense of reward, making the individual's self-control frustrated and entering a state of fighting for rewards. Not only that, the facts may be more severe than this. When an individual's sexual desire cannot be satisfied due to specific events, it will enter a more severe state of lack of behavioral rewards, which will make its impulse to seek rewards more obvious, accompanied by a further decline in self-control, and eventually commit violence to achieve individual rewarding satisfaction. The detailed neurobehavioral network regulation is depicted in **Figure 3**.

In this issue, He (2020) used his experiments and observations and found that more than 90% of his middle school students' violent incidents were caused by conflicts in adolescent men and women's communication behaviors. The reason is the neurobehavioral performance caused by the individual's testosterone level changes. The author found that activities high-intensity training characteristics can satisfy students' lack of behavioral rewards in another way, thus interrupting the vicious circle of school violence. This school approach has achieved the effect of killing two birds with one stone. On the one hand, it reduces school violence; on the other hand, it en-

hances the individual's team consciousness and physical fitness. This is a feasible approach worth promoting.

School violence intervention based on neuroendocrine mechanisms may be more effective than other external factors (Rivara et al., 2016). It is of greater practical significance to use the interactive network formed between testosterone, cortisol, and dopamine at different brain center sites as the target of intervention.

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**Correspondence to:**

Fuzhou Wang, M.D., Ph.D.  
Group of Neuropharmacology and Neurophysiology  
Division of Neuroscience  
The Bono Academy of Science and Education  
Chapel Hill, NC 27510  
USA  
Email: fred.wang@basehq.org.

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# The Impact of Stratified Teaching on the Academic Performance of Chinese Middle School Students: A Meta-Analysis

Hui Shi,<sup>1</sup> Elizabeth S.T. Cheung,<sup>2</sup> Alan C.K. Cheung<sup>3</sup>

1. Nanjing Dianji Institute of Psychological Education, Nanjing 210000, Jiangsu, China
2. Freedom Preparatory Academy, Provo, UT 84604, USA
3. The Chinese University of Hong Kong, Hong Kong 999077, China

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**Abstract:** *Stratified teaching is an effective method and means to implement teaching students per their aptitude. Domestic and foreign scholars have carried out many experimental and quasi-experimental studies to observe the impact of stratified teaching on students' academic performance, but the results are quite different. So, can stratified teaching effectively help Chinese students improve their academic performance? How big is its impact? Which model is more suitable for Chinese students? To answer these questions, this article uses meta-analysis to quantitatively analyze 22 Chinese studies on the impact of Stratified teaching on student academic performance. We found that (i) stratified teaching has a positive effect on students' academic performance, and the overall combined effect size is 0.53; (ii) among the seven subjects of mathematics, English, physics, chemistry, biology, geography, and information technology, stratified teaching has had a positive effect on their learning. Stratified teaching's order of effect on different subjects was English > Physics > Geography > Information Technology > Mathematics > Biology > Chemistry; (iii) stratified teaching is suitable for students of different sizes of classrooms. However, the smaller the number of students in the classroom, the better the learning effect, and (iv) stratified teaching is more suitable for improving their learning in the mobile learning system.*

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**Keywords:** *Meta-Analysis; Stratified Teaching; Middle School Education; Academic Performance; Effect Size*

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**About the Authors:** Hui Shi, Nanjing Dianji Institute of Psychological Education, Nanjing 210000, Jiangsu, China. Email: 873946540@qq.com

Alan C.K. Cheung, Department Chairperson & Professor, Department of Educational Administration and Policy, The Chinese University of Hong Kong, Hong Kong 999077, China. Email: alancheung@cuhk.edu.hk

**Correspondence to:** Elizabeth S.T. Cheung, Freedom Preparatory Academy, Provo, UT 84604, USA. Email: lizcheung123@gmail.com.

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## Problem

“THE teaching by a wise master varies from student to student.”<sup>1</sup> Each student has differences in cognitive level, knowledge structure, behavior habits, and emotional attitudes (Xia, 2008). Chinese-style traditional classroom teaching can only meet some students’ learning needs, ignore students’ differences, and affect students’ personality development.

Stratified teaching is a teaching mode formed based on a reflection on the traditional class teaching system. It first recognizes that students are different, so it teaches students in accordance with their aptitude. By changing the traditional teaching organization, updating teaching methods, starting from students’ objective differences, and learning that can be achieved, the teaching objects, goals, and activities are hierarchized. Therefore, according to the different levels and types of students, based on their existing knowledge and learning conditions, differently formulate hierarchical learning goals, design hierarchical teaching content, propose different levels of learning needs, and try to make every student get the best development in the level of learning that is most suitable for them (Lu, 2014).

Stratified teaching focuses on improving students’ overall quality and pays attention to each student’s individual development. It is a classroom teaching mode that solves the contradiction between uniform teaching requirements and individual differences in students’ actual learning ability. Stratified teaching is generally recognized abroad and is actively used in daily teaching. Professor Susan Hallam (2002) believes that stratified teaching is to adapt school education to students’ differences by constructing diversified courses and teaching, which fully reflects students’ subjectivity. The British Ministry of Education believes that Stratified teaching is a kind of “student-centered teaching to meet all students, especially those with special needs” (Wu, 2016). In “*Vision 2020: Report of the Teaching and Learning in 2020 Review Group*” of the UK, stratified teaching was defined as a highly organized and interactive teaching method, which pays more attention to the individual development of students and helps each student tap their potential, and obtain learning achievements in order to actively integrate into the society and move towards success in the future (GTCE, 2020).

Stratified teaching in China is currently in the development and experimental stage. However, due to the large population base in China, the number and proportion of teachers are relatively small compared to the excessive number of students. This has led to many difficulties in the research and implementation of stratified teaching (Hua, 2015). In the pursuit of educational fairness and educational balance, China does not allow large-scale actual stratified teaching, but only small-scale experiments.

Therefore, this article integrates existing Chinese research on the impact of stratified teaching on student learning through literature analysis and uses meta-analysis methods to explore whether stratified teaching is generally applicable to Chinese students and positively impacts their academic performance.



# **The Background and Significance of Stratified Teaching**

## ***Definition and Types of Stratified Teaching***

Stratified teaching is a teaching strategy, a teaching model, and a teaching ideology. It focuses on (i) the current level of knowledge and ability of students; (ii) stratification; (iii) all students have been improved. Combining various viewpoints, stratified teaching means teachers divide students scientifically into groups of similar levels based on their current knowledge, abilities, and potential, and then teaches them accordingly. These groups are best developed and improved in teachers' appropriate stratification strategies and interactions (Liu, 2006).

At present, there are generally three types of stratified teaching: "hierarchical grouped fix-class teaching system," "hierarchical shift-class teaching system," and "in-class hierarchical teaching system." "Hierarchical grouped fix-class teaching system" refers to students' basic knowledge and ability level, divided into several levels to form a new teaching class. "Hierarchical shift-class teaching system" refers to the fact that all students in the same grade are divided into several levels based on keeping the original classroom unchanged and teaching in separate classes only for a particular subject. The "in-class hierarchical teaching system" divides students into several levels within the existing natural classes, and teaches at different levels, so that students at all levels can be fully developed (Sun, 2009).

In recent years, in order to avoid the negative impact of stratified teaching on students, "in-class hierarchical teaching" is divided into "in-class dominant stratification" and "in-class recessive stratification." "Dominant stratification" means that students know the stratification of themselves and others, and "recessive stratification" means that only the teacher knows or the teacher and the individual student (parent of the student) know the stratification.

Stratified teaching is a concentrated expression of the "people-oriented" teaching philosophy. It is a concrete implementation of teaching students in accordance with their aptitude in teaching practice and is a teaching model that conforms to the new curriculum reform and meets the needs of students' individual development.

## ***Research Background of Stratified Teaching***

Stratified teaching first appeared in the United States. At the beginning of the 20th century, the US taught immigrant children from different countries into groups according to academic performance, ability, and different nationality factors. With the promotion of compulsory education, Stratified teaching has been gradually adopted in Western countries such as the US, Germany, and the UK. In the 1950s, almost all elementary and middle schools in the UK divided students into different levels according to their abilities and allowed students of different levels to learn the same courses in the same class (Boaler, 2000). In the mid-to-late 20th century, along with the introduction and influ-

ence of the “Optimization of Teaching” theory and the Theory of Mastery Learning, many countries started to practice stratified teaching, and some stratified teaching theories and models with international influence emerged, Bloom’s Mastery Learning, Keller’s personalized teaching system, and Rogers’ non-directed teaching still affect the world’s teaching field (Peng, 2019).

As early as more than 2,000 years ago in China, the educator Confucius put forward the educational principle of “teaching students per their aptitude” in his book *The Analects of Confucius*. He mentioned, “To those whose talents are above mediocrity, the highest subjects may be announced. Nevertheless, to those who are below mediocrity, the highest subjects may not be announced.” This is the embryonic stage of the thought of stratified teaching. Han Yu, a thinker in the Tang Dynasty, proposed “Teach each person according to his abilities and get the best development,” that is, teachers should use different teaching methods according to the students’ abilities and qualifications. The Ming Dynasty thinker Wang Shouren put forward the educational principle of “gradually achieve development at different levels according to each individual’s abilities.” The meaning expressed by it is “people have different levels of acceptance and aptitude; therefore, learning, cultivation, and education should be based on their ability and advance gradually.” Wang Fuzhi, a thinker in the Qing Dynasty, advocated that “The students are not uniform, so we have to go in for each person,” pointing out that there are individual differences between students, and personalized teaching should be carried out according to the differences between them. These ideas have thoroughly bred the ideas and concepts of stratified teaching (He, 2014).

In the early 20th century, the stratified teaching method was introduced to China. In 1914, Zhishan Zhu’s “group teaching method” was the beginning of China’s stratified teaching experiment. However, due to the social background and educational situation, stratified teaching did not become the mainstream. It was not until the 1980s that with the introduction of quality education, stratified teaching emerged in China due to the differences between students and education quality requirements. Since the mid-1990s, with the overall development of stratified teaching, all provinces and cities in eastern China and the central and western regions have begun to participate in experimental research on stratified teaching. With the accelerated economic development and the expansion of education scale, stratified teaching has become the mainstream of modern education (Sun, 2009).

## **Literature Review and Questions**

Stratified teaching is one of the “hot spots” and “teaching methods” favored by contemporary Chinese essential education teaching practice. Stratified teaching is mainly displayed in an educational experiment in the reform and practice of fundamental education teaching. For example, the experimental research on “stratified teaching” started in Shanghai in the mid-1980s; the experimental research on “leveled teaching of compulsory courses” carried out by the Affiliated Middle School of Nanjing Normal University in 1992; Model experiment; experimental research on “stratified teaching of junior high

school English” conducted by Zhanggong Middle School in Bengbu, Anhui, etc. Therefore, stratified teaching’s experimental research is characteristic of fundamental education teaching reform (Ye, 2003).

The experimental subjects of stratified teaching are mainly concentrated in middle schools and high schools. However, the research on stratified teaching in middle and high schools was carried out in its main subjects. Common subjects used in Stratified teaching experimental research are mathematics, English, physics, chemistry, biology, and geography. Such as Zhang (2005) on the experimental study of stratified teaching in middle school English, Wu (2006) on the implementation of hierarchical research on middle school mathematics, Deng (2012) on the application of “layered and progressive protocol-guided leaning” in high school chemistry teaching, and Zhang (2013) on stratified teaching strategy of high school biology, etc. Stratified teaching in different disciplines has different impacts. For example, Liu (2019) found that under the condition that there is no significant difference in English scores in the pre-test, students’ performance in the stratified teaching group was higher than that of the traditional teaching group. The amount was as high as 2.32. However, some studies have found that some disciplines have only a small degree of influence. Zeng (2018) studied on the practice of high school biology stratified teaching showed that in the case of no significant difference in the pre-test, compared with the students in the non-stratified teaching group, the students in the stratified group had only a small improvement, and the effect size was only 0.40.

The experimental research on stratified teaching in China is carried out on a class basis. Traditional Chinese classes generally have around 40-50 students. In some underdeveloped areas, there are 60-80 students in a class due to uneven education. Some schools in the eastern developed areas also carry out small-class teaching, and the average class size is about 20-30 (Zou, 2005). Different class sizes have different effects on stratified teaching. Huang (2013) used a large-class teaching scale in the study of stratified teaching of English reading, and the effect of stratified teaching on student performance was 0.70, while He (2014) chose small-class teaching for stratified teaching of English reading. Its effect size is only 0.28. Therefore, under different class sizes, which are more conducive to improving student performance, is not clear.

Is the length of the experiment period one of the factors that affect the effect of stratified teaching? Literature data show that China’s stratified teaching experiment period is roughly divided into three types, such as Tan (2008) and Wei et al. (2014) half-semester teaching experiment research; Zhu (2012) and Gao (2017) one-semester teaching experiment research; Xing (2006), Wang (2011) and Xie (2017) teaching experiment research for one academic year. The effect size of Liu (2015) half-semester study is 0.43, and the effect size of Zhuang (2015) one academic year study is 0.48, the effect size of the two is not much different. Can it be considered that stratified teaching has nothing to do with the length of the experiment period? However, according to Huang’s (2011) half-semester research, the experimental result has an effect size of 0.69. Therefore, it can be assumed that stratified teaching is affected by the length of the experimental period.

Domestic experimental research on stratified teaching has mainly focused on shift-class and in-class recessive stratification in recent years. Pu's (2011)'s shift-class stratified teaching, Jin's (2014) in-class stratified teaching, Yan's (2015) in-class group collaboration stratified teaching, and You (2018)'s reactive stratified teaching all show that stratified teaching is useful for students' learning Performance has a positive effect. However, which strategy has a more significant impact on students' academic performance and can promote students' enthusiasm for further research.

In sum, stratified teach has an incredibly beneficial impact on students' academic performance. Stratified teaching is a new teaching model proposed based on respecting individual differences of students. This teaching model follows the theories of "teach students per their aptitude" and "zone of proximal development" to be suitable for students' physical and mental growth and development (Xia, 2010).

However, some scholars question whether stratified teaching is effective? Regarding this issue, countries represented by the United States have conducted extensive investigations and studies. Jeannic Oakes of the University of California has done much empirical research on "Stratified teaching" and found that the effectiveness of "stratified teaching" is questionable, and most studies have shown the ineffectiveness and danger of "stratified teaching" (Sato, 2010). Some scholars in China have also suggested that there are many types of stratified teaching. It is not clear which type of stratified teaching is more suitable? Stratified teaching does not target all disciplines, and some disciplines are insufficient (Chen, 2014). Yu's (2006) research results show no significant difference between the impact of stratified teaching and non-stratified teaching on student performance. Jiang's (2019) research concluded that stratified teaching did not positively affect students' academic performance and decline.

It can be seen that whether stratified teaching positively affects students' academic performance has not been reached a unified conclusion. It is not clear which kind of stratified teaching model helps improve students' academic performance? Is Stratified teaching applicable to all subjects? Scholars have doubts about a series of questions. Although the current research on stratified teaching in China and abroad is abundant, different national systems and national conditions prevent us from directly using foreign research results. Domestic research is often based on theoretical research, and many of the results are suggestions on how to carry out stratified teaching. As for the impact of implementation and its significance, few studies were involved (Xu, 2012). Therefore, compared with traditional teaching methods, it is of great significance to study whether teachers' stratified teaching impacts students' academic performance.

To this end, this article will use meta-analysis to analyze the experimental and quasi-experimental effects of stratified teaching on students' academic performance in China, aiming to answer the following questions:

- (i) Compared with traditional classroom teaching, does stratified teaching help students improve their academic performance?
- (ii) Does stratified teaching affect students' academic performance in different stages, subjects, class sizes, and experiment cycles, and how much influence does it have?

- (iii) Which type of stratified teaching is more conducive to the improvement of students' academic performance?

## **Methodology**

### ***Research Method***

Meta-analysis was first proposed by Glass (1976) and applied to clinical psychology. It is a comprehensive and quantitative statistical analysis method for multiple original studies using effect size (ES).

Meta-analysis is widely valued and applied by researchers because it can better control different studies' differences and make them comparable. Compared with traditional narrative reviews, meta-analysis has two outstanding advantages: (i) It can provide comprehensive conclusions relatively scientifically to resolve research disputes and can virtually explore the reasons for differences in different research results. (ii) The existing literature data can be analyzed again, and the research results of a specific field can be discussed without obtaining the original data (Borenstein, 2009).

Meta-analysis does not exclude the evaluator's own research experience, but its conclusions will be more robust and scientific due to stricter norms. Therefore, the meta-analysis method has become an important method to find the "best evidence" in the process of education evidence-based reform (Zeng, 2020).

### ***Research Process***

#### **• Determine Selection Criteria**

Meta-analysis needs to determine the criteria for literature inclusion according to the research objective, content, and statistical requirements. Lipsey (2001) pointed out that the inclusion of literature must include the following essential elements: the salient features of the included literature, research objects, essential variables, research design, cultural and language scope, time frame, and literature type. Based on this, this study formulated the following selection criteria:

- (1) The research topic is the impact of stratified teaching on students' academic performance, and stratified teaching is used as the main research variable;
- (2) The research must be experimental or quasi-experiment. Based on controlling the difference of the pre-test data, it is necessary to have the pre-test data, and one group of data is stratified teaching;
- (3) The research data is complete and should include statistics such as sample size, average, and standard deviation to calculate the effect size;
- (4) The research phase is middle school;
- (5) The research subjects are basic education subjects, including Chinese, mathematics, English, history, geography, politics, physics, chemistry, biology, etc.;
- (6) According to JHU or WWC standards, the experiment period should be 12 weeks or more to ensure its effectiveness;

- (7) Students' sample size is based on the class size and is selected according to the class size. In Asia, the number of small classes is generally around 30 (Guo, 2011). Therefore, this time the student sample size is selected to be more than 30 people, and the sample sizes of the two groups are similar to ensure its accuracy;
- (8) At least two teachers should teach the experimental group and the control group separately to reduce the influence of teachers;
- (9) The focus of this research is the impact of stratified teaching on student performance in the Chinese context. Therefore, the selected studies are all from China. Studies on stratified teaching published before 2000 are mainly qualitative. Therefore, the selected studies are published between 2000 and 2020, and the type of literature is not limited.

### • Literature Retrieval

Based on the China National Knowledge Infrastructure (CNKI) and Wanfang database, using stratified teaching as the keyword, 43,313 documents were retrieved. Firstly, all the searched literature titles are screened out and imported into Excel for review, and repetitive and non-compliant studies are excluded. Download the documents that may meet the standards and read the abstracts in batches by multiple people to exclude further the research that does not meet the requirements; then, read the document's full text. Finally, search the selected documents again, and finally obtain standard documents that meet the requirements.

According to the selection criteria, 22 studies meet the requirements, and a total of 26 sets of data can be used for analysis (some research samples contain multiple sets of data). The literature search and screening process is shown in **Figure 1**, and the literature screening information is shown in **Table 1**.

### • Characteristic Value Coding

Different studies contain different characteristic values. In this research, after obtaining the literature on the impact of stratified teaching on students' learning, which can be analyzed, the feature value is coded. The coding objects comprise the author of the literature, the year of publication of the journal, the subject, the learning stage, and the number of samples, the period, and the method. The specific rules are as follows:

- (1) Experimental subjects (D): including Mathematics, English, Physics, Chemistry, Biology, Geography, and Information Technology;
- (2) Experimental section (Gr): elementary school is pri, middle school is jun, high school is hig;
- (3) Experimental number (N): According to the size of the class, the size of the small class is generally between 25-30 (Guo, 2011), coded as S; the traditional class size is generally around 40-50, coded M, a class with more than 50 students is defined as a large class (Hayes, 1997), coded as B;
- (4) Experiment period (T): The half-semester experiment period is short, coded as ST, the one-semester experiment period is medium, coded as MT, and the experiment period of one academic year and above is longer, coded as LT;

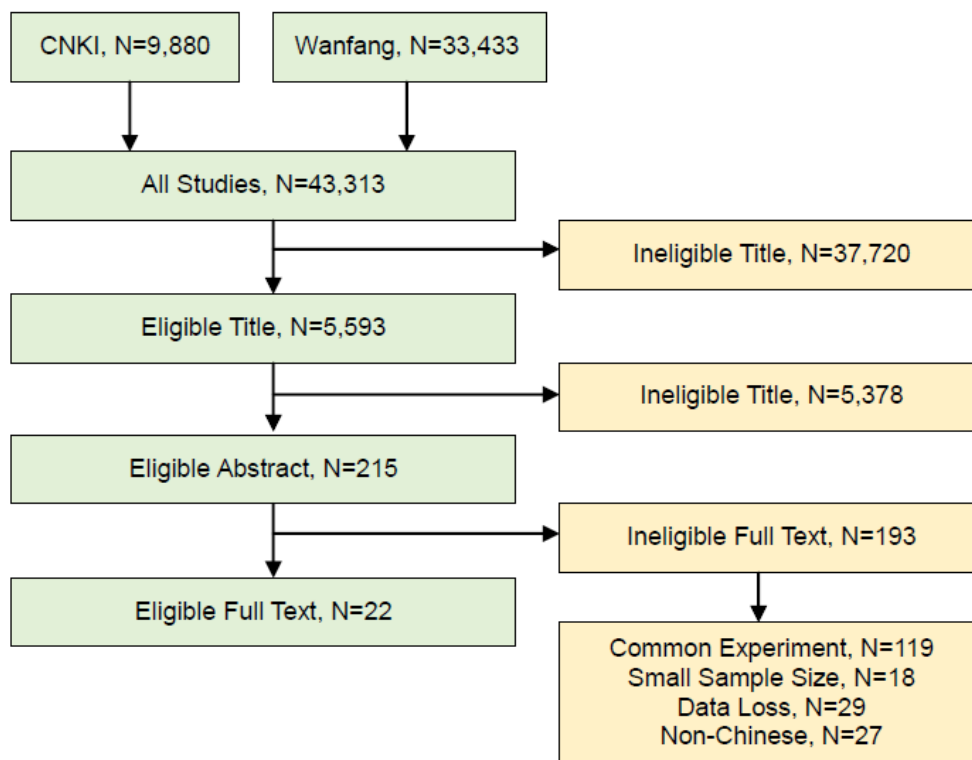


Figure 1. Flow Chart of Literature Search and Screening.

Table 1. Heterogeneity Test Results.

Model	#	Effect Size and 95% Confidence Interval			Heterogeneity				
		Effect Size	SMD	Lower Limit	Upper Limit	Q-value	Df (Q)	P-value	I <sup>2</sup>
Fixed	22	26	0.53	0.455	0.598	33.969	25	0.109	26.404
Random	22	26	0.50	0.415	0.590				

- (5) Intervention method (M): According to the method of stratified teaching included in the study, in-class dominant hierarchical was coded PO, in-class recessive hierarchical was coded NE, non-dominant and non-recessive in-class stratification was coded GE, the class-shift stratified teaching was coded TR, and the combined dominant and recessive stratified teaching was coded MI.
- (6) Research design: i.e., experimental studies or quasi-experiments.

## • Data Analysis

We used Comprehensive Meta-Analysis 3.0 (CMA3.0) software as a data analysis tool to perform specific analyses on publication bias, heterogeneity test, and effect size.

Results

### *Study Characteristics*

Twenty-two studies based on approximately 3135 junior and senior high school students met the inclusion criteria. The characteristics and findings of these studies appear in Appendix 1. Participants of 12 studies were high school students, and the other 10 were junior high school students. In terms of subjects, over 60% were English and Mathematics, and less than 40% were others. All studies except one (Huang, 2013) were small-scale studies, less than 150 participating students.

In order to examine whether stratified teaching has an impact on students' academic performance and how significant the impact is, this study used meta-analysis software and a random effect model to summarize and analyze the data of stratified teaching (**Table 1**) to show the overall impact of stratified teaching on students' academic performance.

According to **Table 1**, the combined effect size SMD of the included study was 0.53. According to Cohen's statistical theory of effect size, the study produced a moderate effect. It can be seen that stratified teaching has a more significant impact on students' academic performance and can significantly improve it (see details in **Appendix 1**).

### *The Influence of Stratified Teaching on the Academic Performance of Students in Different Stages*

Stratified teaching has an impact on students' academic performance and can improve it. However, for different stages, class sizes, subjects, and whether there are differences in stratified teaching's impact on students' academic performance? In response to this, we did further analysis.

According to the school period, the literature included in this study was divided into middle school and high school. We focused on analyzing the impact of stratified teaching on middle and high school students' academic performance.

According to **Table 2**, the combined effect size of stratified teaching for middle school students is 0.577, and the combined effect size for high school students is 0.47. The effect values are all-around 0.5, which is a moderate effect. The combined effect size test  $p = 0.000$  ( $p < 0.05$ ), indicating that stratified teaching positively affects students of different stages. The between-group effect test shows that the difference between the two groups in middle school and high school shows that  $QBET = 1.176$ ,  $p = 0.278$  ( $p > 0.05$ ), indicating that stratified teaching has no significant difference in the academic performance of middle school students and high school students.



**Table 2. The Impact of Stratified Teaching on the Learning of Students in Different Stages.**

Stage	#	Effect Size	95% CI		Intergroup Effect Size	
			Lower Limit	Upper Limit	QBET	P
Middle School	10	0.58	0.413	0.74	1.176	0.278
High School	16	0.47	0.365	0.574		
Combined Effect Size Test	Z=11.15, P=0.000					

**Table 3. The Impact of Stratified Teaching on the Performance of Different Subjects.**

Subject	#	Effect Size	95% CI		Intergroup Effect Size	
			Lower Limit	Upper Limit	QBET	P
Biology	3	0.35	0.123	0.567	7.619	0.276
Chemistry	2	0.33	0.067	0.593		
English	8	0.64	0.467	0.821		
Geography	3	0.54	0.287	0.802		
Mathematics	6	0.40	0.241	0.550		
Physics	3	0.55	0.301	0.796		
Information Technology	1	0.45	0.062	0.837		
Combined Effect Size Test	Z=11.17, P=0.000					

**Table 4. The Impact of Stratified Teaching on Student Performance of Different Class Sizes.**

Class Size	#	Effect Size	95% CI		Intergroup Effect Size	
			Lower Limit	Upper Limit	QBET	P
Big	15	0.44	0.336	0.542	4.727	0.030
Medium	11	0.64	0.491	0.785		
Combined Effect Size Test	Z=11.71, P=0.000					

## ***The Impact of Stratified Teaching on the Performance of Different Subjects***

Different disciplines have their characteristics. To investigate whether stratified teaching applies to all disciplines and whether it has different effects on different disciplines, we have discussed the stratified teaching of different disciplines. The subjects included in the study include English, mathematics, physics, chemistry, biology, geography, and information technology. The results are shown in **Table 3**.

According to **Table 3**, all disciplines' combined effect sizes are greater than 0.2, and the combined effect sizes of English, geography, and physics are all greater than 0.5. Judging from the combined effect size test,  $p = 0.000$  indicates that stratified teaching has a moderate impact in different disciplines. From the effect between groups, the difference between groups showed  $P = 0.276$ , indicating no significant difference between different disciplines in statistically significant stratified teaching. This shows that disciplines have their characteristics, but stratified teaching positively impacts them. The order of effect size among different disciplines is: English > Physics > Geography > Information Technology > Mathematics > Biology > Chemistry. This shows that stratified teaching positively impacts English, physics, and geography better than chemistry, biology, and mathematics.

## ***The Effect of Stratified Teaching on the Academic Performance of Students from Different Class Sizes***

To observe whether stratified teaching has the same effect on students of different class sizes, we divided the number of student samples into small, medium, and large based on the class size of Chinese public schools. Since there are no small-sized classes in the included studies, we chose medium-sized and large-sized classes to analyze the impact of stratified teaching on the performance of students of different class sizes (**Table 4**).

**Table 4** shows that the combined effect size of the number of students in large and middle-size classes,  $Z = 11.712$ ,  $P = 0.000$ , indicating that stratified teaching has a significant impact on students' academic performance of different class sizes. From the perspective of the effect size between large and medium-size classes,  $QBET = 4.727$ ,  $P = 0.030$ , reaching a significant level, indicating significant differences in the impact of stratified teaching on the performance of different class sizes. From the perspective of the specific effect size, the student effect size of the large size class is 0.44, the student effect size of the medium size class is 0.64,  $SMD \text{ medium size} > SMD \text{ large size}$ , indicating that stratified teaching has a more significant impact on the academic performance of students in middle-size classes than students in large-size classes.

## ***The Influence of Stratified Teaching on Students' Academic Performance in Different Experimental Periods***

**Table 5. The Impact of Stratified Teaching on Student Performance in Different Experimental Periods.**

Period	#	Effect Size	95% CI		Intergroup Effect Size	
			Lower Limit	Upper Limit	QBET	P
Long	6	0.50	0.327	0.681	1.944	0.378
Middle	17	0.45	0.351	0.545		
Short	3	0.82	0.280	1.351		
Combined Effect Size Test	Z=10.93, P=0.000					

**Table 6. The Impact of In-Class and Shift-Class Stratification on Students' Academic Performance.**

Mode	#	Effect Size	95% CI		Intergroup Effect Size	
			Lower Limit	Upper Limit	QBET	P
In-Class Stratification	24	0.51	0.431	0.578	2.098	0.147
Shift-Class Stratification	2	0.99	0.339	1.633		
Combined Effect Size Test	Z=13.77, P=0.000					

**Table 7. The Impact of In-Class Dominant, In-Class Recessive and Combined Dominant and Recessive Stratification on Student Academic Performance.**

Mode	#	Effect Size	95% CI		Intergroup Effect Size	
			Lower Limit	Upper Limit	QBET	P
Combined Dominant and Recessive Stratification	1	0.65	0.208	1.097	1.685	0.431
In-Class Recessive Stratification	12	0.37	0.255	0.479		
In-Class Dominant Stratification	2	0.45	0.181	0.716		
Combined Effect Size Test	Z=7.67, P=0.000					

Do different experimental periods have different effects on students' academic performance? Is the longer the experiment period, the more significant the impact on students'?

academic performance? Therefore, we divide the experimental period included in this study into short, medium, and long periods.

In **Table 5**, the combined effect size  $Z=10.933$ ,  $P=0.000$  of the effect of long, medium, and short periods on students' academic performance, the effect is significant, indicating that regardless of the length of the experiment period, the stratified teaching improves students' academic performance. Among the group effects,  $QBET = 1.944$ ,  $P = 0.378$ , no significant difference, indicating that no matter how long the experiment period is, it has the same effect on improving student performance. In terms of a single period, the effect size of the short period  $SMD = 0.82$ , reaching a significant level; compared to the medium and long periods, the stratified teaching in the short experimental period has the most apparent effect on students' academic performance.

### ***The Impact of Different Stratified Teaching Modes on Students' Academic Performance***

We subdivided the stratified teaching model into "in-class dominant stratification," "in-class recessive stratification," "in-class stratification" (not mentioned whether it is dominant or recessive), "shift-class stratification," and "combined stratification of dominant and recessive."

Due to the obscure information of some researches, it cannot be accurately summarized. In order to make the results more rigorous, we subdivide these studies into two small parts and compare them one by one: (i) the impact of in-class stratification and shift-class stratification on students' academic performance (**Table 6**); the influence of "in-class dominant stratification," "in-class recessive stratification," and "combined stratification of dominant and recessive" on student academic performance (**Table 7**).

In **Table 6**, in-class stratification includes "in-class dominant stratification", "in-class recessive stratification", and "combined stratification of dominant and recessive". The combined effect size of in-class stratification and shift-class stratification  $Z = 13.770$ ,  $P = 0.000$ , indicating that no matter which kind of stratified teaching mode, could help students improve their academic performance. The between-group effect size  $P = 0.147$ , indicating that different stratified teaching models had no significant difference in the impact of student learning. But in the specific effect size, shift-class stratification ( $SMD = 0.99$ ) > in-class stratification ( $SMD = 0.51$ ), indicating that shift-class stratification had a greater impact on students' academic performance.

**Table 7** compares the impact of three different stratification modes on students' academic performance in in-class stratification. The results showed that "in-class dominant stratification," "in-class recessive stratification," and "combined stratification of dominant and recessive" all had significant effects on students' academic performance, with the combined effect size  $Z = 7.666$  and  $P = 0.000$ . The between-group effect size  $P = 0.431$ , indicating that the three in-class stratified teaching models had the same effect on students' academic performance. Among the single effect sizes, combined stratification of dominant and recessive had the best effect on students' academic performance.

## ***Publication Bias Test***

Publication bias refers to a phenomenon in which statistical results are positively significant and more straightforward to be accepted and published by journals. When the published research cannot systematically represent the fundamental research completed in the field, it is considered that publication bias has occurred. If there is publication bias, the meta-analysis results may be at risk of amplifying the real effects of interventions (Rothstein, 2006).

Publication bias is an essential factor affecting the reliability of research results, so the test of publication bias is an indispensable part of a meta-analysis. To ensure the scientific characteristics of the stratified teaching results, we used the funnel chart combined with the Egger test to test the publication bias of the included research samples, and the results are shown in **Figure 2**.

In **Figure 2**, the sample effect size of the included study is symmetrically distributed on both sides of the average effect size, indicating that the included study's publication bias is less likely. To avoid the subjectivity of the funnel chart, we combined the Egger method to test further, such as  $t < 1.96$ ,  $p > 0.05$ , which shows no significant publication bias between studies (Begg, 1994). The results show that  $t = 1.53$ ,  $p_1 = 0.07$ , and  $p_2 = 0.14$ . Based on this, the research on stratified teaching we included is less likely to have publication bias, and the conclusions reached are more reliable.

## ***Heterogeneity Test***

Heterogeneity testing is the key to meta-analysis. Due to differences in the sample size, evaluation criteria, and research methods of the initial studies included in the meta-analysis, if there is heterogeneity between the studies, the effect size cannot be combined (Wang, 2018).

According to the statistical principles of meta-analysis, only better homogeneous data can be combined. Therefore, it is necessary to test the heterogeneity of the results of multiple studies to select an appropriate effect model based on the results. When the included studies' heterogeneity is considerable, the random-effects model is generally used for analysis; when the research heterogeneity is small, the fixed effects model will be better (Li, 2018).

Commonly used methods of heterogeneity testing include the Q test and  $I^2$  test. The test level of the Q test is usually set to 0.10. If the heterogeneity test result  $p > 0.10$ , it can be judged that the studies are homogeneous, and the fixed effects model can be selected. If the heterogeneity test result of multiple studies is  $p \leq 0.10$ , it can be determined that the studies are not homogeneous, and the random-effects model is used (Borenstein, 2009). The  $I^2$  statistic is a supplement to the Q test's heterogeneity result and can give a more apparent result. The larger the  $I^2$  value, the more significant the heterogeneity. Generally, 25%, 50%, and 75% of  $I^2$  values classify heterogeneity into low, medium, and high grades (Cooper, 1994). When  $I^2 = 0\%$ , it indicates that there is no heterogeneity between studies; when  $I^2 < 25\%$ , there is low heterogeneity; when 25%

$\leq I^2 < 50\%$ , there is medium heterogeneity; when  $I^2 > 50\%$ , it is considered that there is high heterogeneity (Higgins, 2003).

**Table 1** shows the combined effect values of the 26 groups of student learning data of different stages in 22 stratified teaching studies. The sample heterogeneity test results show that  $Q = 33.969$ ,  $p = 0.109$  ( $p \leq 0.10$ ),  $I^2 = 26.4\%$  ( $25\% \leq I^2 < 50\%$ ), indicating that the data has medium heterogeneity, so we chose random effect model to remove heterogeneity and combined the data.

## Conclusion and Discussion

We analyzed 22 experimental and quasi-experimental studies on the impact of stratified teaching on student academic performance through meta-analysis. It is found that (i) stratified teaching has a moderately positive effect on students' academic performance (effect size is 0.53). (ii) Stratified teaching is more effective when applied to subjects such as English, physics, and geography. (iii) Compared to classes with larger sizes, stratified teaching in middle-size classes is more conducive to improving students' academic performance. (iv) The research effect of stratified teaching with a short experimental period is more significant. (v) Compared with in-class stratified teaching, shift-class stratification is more conducive to improving students' academic performance and the development of physical and mental health.

### *Stratified Teaching is Significantly Related to Students' Academic Performance*

Our study showed that compared with traditional classroom teaching, stratified teaching has a moderately positive impact on students' academic performance ( $SMD = 0.53$ ). This result was consistent with the results of Shi (2009), Diao (2010), and Ren (2013). We examined the relationship between stratified teaching and student academic performance. According to the results, it can be inferred that the mutual influence mechanism between the above two is that stratified teaching makes it easier for students with similar learning needs to study together and achieve the teaching goals more quickly. Students' sense of accomplishment in problem-solving can be transformed into an individual's internal learning motivation, improve their subjectivity and initiative in learning, and to a certain extent, promote students' awareness of cooperation and competition (Zhang, 2019), thereby helping them essentially improve the academic performance. Xia's (2010) study also mentioned that stratified teaching puts students with similar academic performance and comparable level of ability at the same level, which is in line with students' competitive psychology, strengthens students' sense of competition, can further stimulate students' internal motivation and mobilize students' passion for learning.

### *The Moderating Effect of Subject, School Stage, Class Size, Experimental Period, and Stratification Modes*

The moderating effect test results show that stratified teaching has a positive effect on students' academic performance, but it is restricted by factors such as school stage, subject, class size, experiment period, and stratification mode.

In terms of stages, stratified teaching has similar effects on the performance of middle school students and high school students, and its combined effect sizes were 0.58 and 0.47, respectively, suggesting that it has a moderate impact, that is, stratified teaching has the same effect on middle school students' academic performance.

In terms of subjects, the studies of Jiang (2018), Xiao (2017), and Xia (2010) all showed that stratified teaching had a positive impact on different subjects. However, after analyzing each subject's specific effect size, we found that the effect of stratified teaching on some subjects is more significant, such as English, physics, geography, and mathematics.

In terms of class size, this study shows that compared to large-sized classes, the application of stratified teaching in medium-sized classes is better. Due to the lack of a sample of students from small-size classes in this study, it is impossible to compare stratified teaching's application effects between medium-size and small-size classes. However, small class education has apparent advantages over traditional large-size class education (Huang, 2006). Chen (2020) pointed out that in a large-size class environment, even if teachers have stratified teaching and take into account the mind of each student, they are often limited by their energy. Zhang (2019) emphasized that the class size is large, and the room teacher cannot observe every student in detail, so there is a high probability that students may be stratified to a level that does not match their situation. The implementation of stratified teaching in small-size classes can make teachers' pay more attention to each student's learning situation and promote students' personalized learning. Simultaneously, teaching in small-scale classes can reduce the workload of teachers' class management; so that they can have more time for teaching design to achieve better teaching effects (Wang, 2018).

In the experiment period, we found that students' academic performance is not controlled by the experiment period. Different experimental periods have the same effect on students' academic performance, but from the perspective of a single experimental period, research with a short experimental period can help students improve their academic performance more obviously. However, it can be assumed that this is related to the high degree of teacher input and high student enthusiasm and excitement caused by the short experiment period. The studies of Xu (2005), Wu (2012), and Zhang (2013) showed that stratified teaching would increase the workload of teachers. If the school cannot allocate more teachers, if things go on like this, the teachers' teaching energy will decrease, and the teaching effect will inevitably be significantly reduced. In terms of teaching mode, stratified teaching has multiple teaching modes. In China, the common forms of stratified teaching are "in-class stratification" and "shift-class stratification." "In-class stratification" is divided into "in-class dominant stratification" and "in-class recessive stratification". This study found no significant difference in the impact of different in-class stratification modes on students' academic performance; when teachers are teaching, they can choose dominant stratification, recessive stratifica-

tion, or a combination of the two. Yan (2008), Zhang (2012), and Liu (2015) found that considering the mental health of students, teachers more often choose in-class recessive stratified teaching or group stratified teaching. Compared with in-class stratification, shift-class stratified teaching has a more significant impact on students' academic performance, and its effect size is  $SMD = 1.009$ . Shift-class stratified teaching retains the original class, but according to the students' learning level and interest in class at the corresponding level. In this way, students' passive acceptance of knowledge becomes their active absorbing knowledge. This can stimulate students' interest in learning, improve students' academic performance, and promote each student (Lv, 2020). Mou (2020) believed that shift-class stratified teaching ensures the realization of school teaching tasks and meets the diverse development needs of students.

Compared with traditional classroom teaching, stratified teaching is more conducive to students' development, but many factors restrict it. Our research results are based on comprehensive statistical analysis and have absolute reliability. However, because meta-analysis is still an exploratory analysis tool, its conclusions are inferential rather than factorial results and are susceptible to some adjustment variables; therefore, it is necessary to be cautious in promoting results.

## **Problems and Summary**

Our research has found that stratified teaching can meet the learning needs of students at different levels. Stratified teaching can promote the smooth development of classroom teaching and positively impact students' learning attitudes and strategies. However, there are also some problems in the same stratified teaching, which need attention.

### ***Problems***

Students want to be recognized by the school, family, and society. In the class, due to the students themselves' individual differences, it will be difficult for some students to change in a short time, lack of learning ability, lowered learning enthusiasm, and eventually lose confidence in learning (Xu, 2012). Stratified teaching follows the principle of "teach students according to their aptitude, proceed in an orderly way and advance step by step," and fully respect the individual differences of students so that they can be more effectively integrated into classroom learning. This is a teaching method that truly considers students and hopes to narrow the differences among students. Nevertheless, in practice, there are often some problems.

- **If Stratified Teaching Is Not Well Controlled, It Will Transform to Diversion**

In most studies, stratified teaching stratification is based on student performance and does not take into account factors such as student abilities, motivation, interests, and cognitive structure. When implementing stratified teaching, teachers should consider these factors; otherwise, the stratification will evolve into a diversion, which is not sig-



nificantly different from the “fast and slow class” teaching in some middle schools (Xu, 2005).

- **Stratified Teaching Tends to Cause Students’ Psychological Burden**

After implementing stratified teaching in schools, whether it is recessive stratification, dominant stratification, or shift-class stratification, students are often labeled with A, B, and C levels, which creates psychological problems for middle and low-level students with some kinds of hint. Most studies showed that teachers would communicate and psychologically counsel students at different levels in the early stage of stratification, but the lack of attention in the later stage could easily cause students’ psychological imbalance, especially those at the extremes. Therefore, in the entire implementation of stratified teaching, teachers must always give every student care and encouragement to integrate into the new class and maintain the right attitude.

- **Stratified Teaching Lacks Correct Guidance and has not yet Formed a Complete System**

Stratified teaching, which is carried out under the guidance of new educational theories and concepts, requires teachers to get rid of traditional teaching methods and make new attempts, which is problematic. China’s current stratified teaching is only used for experimental research and has not formed its own unique, shaped, and realistic method of stratified teaching (Hua, 2015).

### ***Summary***

Stratified teaching is a useful exploration of the current situation of Chinese education. Stratified teaching aims to change the original classroom teaching mode and method and design different teaching goals, contents, and tasks according to different teaching objects; so that every student can gain something, feel the joy of learning, and understand the importance of learning. In the end, a set of learning methods suitable for individual students can be formed and can be used in any environment.

Stratified teaching brings advantages to students, increases the intensity and difficulty of teachers’ work, and puts forward higher teachers’ requirements. Therefore, teachers must advance with the times, strengthen their professional ability, constantly sum up experience, improve teaching models, adjust teaching ideas, and fully mobilize students’ learning enthusiasm and initiative to meet students’ different needs at different levels.

This study proved that stratified teaching is universally useful and positively impacts students’ learning through meta-analysis. However, since this study only focuses on stratified teaching in the Chinese context, and the research stage only focuses on middle and high schools, the overall sample size is small, so the final results need to be treated with caution.

## Note

1. The “*The Analects of Four Confucian Classics*” by Xi Zhu, an educator in the Song Dynasty of China, means that the saints conduct targeted education based on each person’s different qualifications and abilities.

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**Appendix 1.**

The 26 Effect Sizes from the 22 Included Studies.								
ID	Author(s)	Sample Size	Grade	Period	Subject	Stratification	Design	Effect Size
1	Ren, Z.H. (2013)	T=38 C=38	Middle School	1 Semester	English	In-Class Recessive	Experimental	0.58
2	Liu, T.T. (2015)	T=60 C=60	High School	1/2 Semester	English	In-Class Recessive	Experimental	0.45
3	Qi, G.X. (2012)	T=38 C=38	High School	1 Semester	Physics	In-Class Recessive	Experimental	0.46
4	Huang, W.Q. (2013)	T=352 C=346	High School	2 School Year	English	In-Class	Experimental	0.69
5	He, Y.X. (2014)	T=35 C=35	Middle School	1 School Year	English	In-Class Recessive	Experimental	0.27
6	Gong, Y.X. (2015)	T=58 C=55	High School	1 Semester	English	In-Class Recessive	Experimental	0.52
7	Diao, Y. (2010)	T=52 C=53	Middle School	1 School Year	Technology	In-Class Recessive	Experimental	0.46
8	Sun, X. (2009)	T=41 C=41	Middle School	1 Semester	Mathematics	Combined In-Class Dominant & Recessive	Experimental	0.64
9	Zhang, G. (2004)	T=51 C=50	Middle School	1 School Year	Mathematics	In-Class	Experimental	0.36
10	Guo, M.M. (2011)	T=52 C=52	Middle School	1 Semester	Mathematics	In-Class	Experimental	0.66
11	Zhang, J. (2018)	T=74 C=74	Middle School	1 Semester	Mathematics	In-Class Recessive	Experimental	0.31
12	Xu, M.J. (2014)	T=40 C=40	Middle School	1 Semester	English	Shift-Class	Experimental	0.67
13	Liu, N. (2019)	T=40 C=40	Middle School	1/2 Semester	English	Shift-Class	Experimental	2.39
14	Peng, H.Y. (2019)	T=47 C=45	Middle School	1 Semester	English	In-Class	Experimental	0.85
15	Feng, F. (2014)	T=40 C=40	High School	1 Semester	Geography	In-Class	Experimental	0.35
16	Feng, F. (2014)	T=40 C=40	High School	1 Semester	Geography	In-Class	Experimental	0.60
17	Feng, F. (2014)	T=40 C=40	High School	1 Semester	Geography	In-Class	Experimental	0.48
18	Yan, X.X. (2018)	T=56 C=57	High School	1 Semester	Chemistry	In-Class	Experimental	0.28
19	Yan, J.N. (2005)	T=53 C=55	High School	1 Semester	Biology	In-Class Recessive	Experimental	0.21
20	Yan, J.N. (2005)	T=54 C=52	High School	1 Semester	Biology	In-Class Recessive	Experimental	0.30
21	Yan, J.N. (2005)	T=50 C=52	High School	1 Semester	Biology	In-Class Recessive	Experimental	0.10
22	Zhuang, S.H. (2015)	T=55 C=53	High School	1 School Year	Mathematics	In-Class Dominant	Experimental	0.55
23	Zhang, H.Y. (2012)	T=58 C=58	High School	1 Semester	Mathematics	In-Class Recessive	Experimental	0.10
24	Huang, Y.P. (2011)	T=37 C=36	High School	1/2 Semester	Physics	In-Class	Experimental	0.85
25	Yuan, F. (2008)	T=58 C=54	High School	1 Semester	Physics	In-Class Dominant	Experimental	0.53
26	Xu, J.P. (2005)	T=57 C=55	High School	1 School Year	Chemistry	In-Class Recessive	Experimental	0.58

# The Culprit Hormone: The Physiological Origin of School Violence amidst Middle School Students<sup>®</sup>,<sup>©</sup>

Danlong He

Xinjiang Normal University, Urumqi 830017, Xinjiang, China

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**Abstract:** *The increasingly severe school violence has become an influential and notorious worldwide problem. The attribution of school violence determines the formulation of coping strategies. Unlike the analysis of family, psychological and social factors, long-term front-line work and follow-up studies have found that student violence's physiological factors in adolescence are more significant than other factors. The decisive factor leading to school violence among middle school students is the secretion of sex hormones during adolescence, so hormones mostly cause violence. Attributing school violence to "sex instinct" does not deny the role of education; on the contrary, it recognizes the crux of the problem and provides the possibility of finding effective prevention and intervention measures. Using dopamine to antagonize hormones provides a physiological basis for education and violence intervention. Strengthening physical exercise, carrying out activities where boys and girls are present simultaneously, and building a harmonious teacher-student relationship and a friendly campus environment effectively prevent middle school students from campus violence.*

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## Problem

**T**HE World Health Organization surveyed students from 40 European countries and found 26% said they had experienced violence in the past two months (Craig et al., 2009). UNESCO released a report at the World Education Forum that school violence has become a global public hazard, and 32% of students have been bullied by their peers in school at least once in the past month. According to a survey conducted by the Ministry of Education, Japan, there were 543,933 incidents of bullying in elementary and middle schools in 2018, and 80.8% of schools were confirmed to have bullied, and the “major incidents” of severe physical and psychological damage reached the highest level in history. In 2018, the “*Survey Report on School Violence in China*” jointly released by the Social Risk and Crisis Management Research Center of Nanjing University and Central South University in China showed that the incidence of school violence in central China was 46.23% (Han et al., 2017). The “*White Paper on Juvenile Procuratorial Work (2014-2019)*” issued by the Supreme People’s Procuratorate of China in 2020 shows that the number of school violence and juvenile crimes is on the rise, with the highest number of violent incidents among middle school students aged 12-15.<sup>1</sup> School violence hits the moral bottom line, challenges human dignity, and is extremely harmful. All countries have spent colossal human resources and material resources to prevent it, but why does it continue to exist and is still deteriorating?

## Research Foundation

### Definition

No consensus is available on the definition of school violence. France defines school violence as “school harassment” (Han & Shi, 2020). The United States regards active, continuous attacks, and the disparity between both parties’ strengths as campus violence (Liu & Zheng, 2019). Norwegian scholar Dan Olweus defined campus violence as a

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**Correspondence to:** Danlong He, Senior Teachers, Special Teachers, Doctorate Candidate, School of Educational Science, Xinjiang Normal University, Urumqi 830017, Xinjiang, China. Email: 15938707829@126.com.

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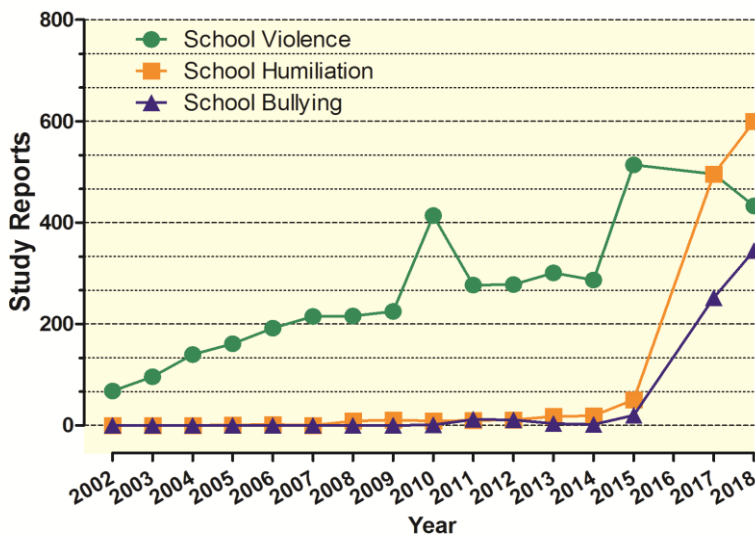
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student is repeatedly exposed to one or more student-led negative behaviors for a long time, while Germany tends to criminalize campus violence (Wang, 2019). China defines student violence as occurring between students on or off-campus, where one party deliberately or maliciously conducts bullying or insults through physical, verbal, and online methods one or more times, causing physical injury, property damage, or mental damage to the other party. The incident also covers the offensive behavior of outsiders (Yao, 2018). In recent years, related expressions have mostly avoided the word “violence,” but in 2019, UNESCO released “Behind the Numbers: Ending School Violence and School Bullying” (Gu, 2020), from which strict conceptual distinction was made between school violence, school humiliation, and school bullying (Zhang, 2015.). Uncertain concepts will seriously affect the quality of research (Zou et al., 2019). Before 2016, most of the forms of aggressive behavior on campuses were school violence. After 2016, violence, humiliation, and bullying are often confused. The order in which these three words first appeared in the paper is: school violence in 1989, school humiliation in 2002, and school bullying in 2010, reflecting that people are trying to avoid the word “violence” by using “humiliation” and “Bullying” instead. This “plug one’s ears while stealing a bell” approach conceals the situation’s seriousness, diverts people’s attention, and is detrimental to active and effective intervention, prevention, and control. Only by facing reality can the problem be solved. Therefore, the word “school violence” is used without taboo in this paper. The changes in the number of studies of the three concepts are shown in **Figure 1**.

To clarify the concept of school violence is a necessary prerequisite to prevent its occurrence effectively. This study defines “school violence” from the four dimensions of space, time, object, and degree of injury. No matter when and where an incident occurred between school students, that harms students to a severe degree. In terms of space, it is limited to the specific area of the campus because the campus has many teachers and students, is in the public’s view, and the monitoring is strict, so violence is not easy to occur. Violence among students often occurs outside the school, especially in tiny lanes. There are studies abroad that call violence incidents within 200 meters of the campus as school violence. In terms of time, school violence, in a narrow sense, refers to the period of schooling. Violent incidents mostly occur before and after school. These violations are ultimately the continuation of the contradictions among the students at school, so the time and space are extended to anytime and anywhere. In terms of objects, this refers specifically to violence between students, not between teachers and students, and external personnel explicitly targeting students. The degree of injury is more severe than humiliation and bullying.

### ***Status Quo of Current Research***

The 2015 China Education Blue Book pointed out that the age of juvenile delinquency tends to be younger.<sup>2</sup> In June 2015, the Legal Network Public Opinion Monitoring Center announced that 75% of school violence occurred among middle school students.<sup>3</sup> Because elementary school students are still ignorant, and high school students have a



**Figure 1. Comparison of Research Trends on School Violence and Related Concepts.**

certain degree of self-control, this research focuses on the group of middle school students.

In response to the persistence of school violence, countries have racked their brains to try various solutions. The United States has set up campus police, allowing children various “adventurous” activities and training children on how to deal with criminals invading campus. Japan has established a “mother agent team” to protect the safety of children. Argentina has allowed vendors to serve as mobile outposts on campus to assist the police in paying close attention to suspicious people. Russia distributes identification cards to students. Germany allows students to learn Tai Chi to defend themselves. In the final analysis, their basis is the Crime Prevention through Environmental Design (CPTED) theory proposed by the scholar Ray Jeffrey in the early 1970s (Zhang, 2015). Although we try our best to achieve 360-degree monitoring without blind spots, close defenses to ensure that there is nothing wrong, it is impossible to prevent, and such incidents are still emerging. The reason is that the diagnosis has not been confirmed, and the real cause of school violence has not been found, so the right medicine cannot be prescribed.

Different researchers have different conclusions about the attribution of school violence. There are family attributions: Perren and Hornung (2005) surveyed 1,107 Swiss students in grades 7-9 that male victims are generally overprotected by their par-

ents, while female victims mostly come from families with emotional abuse (Chinese Government Network, 2018). According to statistics from the World Health Organization, domestic violence occurs in one-third of families worldwide, and at least 50% of minors grow up in a “domestic violence” environment. Such children are more violent, and violent fathers may affect two extreme children: cowardice and violent inheritance. Attributable to sexual orientation: The 2011 National School Environment Survey in the United States showed that 81.9% of LGBTQ students had had the experience of being bullied (Kosciw et al., 2012). There are education levels and even I.Q. Attributions; there are also a large number of psychological attributes and moral character attributes that believe that middle school student’ views are distorted, morally disordered, influenced by violent movies and television, and advocate violence.

According to Rawls’s Theory of Justice, Aijun Zhang analyzed the causes of school violence from three levels: politics, society, and family, and believed that the fundamental cause of school violence was a problem with the system (Zhang, 2016). In 2017, Xuezheng Zhang analyzed 145 papers related to CSSCI source journals related to school violence from 1999 to 2016: education research accounted for 69%, psychology accounted for 16.6%, but no physiological studies (Zhang, 2017).

Among the 50 papers in the CSSCI journal literature on school violence from 2016 to 2020, 11 papers were researched from the lack of legal system construction, 17 papers were made for comparative research between China and foreign countries, six papers specifically defined the concept, and three papers Study female violence. In the past three and a half years, with “school violence” as the keyword, 582 related journal articles were retrieved in CNKI, and no articles were found that analyzed from the physiological point of view, especially sexual physiology (**Table 1**).

## ***Analysis of Physiological Attribution***

### **• Theoretical Basis**

Hormone originally means “exciting activity” in Greek. It is a substance produced by the endocrine glands and directly enters the blood circulation. The secretion is minimal, but the effect is excellent. It plays a significant role in regulating the body’s metabolism, growth, development, reproduction, sex, and sexual activity. Sex hormones are divided into male and female. The male hormones are mainly testosterone secreted by the testes, which makes men masculine and robust; the female hormones are mainly estrogen and progesterone secreted by the ovaries, making women gentle and charming. Hormone secretion increases sharply during adolescence. Nerves and body fluids regulate human life activities. Body fluid regulation mainly refers to hormone regulation. The difficulty of controlling violent impulses is closely related to the body’s regulation. Hormonal effects occur unconsciously, making the rational side challenging to control. Sex hormones make adolescent children prone to impulse and make mistakes. As Schopenhauer said, “It is the strongest and most powerful activity besides the impulse of life; it occupies half of the golden age of human adolescence, consumes the body’s thoughts and energy, and can produce the most vicious event” (Schopenhauer, 1990).

**Table 1. Distribution of Subjects and Number of Articles on Campus Violence among Middle School Students.**

<b>Subject</b>	<b>Article Number</b>	<b>Percentage</b>
Education	69	47.6
Psychology	24	16.6
Law	21	14.5
Sociology	15	10.3
News Communication	11	7.6
Others	5	3.4
<b>Total</b>	<b>145</b>	<b>100</b>

Sexual desire is an inherent instinct based on human reproduction needs. The violent tendency of desire and impulse is the most profound and most essential existence of life. “Without reproduction, mankind would not develop to this day” people have always valued the sexual physiology and psychology of adolescence. Affected by sex hormones, adolescents are intertwined with anxiety and curiosity, self-awareness is high, and love goes to the opposite side, which quickly leads to violence. Testosterone has been accused of causing bad things in hooliganism, increasing violence, and risk-taking. Female hormones make women compare with each other, jealous, and make trouble for no reason, which becomes the fuse of school violence. The group effect and audience psychology of school violence are mostly the results of hormones. Through violence to satisfy masculinity, many abusers are entirely unaware of it. British scholar Whitehead once put forward “*Masculinity Anxiety*,” saying that when masculinity is threatened, anxiety and fear will arise. This “fear of unlike a man” overwhelms the sense of morality and compassion and is more likely to produce violence. The group effect of school violence and audience psychology is mostly the result of hormones. Through violence to satisfy masculinity, many abusers are entirely unaware of it. British scholar Whitehead once put forward “*Masculinity Anxiety*,” saying that when masculinity is threatened, anxiety and fear will arise. This “unlike fear of men” overwhelms the sense of morality and compassion and is more likely to produce violence. Sexual instinct is the strongest desire of human beings. Freud called it the vital life force of human beings and explained everything with it. Although it is a bit excessive, there is some truth in it. Human beings need to maintain the continuity of life and leave their genes to the next generation, and the role of hormones is indispensable.

Related theories and viewpoints include: Adolescent phobia (Adolescent phobia) theory believes that adolescent children’s physical and psychological development are not synchronized, and their desire for performance at this time is extreme. When they cannot find a suitable stage, they will use school violence to vent in form. The drift

theory of juvenile delinquency (The drift theory of juvenile delinquency) believes that young people's ability to control their behavior is far behind, small things will be infinitely amplified, and inexplicably appear irrational and illogical mania and excitement, resulting in extremely irresponsible behavior (Wang, 2016). Regarding the theory of adolescence, there is Hall's theory of great turmoil, Freud's theory of psychoanalysis, Mead's theory of cultural influence, Bandura's theory of social roles, and Eriksson's theory of social psychology stages.

### ***Physiological Factors: Adolescent Sex Hormones are Making Trouble***

“Sisters have an affair, several of our friends heard the matter, ready to represent her, and teach the two who engaged in the illicit love affair”, the result was the male and female students were beaten up after pulled into the bathroom (Yu, 2016).

The girl was dissatisfied with her ex-boyfriend being in love with someone else, beating her, and taking nude pictures forcibly. Ming Zhang of the Renmin University of China used the Law of the Jungle to study school violence and showed that: “In all violent incidents involving girls, almost all the other girls' clothes are stripped off” (Zhang, 2016).

There are many similar cases. Through a literature search, case tracking, survey interviews, police station visits, data collection, and comparative analysis, the same conclusions can be drawn. What kind of hatred makes teenagers so cruel? A large number of studies have shown that it is the result of hormonal action during puberty. “Love and war are unscrupulous.” The extreme exclusivity of the relationship between the sexes determines this war's irreconcilability, so violence occurs naturally. As animals' instinct, they are fighting for the opposite sex during the breeding period is life-threatening. Not to mention the African lion, the fight between two roosters must also end in one party's surrender. Darwin's natural selection theory emphasizes “the survival of the fittest and the weak as the meat of the strong.”

After years of school management, I have dealt with many violent incidents among students. Most students are criticized and educated because they have bad moral qualities and violate school discipline. The parents and the police acted together to confess their mistakes on the surface but did not really repent, and similar incidents happened soon after through the re-examination, thinking, and research of 141 cases that have been memorized and recorded during the 30 years of teaching. As a psychological counselor, he has a deeper understanding of the incident through individual counseling experience for students. It was found that the original cause of 111 of these cases was related to the interaction between adolescent men and women. Finding commonalities can reveal the underlying causes of violence among middle school students.

The relationship between testosterone and aggressive behavior has been confirmed in animal experiments. Dolan's research on male crimes with personality disorders shows that high levels of plasma testosterone are closely related to increased aggressive behavior, and the average level of testosterone secretion by juvenile offenders

is higher than that of the control group.<sup>4</sup> Psychologists say that human cultivation is the control and balance between self, id, and superego, while the mental development of middle school students lags behind the physical development, and reason cannot overcome emotion. British poet Tennyson said: "violence is a blind beast." The external destructiveness of this sex hormone is enormous.

Investigation and research have found that the inducement of violence in middle school students is mostly related to obscure sexual awareness and sexual initiation during puberty. Violence mostly occurs in the presence of the opposite sex to attract the attention of the opposite sex, excessive self-expression, which is similar to the instinct of animals. Although violent behavior is affected by psychology, its root lies in the physiological changes of the person. Internal factors determine external factors. The primary source of adolescents' violent behavior is their physiological changes, which result from adolescent hormones. The questionnaire survey found that 74.54% of school violence incidents among middle school students were related to sex, and most of them occurred because they could not correctly handle heterosexual interactions during adolescence.

## **Coping Strategies: Dopamine Antagonizes Hormones**

Facing the hormones, the culprit of school violence, do you feel helpless? As virtue rises one foot, vice rises ten. In physiology, another substance inhibits a substance or that a physiological process restricts another process is called antagonism. Dopamine (dopamine) is a neurotransmitter secreted by the hypothalamus. It can regulate a variety of physiological functions of the central nervous system, relate to human lust and feelings, and transmit information of excitement and happiness. Dopamine, also known as happy growth hormone, increases its secretion during exercise, which can antagonize the damaging effects of sex hormones and reduce school violence.

In other words, to attribute school violence to physiological factors and adolescent sex hormones does not deny the human intervention's effectiveness, nor does it mean that education is powerless. On the contrary, with this research conclusion, intervention and education can be effectively carried out in a targeted manner.

## ***Release the Energy of Adolescence through Physical Exercise***

The physiological characteristics of adolescence determine school violence-interview and survey of a martial arts school near Shaolin Temple in Dengfeng, China. There are 86 martial arts schools with 157,392 students. Among the 143,721 students between the ages of 13-18, violence incidents rarely occur, and part of this group is because of family or clan being bullied, and then came to the martial arts school to learn Kung Fu for revenge. There are two main factors at play: one is that the daily martial arts training has exhausted them, and there is no extra strength to violent other students; the other is that martial arts schools are male (the proportion of boys is more than 90%), and very few girls there and they also train and live alone, and the factors that induce violence

among students no longer exist due to the scarcity of girls. This also confirms the conclusion of the study from another aspect.

Our school has developed school-based courses in recent years, combining martial arts teaching and sports, increasing the frequency and intensity of exercise, significantly increasing confrontational games, such as boxing, karate, basketball, football, badminton, and other sports. This not only played a role in strengthening the body but also significantly reduced violence among students.

Studies have shown that the number and duration of physical activity participation are negatively correlated with school violence tendency: the increase in physical activity and the decrease in school violence tendency. Positive emotions and collective violence tendencies are also negatively correlated. For middle school students in adolescence have healthy hormone secretion and are over-energetic, they need proper ways to vent, and physical exercise and physical labor are the best forms (Guo, 2017). Therefore, our intervention focuses on the popularization of sports activities and vents the body's excess energy through physical exercise and physical fitness.

### ***Carry out Activities Where both Male and Female Students are Present to Guide Normal Communication***

Create conditions to carry out as many activities as possible so that male and female students can contact and eliminate the mystery brought by gender. Encourage male and female students to interact in public places. For example, recess can also be carried out in ballroom dancing, mental health classes can be group tutoring classes "Trust Journey," and activities such as climbing the "graduation wall" and trust back throws in the expansion activities are all excellent choices.

**Figure 2** shows a climbing "Graduation Wall" activity that I designed when I took the 7th-grade freshmen during military training. All the students in the class had to climb the 4-meter-high wall, and the ladder sent up only the first student. This is the hardest step. The students on the lower level supported a few classmates with their shoulders to the second level, and then a boy with strong arms stepped on the shoulders of the second level student, grabbed the edge of the wall, and turned his body over the wall. This process is challenging to succeed every time, and students need to sum up the lessons after repeated failures and start again. At this time, there are no boys or girls. They all want to contribute as much as they can to the collective. When all the students overcame the wall, the teachers and students hugged each other and cried. Under the influence of this kind of collective identification and boys' and girls' presence, how can there be hatred and violence?

Another case: a group of girls fainted in a private suburban middle school. As long as one girl fainted, the other girls fainted one after another, and the hospital could not detect any organic diseases. After investigation and analysis, experts believe that this phenomenon is psychogenic. Due to the distance from the urban area, the school adopts closed boarding management. Communication between male and female students is not allowed, and the male and female dormitories are entirely separated. Under





**Figure 2. The Seventh Graders are Crossing the "Graduation Wall".**

this kind of high-pressure control, once, a girl suddenly fainted. Because of a sudden incident, everyone was caught off guard and swarmed; some people pinched Renzhong acupuncture point, and some people performed cardiopulmonary resuscitation; there were no boys and girls scrupulous at the time, and then a boy picked the girl up. So I took her to the hospital. After that, the opening scene appeared. Later, experts suggested that the school demolish the wall between male and female dormitories, promote regular exchanges between male and female students, and carry out ballroom dancing activities. This phenomenon has never happened again.

### ***Build a Harmonious Teacher-Student Relationship***

Pascale Benoiel surveyed 692 students and 92 principals in Israel, and the structural equation model showed that a harmonious and good teacher-student relationship could reduce school violence (Benoiel, 2020). Under UNESCO and the European Union's influence, Spain had implemented the "Campus Coexistence Policy," established national and local campus coexistence observatories, opened school violence hotlines, organized campus coexistence conferences, established campus coexistence awards, and strengthened relevant teacher training. The evaluation showed that these policy measures had achieved good results and were recognized by the Spanish education community (Sun & Yang, 2019). The construction of "Happy Campus" in South Korea was also to build an excellent teacher-student relationship to reduce violence.

## Conclusions

Because of the seriousness of reality, we will not avoid the term “school violence,” and focus our research on the specific group of middle school students, and define middle school violence as no matter when and where occurred in a more physical severe conflict than humiliation and bullying injuries between middle school students. Through literature, questionnaires, and interviews, we found the internal cause of such events, that is, due to the healthy secretion of adolescent sex hormones. The study found that the causes of school violence in middle school students are physical and physiological reasons. This does not mean that education and external interventions can do nothing about school violence in middle school students. On the contrary, the right medicine can be prescribed. Good results can be achieved through the targeted enhancement of the quality and quantity of sports, collective activities, and group psychological counseling. Both boys and girls replay and construct a harmonious teacher-student relationship and campus atmosphere.

### Notes

1. Information source: *Learning Powerful Nation Platform*, June 2nd, 2020.
2. “Basic Education Reform Trends” 2015 No. 10 21-22.
3. Tian Xueqing. *Research on School Violence of Middle School Students*. Shanxi Normal University, 2018.
4. Ying Liuhua. *Study on the Physiological Mechanism of Violent Crime*. *Journal of Henan Judicial Police Vocational College*, 2008(3):24-27.

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# Comprehensive Evaluation of Xiaoman Zhu's Emotional Education Theory

Juan Xiong

Nanjing Museum of Modern Chinese Historical Sites, Nanjing 210018,  
Jiangsu, China

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**Abstract:** Professor Xiaoman Zhu is the theoretical initiator and the promoter of contemporary emotional education in China. Since the 1980s and 1990s, she has led the research on China's emotional education and has put forward many pioneering insights, forming a rich and systematic emotional education theory. She has been involved in guiding several experimental schools and research bases for a long time committed to the proper combination of emotional education theory and school education. She infiltrated it into moral education, teacher education, textbooks, courses, etc., and her theory has been widely recognized. This paper evaluates the source, theoretical basis, and practice of Xiaoman Zhu's emotional education as a whole, intending to construct a theoretical cognitive framework to describe Xiaoman Zhu's educational thought and theory in a more comprehensive manner.

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**Correspondence to:** Juan Xiong, Nanjing Museum of Modern Chinese Historical Sites, Nanjing 210018, Jiangsu, China. Email: 872624819@qq.com.

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**E**MOTIONAL education is a concept parallel to cognitive education, and it is an indispensable part of a comprehensive education process. As the initiator, pioneer, and practitioner of China's emotional education theory, Professor Xiaoman Zhu has been dedicated to research in emotional and moral education during her three decades of educational practice. She was the first in China to propose a comprehensive educational philosophy based on the concept of "emotionality," emphasizing the emphasis on emotional personality, calling for correction of the cognition-only education in current education, and overcoming the negative impact of practical education. She put forward the moral education theoretical paradigm based on emotion and the operation mode in line with China's national conditions, so she was called the "emotional education saint" (Hou, 2020). Chinese domestic scholars have not only recognized Xiaoman Zhu and her emotional education model but also have had a substantial impact overseas. Japanese educator Manabu Sato said, "I have been in contact with Teacher Xiaoman Zhu for many years, and she is one of my most respected researchers" (Yang, 2020a).

On August 10, 2020, this beloved leader in education and scientific research passed away from illness at 73. Many principals, teachers, and educational scholars of universities, middle and elementary schools at home and abroad have left messages or wrote articles to commemorate her (Wei, 2020). Limin Liu, the former vice-minister of the Ministry of Education and president of the China Education International Exchange Association, said in mourning, "She was born for education and has served the education cause for a lifetime." Mingyuan Gu, a member of the National Education Advisory Committee and a senior professor at Beijing Normal University Mourning, said, "We have lost a very thoughtful and hardworking educator" (Yang, 2020b).

This paper aims to sort out Xiaoman Zhu's lifelong education theory, correctly and deeply understand her emotional education theory's value and significance, and systematically understand and explore her emotional education thoughts.

## **Lay the Foundation of Emotional Education and Open up New Fields of Education Research**

Emotional education is a realistically targeted topic, and it was also a topic at the forefront of academics. Since World War II, emotional education has become one of the focal points of education research in Western countries and has set off a wave. Many



well-known scholars have strengthened the research on emotional education theoretically and have practiced, enriched, and perfected their teaching theories. For example, "The Taxonomy of Educational Goals" edited by Kraswall and Bloom combines teaching goals and emotions, and divides the educational goals in the emotional field into attitudes, interests, ideas, appreciation, and adaptation methods; its sub-goals include acceptance, Contents such as reaction, value judgment, value organization and value personalization (Han, 2008). Rogers proposed "non-supervised teaching" based on many experiments and finally believed that the key to education's success or failure lies in interpersonal relationships and emotional attitudes (Zhao, 2013).

At the same time, emotional education has also begun to gain attention in China. Especially after China's reform and opening up, with the sharp increase in the demand for knowledgeable personnel, the phenomenon of "emphasizing intelligence and despising morality" and "all aligning with scores" has become increasingly prominent. A group of Chinese scholars represented by Xiaoman Zhu found that under the influence of "exam-oriented education," there are worrisome feelings of student weariness in Chinese primary and secondary education. Still, on the other hand, educational models involving emotional factors lack convincing Scientific explanations (such as happy education, etc.) (Lu, 2015). Therefore, in the mid-1980s, in primary education, scholars gradually began to think about studying the impact of theoretical educational work on emotion in education and used more scientific methods to evaluate moral education.

Facing the current situation where emotional education has been neglected in practice and theory, Professor Xiaoman Zhu has a stronger sense of mission and role as a researcher. She first began to reflect on the theory consciously. She proposed, "in addition to external supporting forces, such as social environment, public opinion, rules, laws, etc., what is the internal driving force for the formation of individual morality?" (Zhu & Wang, 2018).

This confusion ended in 1986. She accidentally read the work entitled "The role of emotion in morality and the principle of perception theory," by Professor Titarenko, a famous ethicist in the former Soviet Union, director of the National Ethics Teaching Committee, and chairman of the World Ethics Society. The work was published in the Chinese "Philosophical Translation Collection, and then she suddenly became clear. And from this, Xiaoman Zhu began to pay attention to the special role and value of emotion in morality and ethics (Zhu & Ding, 2015). In her master's thesis, "A Brief Discussion on Moral Emotions," she conducted a philosophical investigation and elaboration on the structure, connotation, germination mechanism, ascending, and development process of moral emotions. Later, she studied for a doctorate in education under Mr. Jie Lu, Nanjing Normal University in 1989, and chose the focus of her research in "emotional education." Focusing on the core of "emotion," it takes emotion as an essential part of human life and moral growth. It attaches importance to the development of the human emotional world, especially the cultivation of moral emotion. The continuous expansion and enhancement of the emotional experience that contributes to the growth of positive and healthy moral qualities in the emotional microenvironment



established by individuals and others is an integral part of moral education and even the fundamental pedagogical research (Wang, 2014).

In the Process, Professor Xiaoman Zhu's monograph "Emotional Education Outline" was officially published in 1993. This is the first book in China that explores emotional education from the perspective of educational philosophy, and it is also the answer she found after decades of thinking. This answer is undoubtedly "a good and significant beginning" in her academic career (Zhu, 2007). In this foundational monograph, Xiaoman Zhu elaborated on the fundamental theories of emotional education during this period and proposed moral emotion (Zhu, 1999) and emotional value (Zhu, 1995). Besides, she completed the goal construction of emotional education from the perspective of the unity of time and space. She proposed emotional education theory in the unity of time, space, and environment (Fang, 1995).

Thinking research, studying, and reading experience at this stage provided critical help for the formation and development of Zhu's educational thought. She had captured the word "emotion" from many theories and research directions, and based on this field, and she had run it through her educational theory and practical research. From an educational standpoint, philosophical ideas and tools are used to unify the knowledge of various related disciplines. It constructs a relatively complete educational concept to deal with the lack of emotion in educational reality and the phenomenon of emotional lack in educational research and open up new educational research territory. In the field of emotional education that it has developed, after decades of theoretical expansion and practical exploration, it has always been based on emotional education as the mainline, which constitutes the core of its fundamental academic research.

## **Starting From the Education Itself, Establish an Emotional Moral Education Paradigm**

The term "paradigm" comes from a philosophical concept, and its original meaning is "to appear together" and is also called "model" (Kuhn, 2003). Researchers believe that in the process of moral theory education and practice, at a particular historical stage, moral education not only has distinct characteristics of the times, but also always maintains relative stability. Therefore, these educational methods that have common characteristics and always maintain relative stability are called "moral education paradigms" (Ding, 1999).

Throughout the history of moral education, there have been many representative moral education paradigms. For example, the "informative moral education paradigm" is characterized by "moral knowledge", the "behavioral moral education paradigm" is characterized by "moral behavior", and the "capacity moral education paradigm" is characterized by "moral reasoning ability", etc. (Gao, 2003). These moral education paradigms have all played a role under specific historical conditions. Still, there were no questions about how moral cognition and behavior could achieve consistency in forming individual morality, the role of emotion in its formation, and the potential mechanism was not resolved (Qi, 1995).

This also constituted an important starting point for Professor Xiaoman Zhu's academic research career. In her research career, thinking about morality and moral education was the beginning of her interest. The research on "moral emotion" was not only the starting point of her academic research, but also the origin of her entire educational philosophy.

Because of the confusion about moral education's status quo and the dissatisfaction with the theoretical research of moral education, Xiaoman Zhu turned her attention to morality to the moral emotion in morality. She believed that moral emotion is not a derivative of moral cognition, but is related to human life and the entire emotional and emotional system of human beings, and comes from human life and life. It is the "reaction caused by whether people's moral needs are met" and is related to the "feelings and experiences when the subject's inherent belonging and good requirements are met." She tried to gradually cultivate the susceptibility, emotion and control ability, empathy ability of the educated from the individual's emotions and emotional hands. Based on the individual's emotional quality, and finally enable the educated to form a stable moral emotion (such as love, affection, and empathy), to truly set up a channel of internalization and externalization between the individual's moral cognition and moral behavior, and cultivate real "moral" people (Ding, 1997a).

### ***Tracing Back to the Essence of Education, Defining Morality in Multiple Dimensions***

Regarding the definition of morality, Xiaoman Zhu returns to human life and the source of life to find the basis for a moral existence. In a sense, Professor Zhu believes that moral formation is also a process of brain cultivation and human nature cultivation; and the emotional connection and response relationship formed by people in the process of communication also constitute the initial conditions for moral formation. As a result, Professor Zhu proposed her definition of morality, "Moral is a harmonious physical and mental life norm and a social norm for coordinating interpersonal relationships for their survival and social development." (Zhu, 2000).

And this moral and moral education with "emotion" as the source and foundation is no longer the traditional moral education work, nor is it separate from other aspects of human moral education. Still, it has a holographic influence on human life and moral education with humanity education as its responsibility and mission. From this standpoint, moral education is also education. The foundation and soul of all education focus on the development and perfection of life through people's moral education (Lu & Wang, 2000).

In the specific research process, Professor Xiaoman Zhu adopted Gardner's "Multiple Intelligence Theory," paid attention to breaking through the limits of speculative philosophy and pedagogy, and extensively absorbed anthropology, physiology, neuroscience, psychology, sociology, and ethics. All these were to seek and reveal the mechanism of emotion generation and development from a comprehensive perspective, to make a convincing explanation (Zhu, 2012).

Therefore, in terms of the definition of morality, Xiaoman Zhu believed that morality should be defined from human life by seeking sufficient conditions for moral education, which includes instructing students on the specific emotional varieties and variants such as a sense of order, sense of connection, sense of awe, etc. She regarded these emotions as the deep foundation of moral structure (Yi & Zhu, 1998). That means they do not have anything to do with morality but show the specific relationship between people and things. The development of these emotions is related to the proper growth of morality. The establishment of “highly value the special status and value of emotion in the formation of individual morality and moral education emphasizes based on emotional experience, the system of emotion-attitude as the core, and the mutual influence of emotion and cognition. From the level of emotional quality to ensure the formation of moral education concepts, orientations, and operations of morality, the paradigm of emotional, moral education has become Professor Zhu's understanding of “morality” and an important discovery and essential point of view in the theory of moral education (Zhu, 2005a).

Xiaoman Zhu studied moral education from multiple dimensions such as society and science; she expounded moral education from essential human nature, human life, human spirit, etc., and aims to help people learn to live a collective life moral education. Life, teamwork, common interest, and nature conform all develop individually through improving self-understanding, making life natural, and pursuing the spiritual world's richness and depth.

### ***Emphasize Emotional Quality and Construct a Paradigm of Emotional Moral Education***

After affirming the special status and value of emotion in individual morality formation, Xiaoman Zhu constructed a paradigm of emotional, moral education. She pointed out that we must attach great importance to the status and value of emotion, informing individual morality and moral education. Simultaneously, she emphasized the moral education concept, orientation, and practice mode of moral education based on emotional experience. So the emotion-attitude as the core and mutual influence and promotion of emotion and cognition from the emotional quality level is called the “Emotional Moral Education Paradigm” (Zhu, 2005b).

First, moral education is different from the traditional “knowledge, affection, intention, and action” moral formation process, which takes “knowledge” as the basis of “emotion”; she believed that emotion is not just a stage, but diffusely from the inside and plays a role of overall restriction. Therefore, moral education should pay more attention to the intrinsic motivation system of spiritual pursuit than cognitive judgment. It emphasizes the role of personality and spiritual sentiments such as emotional tone, emotional hobby, and value orientation on moral education. It should integrate the intrinsic motivation system development rather than external ability systems (such as the level of knowledge) as a sign of moral development (Zhu, 2012).

Second, in the goal of moral education, the development of moral emotions should be the goal of morality. Moral emotion is not only the direct driving mechanism of morality, but also the internal source of the emergence of moral behavior and the formation of moral personality, and it is also the fundamental link of all moral reality. Professor Xiaoman Zhu constructed the educational goals based on the three dimensions of content, function, and time sequence. The content focuses on the five major series of moral relations between modern people, including man and nature, man and operation object, man and other, man and society, and man and self. This is mainly concerned with people's good intentions, desires, and positive emotional experiences. In terms of function, mainly in terms of emotional sensibility, it cultivates students' emotion recognition, experience, expression, and control abilities. This combines the rational and perceptual ways of thinking about emotion in China and Western countries and expands the emotional goal into a new structure. This affirms the role of moral emotions on morality and also affirms the necessity of rational thinking, such as a sense of reason, aesthetic sense, emotional mood, and emotional ability. In terms of time sequence, the focus of emotional development is divided according to students' unique emotional development laws at a specific age (Fang, 2016).

Third, in terms of moral education methods, emotional education advocates establishing an "emotional field." Moral education information, such as the social, moral, cultural, and ethical value recognized by the educated, and the means in the education process such as intuitive means, aesthetic means, and the emotional relationship between both, constitute a variety of moral education emotional field that is called moral education situation. It includes not only the moral education factors in the learning process of school education (including moral education subjects), but also the moral education situational factors created by educators. Generally, moral education's emotional field should have three characteristics: pleasure, concealment, and artistry. Therefore, this requires educators to fully play a leading role in moral education, create moral situations, and use their personality and emotional factors as an intermediary means of moral education to influence the educated. The educator is placed in the educational atmosphere. Through feeling and comprehension, real moral concepts can be obtained (Zhu, 2005b). This has also influenced the proposal of "moral experience theory" in the early 21st century (Liu, 2003; Lin, 2004).

Last but not least, concerning moral evaluation, the emotional, moral education paradigm advocates that the level of the moral and emotional development of the educated are used as an indicator to measure the individual's moral level. The moral and emotional quality of the educated mainly refers to the emotional content of "love," "sympathy," "awe," and the feelings, interests, attitudes, and concepts of the individual on top of the raw emotions. Moral education is an emphasizing of the development of the moral and emotional quality of the educated, taking raw individual emotions as the point of education, emphasizing the subjective participation of the educated in moral activities, and the experiential cognition of moral values to truly reflect moral education method of subject's moral values. It is not based on the premise of opposing other moral education paradigms, but a moral education method created in moral education that

emphasizes the cultivation of moral emotions of the educated in moral education and uses this as an intermediary. It is not a specific moral education method, but an educational concept and an educational value orientation (Ding, 1997b).

## **Tracing the Source of Education Research, and Focusing On the Practicality of Emotional Education**

Educational practice is the source and living water of theoretical educational research. In her educational research, Professor Xiaoman Zhu paid great attention to returning to school education and the spiritual reality of student-teacher, to continuously discover, generalize, refine, and interpret his educational theories. In the emotional and moral education paradigm, Xiaoman Zhu put emotional education into practice and defined emotional education as “caring for students’ emotions and emotional states in school education and teaching. And for those who involve students’ physical, intellectual, moral, aesthetic, emotional qualities of spiritual growth should be positively guided and nurtured” (Zhu & Ding, 2015), and using this as a guide to project educational ideas into educational practice, and strived to seek breakthroughs and innovations in education and teaching.

### ***Pay Attention to the Personification Process and Normal Education***

Xiaoman Zhu paid great attention to teachers’ life state in the whole education field and actively explored teacher education to improve teachers’ “emotion-personality quality.” Beginning in the 1990s, Xiaoman Zhu began to pay attention to the professional development of teachers. She attempted to break through the traditional teacher education model, changing the goal of improving teachers’ academic standards and training “efficiency teachers,” and advocating the development of teachers the “emotion.” personality quality” is the core teacher education model (Zhu, 1998).

In 2014, as the lead host of the three-year “Teacher Emotional Quality Improvement Action” project signed by the Teacher Education Research Center of Beijing Normal University and Hong Kong Tin Ka Ping Education Foundation. Xiaoman Zhu led the team to improve teachers’ emotional expression ability and elementary and middle schools and preschool teachers. They carried out action research on teachers’ and students’ emotional quality and ability in teacher-student interactions and classroom teaching through expressions, language, and behavior. This helped teachers learn to express their emotions adequately to build a good relationship between teachers and students and improve teacher-student emotional interaction (Liu, 2019).

At the same time, Xiaoman Zhu regarded teachers’ emotional humanistic literacy as the “intrinsic” conditions and factors for implementing life emotional education, quality education, and leading teachers’ professional development. She believed that the internalization of teachers’ professional growth requires attention not only to the knowledge level of teachers’ growth, but also to the teachers’ hearts, emotions, attitudes,

and values, to the formation of their personality and the improvement of their inner life (Zhu, 2004). On this basis, emotional teacher education was created, advocating strengthening the training of teacher students' emotional literacy in all levels of ordinary education. So that they not only achieve the goal of teacher education in terms of cognition and skill level but also in their future careers, they can smoothly communicate with students emotionally and are competent for the education of students' emotional orientation (Liu, 2018).

### ***Pay Attention to Subject Experience and Promote School Moral Education Practice***

Xiaoman Zhu believed that school education could contribute to morality's emotional development (behavior, consciousness, personality). The interactions between people and the emotional relationships formed by them constitute the real growth of each specific student. Changes in human emotions will accompany this communication process, and this change will affect the learning activities and life status and growth of all students, parents, and teachers (Wang & Zhu, 2015). Therefore, she paid great attention to finding the conditions to support people's growth from the standpoint of education and sought to improve the school environment, especially the improvement of the individual microenvironment, and emphasized people's education (including parent-child, teacher-student, and peers communication).

In 2015, Xiaoman Zhu, who was the chairman of the China Tao Xingzhi Research Association at the time, established the "Education and Emotional Civilization" select committee and introduced the "Social and Emotional Learning" (SEL)<sup>1</sup> project to China. She named the project ECS (Emotional Civilization School) based on China's national conditions, actively cooperated with experimental schools to explore, and committed to building it as a practical brand of emotional education to promote national academic research and practical exploration civilization (Xu, 2017). Driven by the project, seed middle schools represented by Nantong Tin Ka Ping Middle School and Beijing Middle School have established a relatively complete framework in the goal-setting, content structure, operation mechanism, and effect evaluation of campus emotional education. At that time, a significant impact was produced on the school education that effectively linked the family and society and entered students' hearts (Zhang & Zhu, 2017). At present, driven by the implementation of the first batch of seed schools, many schools in China have carried out campus emotional and moral education experiments, which has produced a more comprehensive range of promotion benefits (Zhang, 2018).

Also, guided by the theoretical ideas of emotional education, emotional education's current practice presents a multi-dimensional practice model. For example, Mei (1988) and Liu (2006) proposed the "Love Education Model" and the "Ecological Experience Education Model." The model of aesthetic construction that focuses on the cultivation of beauty, represented by Jiangyin Experimental Elementary School (Jiao, 1995), Jilin Li's (2011) "Situational Teaching" model of Nantong Normal School Affiliated Elementary School, and Yang (2004) from Nanjing Pukou Xingzhi Elementary

School proposed an appreciation education model, Beijie Elementary School in Dayi County, Sichuan Province proposed a fun education model that emphasizes the protection of children's liveliness, diversity and freedom (Zhu & Zhong, 2014), and the Tenth Middle School of Suzhou, and Jiangsu Province with the poetic education model proposed by Liu (Zhu, 2013). These models have promoted the development of school emotional and moral education to a certain extent and strive to realize the education of "to the students," "to the soul," and "to the happiness."

### ***Attach Importance to Subject Integration, Compile and Integrate Teaching Materials***

The textbook is the direct carrier that embodies the author's educational thoughts, education concepts, and values. Xiaoman Zhu pointed out the emotional resources in the textbooks of various subjects from the perspective of moral education, such as ethics, justice, sympathy, interpersonal sensitivity, and humanitarianism in the Chinese language; justice, tolerance, and understanding in history; rigorous, rational, toughness and aesthetics in mathematics. She also analyzed the roles teachers play in daily interactions such as role models, partners, listeners and appreciators, questioners, guides, caregivers, sponsors, motivators, etc. The moral values of these roles are sincere, equality, respect, justice, tolerance, compassion, and care (Zhu, 2005c). This in-depth excavation of various emotional factors in teaching and its process aims to express that for students, teachers' teaching and education are integral because teachers' emotional qualities are embedded in intentionally or unintentionally and will affect students tangibly and invisibly.

## **The Interaction between Theory and Practice, Deepen and Expand Research with the Development**

The practical exploration of emotional education is the "engineering" research proposed by Xiaoman Zhu, which can further turn abstraction into concrete and enrich emotional education. Therefore, in her over three decades of educational study, she has always pursued closely linking academics with her life and her response to the Chinese education issues that emerged in her life and work, and kept up and continue to deepen emotional education research.

### ***Exploring the Model of Emotional Quality Education Based On Emotional Cultivation***

In the 1990s, it happened that China was promoting quality education. Xiaoman Zhu combined the textual materials she carried out in the school stage with the practice of quality education and proposed to start with the development of human emotions, and establish an "Emotional Quality Education Model" based on the development of emotional qualities and guided by the development of human qualities.

In this Process, Xiaoman Zhu has enriched his research content by participating in national education projects. According to data from Beijing Normal University, from 1996 to the early 2000s, Xiaoman Zhu participated in several provincial and ministerial “Ninth Five-Year Plan” projects related to youth and children’s theories practices’ emotional quality education. During the project’s implementation, she and the research team members went to many elementary and middle schools in Jiangsu Province. They cooperated with the school teachers to participate in experimental research on quality education, such as “Situational Education,” “Little Master Education,” “Harmonious Education,” and “Aesthetics Education,” “Happy Learning Education,” “Life Basic Education,” etc. She refined and summarized more than ten emotional quality education models (Zhu, 1999). Her classic books, such as “Emotional Moral Education Theory” and “Children’s Emotional Development and Education,” were published.

At this stage, the construction of the theoretical model of personal quality education is not only the result of practical cooperation between college theoretical researchers and elementary and middle school teachers but also the product of the in-depth integration of emotional education and quality education in thought and practice.

### ***With the New Curriculum Reform as the Background, Integrate Emotional Education into Routine Teaching***

At the beginning of the 21st century, China’s new round of elementary and middle school curriculum reforms set “emotions, attitudes, and values” as the curriculum goals, marking that “human emotional development” has become an essential part of the curriculum goals. As a significant participant in the eighth fundamental education curriculum reform in China, Xiaoman Zhu led a team to preside over and revise the “Ideological and Moral Curriculum Standards” for middle schools, write “Interpretation of Ideological and Moral Curriculum Standards,” and participated as the editor-in-chief of moral textbooks for elementary schools, especially middle schools. She actively integrated the concept of emotional education into the middle school and elementary school moral education curriculum, emphasizing that the curriculum reform’s core goal is to cultivate “people” with creative characteristics in thinking and morality in personality (Zhu, 2003).

In writing and revising the course, Xiaoman Zhu proposed and advocated the idea of “the curriculum standard highlights the emotional experience and the special value of moral practice in the moral education curriculum” for creating situations, triggering students’ emotional experience, and inspiring students’ learning enthusiasm. This has direct guiding significance for actively exploring social reality and self-growth problems, and enhancing moral learning ability (Zhao, 2012).

Simultaneously, along with the fundamental education curriculum reform, various subjects in the basic education stage regard emotions, attitudes, and values as the curriculum goals, and use curriculum and teaching as the carrier to carry out emotional education to students. The values and educational view of emotional education provide necessary methodological guidance for exploring humanistic education content and



methods in other disciplines. For example, Chen (2013) believed that in the face of students' anxiety, depression, irritability, and other adverse emotional reactions in English learning, teachers could dig out the emotional education materials from the textbooks and create a context to activate students' enthusiasm for participation and enhance the learning experience. To achieve the English course's emotional goal, transform it into a stable learning motivation, establish self-confidence, and promote the formation of students' outlook on life and values.

### ***Pay Attention to the Topic of Social Education and Deepen the Topic of Emotional Education***

With the improvement of educational practice activities, the theme of emotional and moral education continues to deepen. She proposed new research topics such as "emotional education and class construction," "teacher emotional expression and teacher-student relationship construction," "education and emotional civilization construction" (Wang & Zhu, 2015). The introduction of this series of new propositions properly grasped the special significance of emotions for modern people's survival and development and did emotional education research expected to move further into the multidisciplinary and interdisciplinary vision of sociology, aesthetics, and political science. Jiangsu Nantong Tin Ka Ping Middle School and a group of elementary and middle schools from Jiangsu and Zhejiang provinces have begun to form an alliance to carry out practical exploration of building "emotional civilization" schools (Ding & Ge, 2018).

Besides, the theory of emotional education also pays attention to the solution of social problems, especially the spiritual care of left-behind children in rural education, the education of girls, the education of children of particular groups, and the development of children's moral and emotional development. In 2008, Xiaoman Zhu, the UNESCO International Rural Education Research and Training Center director, integrated her emotional education with rural education and put forward the idea of "County-Based Education" in rural education management and teacher training. The construction of the rural teacher team under the "main" system, she promoted rural social and cultural development through rural education, improved farmers' scientific and technological quality, artistic quality, and ethical and moral standards, and further deepened teacher training in emotional education (Yang, 2008).

### ***Focus on International Research and Broaden Research Horizons***

In academic research, many Chinese scholars proposed that social sciences should actively intervene in the international academic community and seek the "internationalization" of their academic activities and research results (Wang, 2007). During the development of the emotional education thought, Xiaoman Zhu took a positive attitude to dialogue with international scholars, learned advanced foreign education concepts, and

creatively absorbed Chinese education research and practice. She also used the opportunity of dialogue with foreign scholars, international conferences, Sino-foreign cooperative research projects, etc., to introduce the domestic practice of Chinese education to the international community.

When discussing emotional education with Sukhomlinskii's daughter Suhomlinskaya, Kaya suggested that "emotional civilization" can be determined as the research purpose of emotional education. Xiaoman Zhu readily accepted Kaya's suggestion because she had already noticed that Sukhomlinskii thought is, in a sense, the thought of moral, emotional education, and all his educational efforts are aimed at building emotional civilization. Since then, "emotional civilization" has been researched as a new core concept with overarching nature, and this concept has been theoretically discussed and demonstrated (Zhu, 2014).

When explaining the connotation and extension of emotional education, Xiaoman Zhu compared her theory of emotional education with the definition of Peter Lang. This emotional education alliance advocates spiritual care in Europe and puts forward the characteristics of Chinese localized, emotional education. Xiaoman Zhu believed that, compared to the British emotional education advocated to keep children in a comfortable, pleasant, and happy state, the emotional education proposed in China inherits China's profound and far-reaching traditional culture. It supports not only the development of human intelligence, but also the development of morality and aesthetics, and it is broader in educational thinking and goals (Zhu & Ding, 2015).

In the project "Modern Social Changes in China and the Model of School Education Reform: The Model of Southern and Northern Jiangsu," in collaboration with Japanese scholar Hiroshi Abe, she learned additional research and thinking methods from Chinese education researchers. Education officials demonstrated the elegance of Chinese education, especially Jiangsu's education (Yang, 2020c). It is precisely in the international exchanges and cooperation that the theory of emotional education has been broadened, perfected, and deepened.

## **Concluding Remarks**

As the initiator, pioneer, and practitioner of contemporary Chinese emotional education research, Xiaoman Zhu perceived emotional education based on her rich life experience, long-term educational practice, and substantial research ethics philosophy. She highlighted the "emotional" dimension of education in the subtleties of social development. She constructed a theoretical educational system with moral and emotional characteristics from the multi-dimensional perspectives of emotion, virtue, wisdom, life, experience, culture, and ecology (Jin & Yang, 2020).

Since the publication of "The Outline of Emotional Education" in 1993, Xiaoman Zhu's theory of emotional education has been continuously improved in the times' development and reform. The publication of monographs on emotional education, such as "Reflection and Construction: Theoretical Research on Primary Quality Education Models," "Educational Issues and Challenges: Responses to Thoughts," "Chil-

dren's Emotional Development and Education," reflects the continuous extension of the research field of emotional education.

Her educational theories include children's emotional development and education theory, personal quality education model theory, emotional teacher education theory, emotional education paradigm theory, emotional education theory in curriculum and teaching, emotional care theory for special children, emotional civilization and education theory, etc., are all educational theories that actively respond to the practical problems of Chinese education, and are also the inheritance and development of Chinese emotional culture. Qiaoli Liu (2020), a researcher at the Chinese Academy of Educational Sciences, once commented on Xiaoman Zhu's emotional education as "Her educational thought is not only a cure for China's education, but also more in line with the essence of education and the needs of people's overall development. It is based on Chinese traditional culture, contemporary Chinese educational doctrine with the global atmosphere, and full of vitality."

Thanks to Chinese scholars' efforts represented by Professor Xiaoman Zhu, the contemporary era has made remarkable achievements in fundamental theoretical research and educational practice exploration. A group of scholars, represented by Yong Zhang, Zhongsun Mei, Jiamei Lu, Jinhong Ding, Hui Liu, Jingduo Liu, and Cilin Liu, emerged. They continue to deepen the research on related topics in emotional education. The goals, methods, and mechanisms of emotional education from a multidisciplinary perspective significantly enrich the theoretical research of emotional education and make China's emotional education theoretical research themes more abundant.

### Note

1. *The United States proposed the "Social and Emotional Learning" (SEL) project in the 1990s. The original intention of the project was to emphasize the vital role of emotion in education.*

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# An Empirical Study on the Construction of a Higher-Education Performance Allocation Model

Xiaoning Zhang

Nanjing University of Aeronautics and Astronautics, Nanjing 210024,  
Jiangsu, China

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**Abstract:** China's financial input mechanism reform's current development trend involves fully implementing budget performance management and constructing a performance-oriented financial allocation model. These are also essential measures in promoting the modernization of the national governance system and governance capacity. The current financial allocation method for higher education entails a financial supply policy based on per-student appropriation. A new performance-oriented system of higher-education financial allocation system is necessary to upgrade the per-student appropriation of a single flow, construct a close loop of financial allocation "fund flow," optimize the allocation of financial resources for higher education, and guide higher-education institutions to deepen comprehensive reform and achieve high-quality development. Based on the actual situation and relevant data of 26 undergraduate universities in Jiangsu of China, this paper proposes a "double dimension" higher-education performance funding index system, conducts an empirical study with the data envelopment analysis model, and suggests policies on the construction, organization, and implementation of higher-education performance allocation models.

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**Correspondence to:** Xiaoning Zhang, PhD, Management Science and Engineering, Nanjing University of Aeronautics and Astronautics, Education Building Room 1702, 15 Beijing West Road, Nanjing 210024, Jiangsu, China. Email: 123823627@qq.com.

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## Defining the Problem

**S**INCE the 1980s, the financial system of higher education in developed countries has undergone significant changes, with the financial crisis and the decline in competitiveness caused by higher education's popularization. On the one hand, cost consciousness was enhanced. Based on the cost-sharing theory, a cost compensation mechanism was established at the national level to promote diversified funding sources for colleges and universities. Some countries that did not collect tuition fees have now begun to do so. Tuition fees and donations constitute a large share of many public universities' total income, with some reaching 30%-40%.

On the other hand, the appropriation mode changed. Guided by the focus on output and efficiency, financial resources allocation pays more attention to a university's actual output and performance. The traditional financial allocation method in a university is mainly based on the number of registered or enrolled students, which is appropriate for elite education. It involves a small number of students or a financial supply with a single funding source. However, because of changes in higher education and financial allocation trends, such a traditional allocation method has failed to meet higher-education development's practical needs. People pay more attention to performance, efficiency, and responsibility than ever. In this case, the introduction of performance mechanisms into higher education resource and financial allocation models has become an inevitable developmental factor.

The current financial allocation method for Chinese higher education constitutes a financial supply policy based on per-student appropriation. According to the student population, allocating funds may result in the unreasonable pursuit of large-scale enrollment, which is not conducive to promoting higher education development. National education fund statistics show that in 2017, the total national higher-education fund input was 1,110.9 billion CNY, of which 80% was national financial education funds. The average education cost per student in public colleges and universities reached 33,481 CNY, which was the highest among all education types. From a fund management perspective, the funds allocated to education by finance at all levels are "flowing" from high to low and are diverted or converged into specific education units. Such "fund flows" are always unidirectional. While some problems have recently been found in the audit and inspection of education funds, funding allocation, and education performance are not relevant because of the lack of suitable information feedback channels. A new performance-oriented system of higher-education financial allocation is paramount to upgrade the single-flow per-student appropriation, construct a close loop of financial allocation "fund flow," and guide higher-education institutions toward comprehensive reform and high-quality development by conveying clear policy and performance orientation, thus optimizing the allocation of financial resources for higher education.

## Literature Review

## ***Research on Foreign Higher-Education Financial Appropriations***

In the 1960s and 1970s, Western countries achieved vigorous development in higher education, and with its popularization, the student count in colleges and universities surged, dramatically increasing the average cost per student. However, the growth rate of financial education funds in various countries started to decline, followed by the emergence of supply-demand conflicts, making the financial crisis a global problem in colleges and universities. The same period also saw the rise of the public management movement, which advocated public response and proposed introducing corporate management or market approaches into government management reforms, improvements in government service efficiency, and emphasis on the increase in the quality and efficiency of fund allocation. Under this reform movement's influence, an increasing number of citizens, government officials, experts, scholars, and other stakeholders changed their monetary fund allocation concepts. They began paying attention to colleges' and universities' efficiency and responsibility with the hope that they would explain their use of funds. In this context, the traditional allocation model, which was based on colleges' and universities' student populations, was no longer able to adapt to higher education development. In contrast, the performance allocation model, which emphasized results and efficiency, began to show its superiority (Zhang & Sun, 2014a; 2014b).

Financial input systems, education management methods, and government policy orientation vary according to country, resulting in distinct forms of implementing performance appropriation. They can be categorized into three: First, they are near related to educational output and are generally linked to the number of students and the learning process. Such appropriations are generally dominated by teaching allocations. For example, in its 1992 higher-education reform, Denmark introduced a performance allocation mechanism and implemented the "taximeter model" based on the valid number of students, which was the basis for its teaching allocation and which effectively promoted the quality of students (Yang & Liu, 2017; Academy of Finland, 2014). Another example is the Dutch government's introduction of the performance grant model (PBM) in university grants in 2000. The PBM is a distribution model in which the ministry of education first determines the total budget allocated to all universities and the distributed amount. In the total budget, the teaching aspect is mainly based on the performance allocation mechanism, which accounts for about 35.8% of the school's total funding. Second, performance appropriation has a close relation with performance evaluation results. It is generally connected to a particular university area's performance, which is seen as a management tool in most countries. For example, in 2003, Hesse-Darmstadt in Germany implemented budget reform in which all higher-education institutions received a total allocation based on evaluation results. Different universities have different index weights.

Meanwhile, through a budget consultation, the Austrian government signed a three-year performance agreement with each of its universities to clarify the tasks they should undertake as a public service provider and as representatives of national interests.

The higher-education structure fund will be determined according to the quality and performance objectives stipulated in the agreement. In the United States, the Student Achievement Initiative was launched in Washington in 2008 and was formally implemented in 2009. It was based on achievement points and appropriated performance funding through additional resources based on unchanged primary allocations. Third, performance allocation is closely tied to governments' strategic demand, generally taking project funding for excellence. "Excellence" programs at the national level such as the German Universities Excellence Initiative in Germany, the Investment for the Future program in France, the Research Excellence Framework of the United Kingdom, among others, motivate universities to participate in international competition and improve the quality of higher-education research and teaching through substantial financial support.

The development of performance funding underwent a tortuous process, from rising to decline and then toward revival. For example, the United States' performance appropriation system's development can be divided into two stages. The initial stage began in 1989 in Tennessee (Li, 2016; Tennessee Higher Education Commission 2015) and ended in the economic recession of 2000. The second phase is the revival, which began in 2008 and is ongoing. According to the research results of Dougherty et al., (2013) about two-thirds of these new performance appropriation projects are re-adoptions of projects suspended in the first phase. Some projects no longer use the method of setting additional performance appropriation bonuses; instead, performance funds are embedded in state higher education allocation. The amount of funds is higher, which is generally 5% to 25% of the total state public higher-education appropriations. The most prominent among these is Tennessee, where student output-related performance funding constitutes 85%-90% of state public higher education (Dougherty & Reddy, 2013).

Similarly, European countries have also experienced two development stages in their performance allocations. The first occurred in the 1990s, when some governments such as in Denmark, Nordrhein-Westfalen in Germany, Italy, Portugal, and Sweden introduced performance allocations. Meanwhile, the second stage began at the start of this century, when France, Hesse-Darmstadt in Germany, Switzerland, and other countries introduced performance appropriation. Some countries adjusted their form of performance appropriation in the performance appropriation process from rising to decline to revival. In general, since the performance allocation system has undergone two rounds of development, the current implementation process in these countries is rational and objective without overstating performance allocation effectiveness. They can objectively view performance allocation and analyze the actual impact of its policies.

Combining the practice and experience of foreign higher-education performance allocation, we found six characteristics. The first involves paying attention to output and efficiency orientation. Here fund allocation and performance evaluation are combined organically, focusing on the use benefit of funds and the moderate embodiment of benefits in fund allocation to realize the closed cycle of "fund flow." The second entails the general use of "number of qualified students" rather than "number of

enrolled students.” The number of qualified students trained by the school and met graduation requirements shall be the reference for fund allocation. This prevents schools from unduly pursuing enrollment expansion, regardless of students’ quality and cultivated ability, to fight for funds, conducive to schools’ rational scale expansion. The third involves placing great importance on teaching quality and student growth. This “student-oriented” outlook adopts a personalized, differentiated reward model, assistance, and training combining production and teaching with research. From the perspective of student growth and learning to behave oneself, management links on fund allocation and use are scientifically designed to reflect a people-oriented approach. The fourth is the establishment of “buffer agencies.” Many countries have set up intermediary agencies or buffer organizations between their governments and colleges and universities to provide a scientific basis for government decisions on general and special appropriations, as well as to prevent the government from excessively intervening in universities, which is beneficial to the autonomous operation of schools. The fifth is the introduction of third-party assessments. Evaluations on performance or quality are generally provided by a third party, which ensures fairness and justice and promotes colleges’ and universities’ independence as the state exerts its influence. The sixth involves focusing on vertical incentives to avoid horizontal competition. Colleges and universities are encouraged to improve their performance level vertically and avoid horizontal competition for funds. This emphasizes that universities must expand their funds rather than compete for the same “cake”.

### ***Research on Domestic Higher-Education Financial Appropriations***

China’s higher-education financial allocation model has undergone three developmental stages. In the first stage (before 1985), the state implemented the “base + growth” allocation model. Under weak state financial circumstances, small scale of colleges and universities, and a relatively simple school structure in a planned economy system at that time, the appropriations system was relatively simple and feasible. However, human factors were easily influenced and did not stimulate colleges’ and universities’ enthusiasm to run schools. In the second stage (1986–2009), the state implemented the “comprehensive quota + special subsidy” allocation model, which enhanced fund allocation fairness and was relatively close to colleges’ and universities’ actual situation. However, the determination of personnel funds and public funds of various schools was mainly based on historical data, and to some extent, the allocation of special subsidies was also subjective. During this model’s implementation, some regions with limited financial resources adopted the “quota subsidy + special subsidy” model. In the rapid development of colleges and universities, it was not easy to guarantee their standard funding requirements. In the third stage (2010 onward), the state began to implement the “students’ average budget expenditure + special subsidy” allocation model. The Outline of National Medium-and Long-Term Program for Education Reform and Development (2010-2020) proposes that “all localities shall, according to the basic stand-

ards of the state for running schools and the basic needs of education and teaching, formulate and gradually raise the basic standards for the per capita funding of schools at all levels within the region and the basic standards for the per capita financial allocation of students.” In 2010, the Ministry of Finance and the Ministry of Education issued the “Opinions on Further Improving the Level of the Student Average Appropriation for Local Universities and Colleges” and, in 2014, issued the “Opinions on Establishing and Perfecting the Reform-oriented and Performance-oriented Student Average Allocation System and Accelerating the Development of Modern Higher Vocational Education,” further improving the investment mechanism for local higher education, establishing a performance evaluation system, and improving the scientific and refined education fund management (Yaozhong, 2014).

Domestic scholars have used empirical research methods to study higher-education performance allocations. Based on the reality higher-education development in China, Zhang et al. (2013) designed a budget performance evaluation index system for colleges and universities, which comprehensively takes into account their functions, namely, teaching, scientific research, social services, and cultural inheritance and innovation. According to input and output, a financial input budget performance evaluation system for colleges and universities was established (Youtang et al., 2014), consisting of 8 first-level indicators and 43 second-level indicators. Through empirical analysis, Yan (2014) found that the major indicators contributing to the performance of education fund input in higher vocational colleges are the registration rate of new students, teacher construction achievements, and teacher construction input, as well as indicators in terms of crucial specialty construction, social training, and social donation (Liangang, 2014). Gong and Chen (2017) applied the DEA method to calculate the performance evaluation of 34 higher vocational colleges’ inputs and outputs in a Western province. They concluded, among others, that the government mainly bears the allocation of education funds for public higher vocational colleges from the central to the local level. Because of the lack of participation of higher vocational colleges and relevant social departments in the appropriations decision-making process, budget preparation cannot comprehensively reflect schools and society’s actual needs..

Meanwhile, most financial allocation methods are based on the students’ count, which cannot truly reflect a school’s actual operational costs and output benefits, resulting in a disconnect between the current funding and school performance (Lianxi & Enlun, 2017). Pan (2017) believed that the “input-output” theory is the simplest and most commonly used method for performance evaluation in colleges and universities. However, the indicator weight is generally set in the study using the expert evaluation method or the mathematical analysis method, the former having unavoidable subjectivity while the latter being limited by data acquisition issues. The establishment of the coefficient of variation in mathematical analysis requires data samples of an extensive period to be accurate.

## **Study Limitations**

Through literature research, we found that foreign research on the higher-education performance allocation system started earlier and has led to relatively mature experience and models that cannot be indiscriminately adopted in China. Concurrently, while the foreign performance allocation system is also continuously improving, its effects need to be further verified and recognized. Domestic research in China is still at its initial stage, focusing on educational performance, input performance, and other factors. It is a kind of “ex-post” performance evaluation. Performing in-depth and systematic theoretical and practical research is vital to figure out ways to organically link performance with budget or per-student appropriation, establish a scientific college performance allocation system, and persuade third-party social organizations to engage performance evaluation.

## **Models, Samples, and Data**

### ***Model Construction of Higher-Education Performance Appropriation***

Colleges and universities exist in large numbers with various types. Although colleges and universities with different types and orientations provide higher education, they have different input levels, service objectives, and operating schools’ motivations. A set of performance evaluation index systems is not enough to measure all colleges’ and universities’ educational performance levels.

This paper proposes a “double dimensions” higher-education performance allocation index system. The educational performance is decomposed into two dimensions of “input” and “output”, each of which includes 3-4 evaluation aspects, thus constructing a multidimensional index system.

Specifically, the “double dimensions” higher-education performance allocation index system is an “evaluation box” formed by three dimensions and four planes. As shown in **Figure 1** below, evaluation index types are divided into: input and output. The former involves three evaluation dimensions (human input (x-axis), capital investment (y-axis), and facility input (z-axis)). At the same time, the latter consists of four projection planes (personnel training (OAB plane), scientific research (OBC plane), social service (OAC plane), and cultural inheritance (ABC plane)). To assess a university’s educational performance is to put it in an “evaluation box” composed of these dimensions and planes. Considering a university’s actual educational effects from different aspects, we can evaluate the number of funds allocated to a university in the next financial allocation cycle.

Compared with the typical performance evaluation index system, this “double dimensions” higher-education performance allocation index system has three characteristics. First, it evaluates the current situation. It is an assessment based on the status quo of “input” and “output.” For the evaluation object, the amount of input and output is a factual situation that has existed objectively in the past that is determined. Second, it is an objective evaluation. Specific performance evaluation indexes are given from two

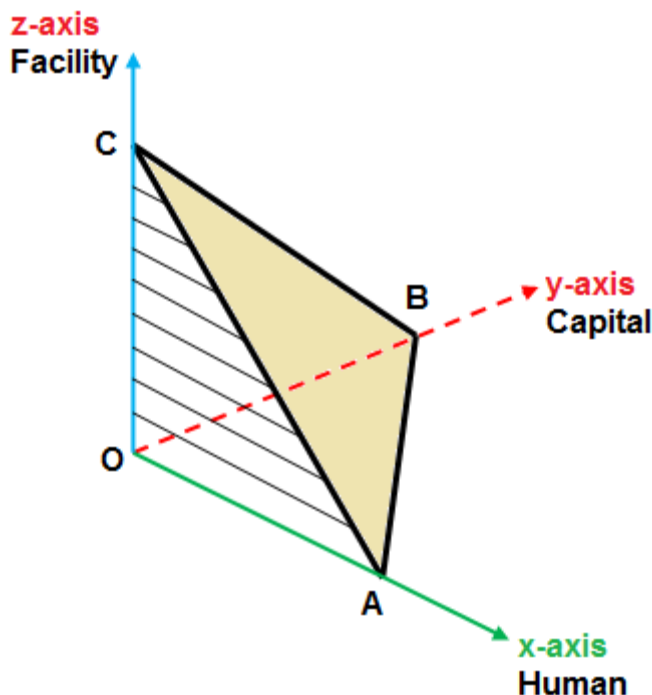


Figure 1. Diagram of Higher-Education Performance Funding “Evaluation Box.”

dimensions: “cost input” “performance output.” Each specific index’s weight does not need to be set manually, significantly reducing the performance evaluation’s subjectivity. Third, it is a kind of data evaluation. The selection of an evaluation index mainly considers whether there are standardized and impartial data collection channels. The data should have statutory force and must be collected regularly through official channels comparable with previous years, conducive to the long-term development of performance evaluation.

### ***Sample Selection and Data Source of Higher-Education Performance Funding***

- **Sample Selection**

The scientific selection of samples and matching the corresponding data set based on the model’s index design and measurement requirements are essential in performance evaluation. This paper selected 26 ordinary universities in Jiangsu Province to confer



master and doctoral degrees based on the scope of higher-education performance funding and data requirements.

- **Major Index Selection**

Considering that the research objects are mainly universities with postgraduate training qualifications, in order to facilitate empirical research, we simplified the performance evaluation indicators. We selected the eight indicators that are most closely related to input and output, as shown in **Table 1**, to construct the performance allocation “evaluation box.”

- **Data Source**

Based on the research needs and the principle of comparability of evaluation results, the index data mainly came from three aspects: (i) the Statistics of Higher Education Undertakings in Jiangsu Province (2012-2016), which covered personnel composition, fixed input, infrastructure, and student training data; (ii) the Statistics of Finite Index of Scientific and Technological Activities in Universities and Colleges in Jiangsu Province (2012-2016), which covered teachers and scientific and technological personnel, science and technology funds, subject patents, monographs, technology transfer, and others; (iii) the Database of Statistical Statements on Educational Funds in Jiangsu Province, which covered data on the income and expense of educational funds in colleges and universities. These data were all normalized statistical projects arranged and carried out at the national level. This study used the five-year data to evaluate and analyze the educational performance of the sample universities.

## **Empirical Results Analysis**

### ***Method Selection of Performance Evaluation***

To systematically present the evaluation process and higher-education performance results, we adjusted and processed the index system according to the principles and methods described earlier and chose the data envelopment analysis (DEA) method as the primary research tool. Using the DEA non-radial method to build a model, the incremental potential of output factors in higher education is measured, and each output factor's efficiency status is clarified. Then, each higher education's educational performance is studied, and the ineffective sources are mined to guide higher education better to improve its educational performance. The DEA method is mainly used to evaluate the production (or management) performance of multiple decision units with multiple inputs and outputs. It can avoid many difficulties caused by seeking weight due to different index dimensions, with relatively objective evaluation results. In the DEA model, it is unnecessary to give input and output the weight coefficient in advance, reducing human factors' influence.

**Table 1. Evaluation Index System of Higher-Education Performance Allocation.**

The Indicator System	Main Indexes	Index Matrix Composition	
		Cost Input	Human Input
	Capital Investment	Funds allocated from public finance budgets for education ( $X_3$ )	
	Facility Inputs	The construction area of school buildings with property rights ( $X_4$ )	
Performance Output	Personnel Training	Number of graduate students with master's and doctoral degrees ( $Y_1$ )	
	Scientific Research	Total number of Science and Technology Topics ( $Y_2$ ), number of academic papers published in foreign and national journals ( $Y_3$ )	
	Social Service	Actual revenue from technology transfer ( $Y_4$ )	
	Cultural Inheritance	Temporarily no	

**Table 2. The Ratio and Average Efficiency of Input-Output Variables Can Be Optimized From 2012 To 2016.**

Year	Number of Graduate Students with Master's & Doctoral Degrees		Total Number of Science & Technology Topics		# of Academic Papers		Actual Revenue from Technology Transfer	
	$\beta_1$	E1	$\beta_2$	E2	$\beta_3$	E3	B4	E4
2012	0.118	0.945	0.118	0.938	0.948	0.886	15.909	0.730
2013	0.156	0.918	0.095	0.947	0.260	0.893	31.210	0.720
2014	0.393	0.873	0.148	0.909	0.584	0.834	20.442	0.587
2015	0.091	0.944	0.156	0.930	0.586	0.851	19.010	0.714
2016	0.288	0.899	0.199	0.885	2.153	0.746	68.929	0.585
Average	0.209	0.916	0.143	0.922	0.906	0.842	31.100	0.660

## ***Result Analysis of Higher-Education Funding Performance Evaluation***

### **• Performance Growth Potential Analysis**

In **Table 2**,  $\beta$  represents the proportion of the output requirement that can be increased, and E represents the output factor's corresponding efficiency. As can be seen from the table below, the four performance output indicators of the 26 sample universities and colleges, namely, the number of graduate students with master's and doctoral degrees, the total number of Science and Technology topics, the number of academic papers, and the actual revenue from technology transfer within five years are 0.209, 0.143, 0.906, 31.100, and the efficiency values are 0.916, 0.922, 0.842, and 0.660, respectively. This indicates that under the premise of constant input, the number of master's and doctor's degrees awarded and the total number of scientific and technological topics need to be improved in a relatively small space, and both the number of academic papers and the output of technology transfer has a large room for improvement, especially the income from technology transfer. This shows that universities should pay more attention to transforming scientific and technological achievements while pursuing academic research.

### **• Comparative Performance Analysis**

The higher the educational performance, the closer it is to 1, the better the educational performance. If the educational performance is 1, the school's educational output is sufficient. In **Table 3**, only five universities, including NJU, SEU, HHU, JU, and NJNU, produced significant results in terms of the average five-year performance of 26 universities. Eight universities produce between 0.9-1.0, four universities produce between 0.8-0.9, two universities produce between 0.7-0.8, five universities produce between 0.6-0.7, and two universities produce between 0.5-0.6. In 2012, 2013, and 2015, the number of universities with effective performance was more than 50%, and in the other two years, it was less than 50%. It shows that the output of higher education in Jiangsu province is invalid in some years, especially in 2016; there were only 11 universities with effectual output, accounting for 42.3% of all universities in Jiangsu province.

### **• Analysis between Performance and Funding**

In this paper, we built the "double dimensions" higher education funding performance evaluation index system. The purpose was to study puts forward the "funds and education performance correlation degree is not high," the creative thinking of the problem, which will be reflected in the government performance evaluation results of university funding allocation mechanism, build "funding-performance-grant" funding "flows" closed loop. Through the discussion and analysis of the educational performance evaluation results of 26 universities from 2012 to 2016, we proposed to calculate and deter-

**Table 3. Jiangsu Higher Education Performance from 2012 to 2016.**

University	2012	2013	2014	2015	2016	5-yr Average
NJU	1.000	1.000	1.000	1.000	1.000	1.000
SEU	1.000	1.000	1.000	1.000	1.000	1.000
HHU	1.000	1.000	1.000	1.000	1.000	1.000
JU	1.000	1.000	1.000	1.000	1.000	1.000
NJNU	1.000	1.000	1.000	1.000	1.000	1.000
NUIST	1.000	1.000	1.000	1.000	0.845	0.969
NJAU	0.784	1.000	1.000	1.000	1.000	0.957
CPU	1.000	1.000	0.741	1.000	1.000	0.948
JSU	1.000	1.000	1.000	1.000	0.728	0.946
NMU	0.701	1.000	1.000	1.000	1.000	0.940
NJ TECH	1.000	0.896	1.000	1.000	0.732	0.926
JSUT	1.000	1.000	0.568	1.000	1.000	0.914
NJIT	1.000	1.000	1.000	1.000	0.549	0.910
YZU	0.732	0.822	0.893	1.000	1.000	0.889
NJUPT	1.000	0.806	0.768	1.000	0.735	0.862
JUST	1.000	1.000	0.631	1.000	0.559	0.838
SOOCHOW	0.683	1.000	0.688	1.000	0.717	0.818
CZU	1.000	1.000	0.566	0.658	0.654	0.776
NUFE	1.000	1.000	1.000	0.415	0.397	0.762
CUMT	1.000	0.624	0.617	0.583	0.622	0.689
NJFU	0.630	0.721	0.606	0.732	0.625	0.663
NJUCCM	0.745	0.586	0.581	0.681	0.551	0.629
JSNU	0.541	0.628	0.674	0.773	0.514	0.626
USTS	0.442	0.518	0.576	0.500	1.000	0.607
NTU	0.488	0.570	0.550	0.577	0.616	0.560
XZHMU	1.000	0.433	0.361	0.436	0.404	0.527
Effective Quantity (Ratio)	17 (0.654)	16 (0.615)	12 (0.462)	17 (0.654)	11 (0.423)	5 (0.192)

mine the amount of financial allocation of universities in the next five years according to the method of “basic allocation + performance allocation.”

In **Table 4**, the financial allocation of 26 universities in the next five years can be divided into two parts. The first part is the basic allocation. Considering the years a university education cost is relatively fixed, the amount of financial allocation from the government to universities should not be too volatile to affect running schools’ regular order. Therefore, the necessary allocation can continue to be calculated according to the original per student financial allocation model, i.e., the “funds allocated from public

**Table 4. Jiangsu Higher Education Performance Allocation.**

University	Funds Allocated from Public Finance Budgets for Education (10,000 CNY)						5-yr Average	Next 5-yr Performance Grants (10,000 CNY/yr)
	2012	2013	2014	2015	2016			
NJU	275,319	185,768	180,929	203,677	240,139	1.000	2,298	
SEU	195,637	147,888	153,747	179,593	184,433	1.000	2,298	
HHU	104,218	118,908	97,691	104,445	104,951	1.000	2,298	
JU	99,796	103,594	109,543	87,778	96,320	1.000	2,298	
NJNU	69,852	67,399	74,088	89,407	95,188	1.000	2,298	
NUIST	34,112	35,528	38,400	45,299	48,521	0.969	2,227	
NJAU	104,630	80,626	90,195	95,609	101,220	0.957	2,199	
CPU	65,159	63,259	66,021	64,103	68,297	0.948	2,179	
JSU	60,125	60,770	71,878	85,830	96,336	0.946	2,173	
NMU	48,274	52,401	51,649	57,861	64,962	0.940	2,161	
NJ TECH	53,887	63,345	67,949	76,033	84,595	0.926	2,128	
JSUT	17,778	18,947	21,999	27,333	30,504	0.914	2,100	
NJIT	29,823	28,615	31,846	39,344	44,355	0.910	2,091	
YZU	73,563	71,205	75,267	92,704	100,005	0.889	2,044	
NJUPT	35,378	57,617	48,422	56,283	64,615	0.862	1,981	
JUST	31,764	32,135	35,977	43,412	46,886	0.838	1,926	
SOOCHOW	117,323	110,408	122,910	143,076	146,781	0.818	1,879	
CZU	22,822	24,864	29,681	37,151	38,582	0.776	1,783	
NUFE	30,961	28,366	32,353	39,579	40,612	0.762	1,752	
CUMT	96,108	88,547	96,813	101,329	107,894	0.689	1,584	
NJFU	45,576	47,192	50,314	55,207	61,049	0.663	1,524	
NJUCM	42,031	49,219	49,473	54,455	58,146	0.629	1,445	
JSNU	35,958	37,911	41,549	50,180	54,166	0.626	1,439	
USTS	29,354	27,370	32,137	37,686	41,491	0.607	1,396	
NTU	52,671	49,828	52,179	62,332	68,054	0.560	1,288	
XZHMU	30,463	33,784	33,369	37,908	45,227	0.527	1,211	
Total	1,804,594	1,687,507	1,758,393	1,969,629	2,135,345	—	50,000	

finance budgets for education educational” of each university in **Table 4** shall remain unchanged.

The second part is the performance allocation. The “incremental” method is adopted to keep the basic allocation unchanged, and the total fund allocation is determined by introducing the educational performance evaluation results.

Suppose the total annual incremental funds of 26 universities are calculated according to 500 million CNY. In that case, the average value and proportion of each university’s educational performance in five years can be used to calculate each universi-

ty's annual performance allocation amount in the next five years. The calculation formula is 500 million CNY  $\times$  (the five-year average performance of each college / the total five-year average performance of 26 universities). In this way, a university's educational performance will directly affect the number of performance grants it receives from the government over the next five years. If the government wants to increase incentives, it could increase the total amount of fiscal funds allocated to performance grants each year.

## **Conclusions**

The full implementation of budget performance management and the construction of a performance-oriented financial allocation model are China's fiscal input mechanism reform's current development trends. They are crucial measures to promote the modernization of the national governance system and capacity. Based on the actual situation and relevant data from 26 universities in Jiangsu Province, this paper constructed the "double dimensions" higher-education performance allocation index system and used the DEA model for empirical research. The following conclusions can be drawn.

First, the higher education performance distribution model can assess the development potential of universities. By constructing a "double-dimensions" performance distribution model, one can see different universities' development potential. Take appropriate incentive measures for universities with excellent development potential to motivate them to improve higher education performance further. On the other hand, it can be seen in which output factors each university has development potential. By setting scientific output performance indicators, colleges and universities will be guided to develop in a government-led direction and more high-quality talents suitable for economic and social development will be cultivated.

The second is that the higher education performance distribution model can evaluate the educational effectiveness of universities. This study found noticeable performance differences among the 26 sample universities, and this difference tends to increase to a certain extent. This phenomenon is not conducive to the improvement of the overall level of higher education in the region. Organizers of colleges and universities can scientifically evaluate each college's educational effectiveness in a certain period by setting up a "double-dimensions" performance distribution model to take targeted reward and punishment measures to encourage each college to improve its educational effectiveness actively.

Third, the higher education performance distribution model can evaluate the relationship between colleges' and universities' educational performance and capital investment. The funding method based on the performance distribution model will no longer be the original funding model based on the "number of students" but a comprehensive evaluation model based on "education performance." Under this model, universities' financial appropriations will be dynamic and change with education quality. Based on the college education performance evaluation results in the previous cycle, dynamically adjust the number of financial appropriations received by colleges and uni-

versities in the next cycle. This will bring external pressure to colleges and universities to continuously improve the quality of education.

## **Suggestion**

Based on the findings, the following suggestions are made to construct a new performance-oriented financial allocation system for higher education and optimize financial resource allocation, form a closed cycle of financial allocation “fund flow,” create clear policies and performance orientation, and guide universities toward continuous improvement of school operations and education quality.

The first is to strengthen the quality orientation and use funds to encourage universities to adjust their school-running behavior. In the context of public resource constraints and competition, through the implementation of performance appropriations, a certain amount of funds is associated with measurable indicators to guide colleges and universities to adjust or change school-running behaviors per government intentions to achieve the purpose of improving the quality of higher education teaching and research. The standard practices are (i) Increase the “process” and “output” indicators, such as the number of students studying in a year, the number of students taking the exam, the number of bachelor’s and master’s degrees and other learning completion indicators, the acquisition of international funds and external funds, research evaluation and other research quality indicators to enhance Relevance of funding to quality. (ii) Increase the performance share of public funding. China currently implements a higher education financial appropriation system of “per student expenditure + special subsidies.” The appropriation formula is mainly calculated based on the number of students enrolled, and the distribution of special subsidies mainly reflects performance. In the future, the reform of the higher education performance appropriation system proposes to increase the evaluation indicators of students’ study completion and academic achievement, increase the weight of financial incentives, and guide universities to shift from focusing on scientific research to equal emphasis on teaching and research.

The second is to set up an adjustment mechanism to promote the sustainable development of university finance. For a long time, there has been a low correlation between appropriation and performance in allocating fiscal funds in China. An essential feature of the budget management system’s ongoing reform is to improve the performance of fiscal expenditures, and it has proposed establishing a reform and performance-oriented per-student appropriation system. It is suggested that the new fiscal appropriation policy should set a period of adaptation and improvement to achieve a smooth transition and sustainable development of university finance.

The third is to pay attention to differentiated treatment and adapt to the actual needs of different objects. Performance appropriation generally does not only use a single model but mostly a combination of several models. How to further guide universities’ individualized development in reforming the current funding mechanism for colleges and universities in China should be fully considered in the top-level policy design.

The fourth is to insist on equal dialogue and improve the transparency of organization and implementation. The relationship between the government and the university is not a relationship between superiors and subordinates, but a relationship of equal consultation, encouragement and guidance, and partnership. In China, the government has long been the competent authority of higher education institutions, deciding on a university's principal allocation, faculty establishment, financial allocation, asset disposal, etc. The original intention of performance funding is to encourage colleges and universities to adjust and improve their school-running behavior and improve school-running quality and efficiency. Such an incentive should maximize the autonomy, enthusiasm, and creativity of colleges and universities. A platform for equal dialogue between the government and universities should be built to improve the transparency and participation of performance funding.

The fifth is to build a regulatory framework to form a synergy between internal and external forces to improve university performance. The cost structure occupies a large share of its financial expenditure, mainly the personnel cost, which is about two-thirds of the university's overall expenditure. This high proportion of fixed costs in overall expenditure limits the flexibility of university financial activities. Therefore, the actual attainment of performance funding is relatively limited in most schools. Performance appropriation is just a change in appropriation methods, and its ultimate purpose is to improve public funds' efficiency. It is difficult to achieve this goal by relying on a single financial means. A regulatory framework should be established to organically link financial incentives with other measures to truly achieve the higher education system's sustainable development and the high quality of education and research.

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# Design and Application of Questions Based on Protocol-Guided Case Teaching

Caimin Li

*NENU Ideal Software Co., Ltd, Jilin 130000, Changchun, China*

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**Abstract:** *As the core element of classroom teaching, questions play an essential role in constructing students' knowledge systems and cultivating their ability to discover, explore, analyze, and solve problems. Therefore, the design and application of appropriate questions is the key to the success of classroom teaching. Teaching based on protocol-guided cases advocates question-centric teaching. It is suggested that teaching activities should be carried out around the discovery and solution of questions, promoting the teaching concept to change from lecture to inquiry, stimulating students' interest and potential, and improving students' comprehensive quality. This article mainly discusses the design and application of questions in middle school protocol-guided learning and discusses the basis and requirements of question design in protocol-guided case. With typical cases as the forerunner, strategic guidance is put forward to apply questions to integrate teaching plans.*

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**Correspondence to:** *Caimin Li, Research Fellow of NENU Ideal Software Co., Ltd, Jilin 130000, Changchun, China. Email: 461772238@qq.com.*

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## Introduction

**T**HE question is the starting point and the driving force of thinking (Yao, 1995). In teaching, the question is the soul of the classroom, and its design reflects the teacher's understanding of the text and the grasp of the students' abilities, while the students' answers to the question, in turn, reflect the effect of teaching. Therefore, high-quality and appropriate questions can significantly improve students' learning (Wlen & Clegg, 1986) and produce motivation, communication, guidance, organization, and creativity (Gao, 2013).

Protocol-guided learning is the carrier of students' autonomous learning under the background of China's new curriculum reform (Zhou & Li, 2020). It is a strategy for elementary and middle school teachers to combine students' learning conditions and cognition according to curriculum standards and textbooks, with learning goals as the guidance and question as to the core, to achieve effective learning for students before, during, and after the class (Xia, 2017). In this learning strategy, question design is the most critical link. The primary purpose is to reproduce knowledge creation and restore it to a question to be solved to learn with the question and fully connect and assist the pre-class preparation and classroom teaching.

Based on protocol-guided case teaching, the question is also the central link. It encourages teachers to guide students to discover and raise questions in the preview, discuss and solve questions in the classroom, to cultivate students' question awareness and stimulate their innovative thinking through the discovery and resolution of questions. This article combines the practice of "question design" in the middle school protocol-guided case to deeply analyze the principles and requirements of question design and teaching application. Some specific methods for optimizing design and application questions in protocol-guided learning are proposed to provide reference and guidance for teaching based on the protocol-guided case.

## Definition and Related Research

The ancient Greek philosopher and educator Socrates once advocated the use of questions to drive students' learning. This method not only motivates students to think but also deepens their further understanding of knowledge. Since then, the question has become one of the essential elements in teaching and has become the topic of extensive research by scholars. The research mainly covers the connotation, type, and design of the question in teaching.



## **Concept Study on “Question”**

Karl Popper (1986) once regarded “question” as the conflict between the expectations inherent in the background knowledge and its new development, or it is the tension between our existing knowledge and ignorance, and the space after expectations and expectations fail. This is the process of revealing the emergence and resolution of the question from a philosophical perspective.

If “question” is placed in the teaching context, it becomes a specific element in the learning and teaching process. Regarding the concept of the question in this context, domestic and foreign scholars have given different meanings from different angles.

In the “*Dictionary of Education*,” the “question” in teaching is explained as follows: by setting the situation, raising and solving questions for teaching (Gu, 1990). Therefore, the question has become the support for all aspects of teaching.

In the “*Encyclopedia of China (Education Volume)*,” the “question” in teaching refers to a method for teachers to put forward questions in response to the difficulties and puzzles encountered by students in life and study, and lead students to analyze and solve them (Liang & Huo, 1995). This elevates the question from an essential element in teaching to a kind of method.

In the “*Western Education Dictionary*,” “question” is further sublimated, and it is interpreted as: “It can not only help teachers understand what students are learning and what they can do, but also can be used as a part of teaching skills” (Lanthua, 1988).

Based on the above concept analysis, the “question” discussed in this article refers to the tasks students need to solve in the learning process. This article believes that knowledge is the perfect solution to the question. The easiest way for students to acquire human knowledge is to restore the origin of knowledge, that is, to reset the process of knowledge construction through questions to learn more effectively with questions. Therefore, in the teaching process, teachers should restore the textbook’s main knowledge points to learning tasks and guide students to understand and master knowledge through tasks.

## **Type Research of “Question”**

Research on question design in teaching began in the 1950s and 1960s. The former Soviet Union educator Mahmutov (1975) have conducted systematic research on the essence, epistemological basis, psychological basis, and methodological system of “question” teaching forming a systematic question pedagogy theory, which provides a theory for the design of classroom questions.

Psychologist Rigg used empirical experiments to provide ample evidence for question design’s fundamental principles and gave strategies for the frequency of questions in the classroom and questioning strategies.

Most domestic scholars in China focus on the design source of the question and think that the question should be designed by analyzing the material’s source. For example, Chen (2015), combined with years of teaching practical experience, proposed

the question's design strategy, namely, Design questions where knowledge occurs, contradictions, and collation. Feng (2016) put forward the selection and construction of core questions in the "relationship" of teaching new and old knowledge, the "migration" of classroom teaching, the "difficulties" of students' cognition, and the "integration" of questions.

On the one hand, we can see that the domestic and foreign education circles attach great importance to the question design in teaching. Especially in China, classroom question design for various subjects has been researched. Nevertheless, in concrete terms, most studies only focus on classroom teaching questions and do not place questions in pre-class preparation and after-class consolidation, so they have not been formed into a complete learning process.

As a self-learning material for students, the protocol-guided case has attracted many domestic researchers' attention in its design and application. However, looking at the existing research on protocol-guided case design, most of its content is about theoretical discussions on the design principles and writing methods of subject protocol-guided case. There is a lack of substantive research on designing and operating at the specific implementation and operation level. The design of questions, how to design questions in protocol-guided learning material, and how to use these questions in classroom teaching need further studies.

Therefore, this article investigates and analyzes the status quo of question design in the middle school history classroom, and discusses the question design strategy of the middle school history classroom combined with the specific teaching links of the middle school history subject. Then carry out specific teaching case practice, but the research into practice and hope to provide practical strategies for further optimizing middle school history question design.

## **The Role of Question in Protocol-Guided Case Teaching**

The protocol-guided case is a carrier of students' autonomous learning under the new curriculum reform background. Objective, question, learning method, teaching method, and practice constitute its essential elements. As the core of the protocol-guided case, question plays a crucial role in designing the protocol-guided case. Therefore, clarifying the question's role in the protocol-guided case is of great significance to the study of question design and application.

### ***The Level of the Question Determines the Quality of the Protocol-Guided Case***

The protocol-guided case is a program for students to learn independently and a program for teachers to guide students in learning. It focuses on questioning knowledge, proceduralizing ability, and subtly developing emotions, attitudes, and values. In this process, the key to designing protocol-guided cases is to question knowledge. It is the

primary basis for students' pre-class preview and independent study, in-class inquiry and discussion, and after-class expansion and consolidation, and it is also the primary basis for teachers to organize effective teaching. Therefore, the question level directly determines the protocol-guided case (Xu & Du, 2015).

### ***Question Is At the Core of Classroom Guidance***

Protocol-guided teaching is based on the carefully designed protocol-guided case or various questions generated during the teaching process. Its significance is that it can stimulate students' interest in thinking, guide students to better carry out independent thinking and cooperative activities, help students understand the content of learning deeply, expand students' vision and thinking space, enhance classroom teaching effects, and achieve stable results

### ***Compelling Question Can Promote the Overall Development of Students***

The protocol-guided case is a program for students to learn independently and a program for teachers to guide students in learning. The protocol-guided case's key is to question knowledge and then hierarchize the questions to achieve a knowledge update. This is the proletarianization of abilities, the subtly cultivating of emotions, attitudes, and values.

In teaching using the protocol-guided case, students complete the relevant questions in the protocol-guided case to clarify the learning goals and preview from the questions. In classroom teaching, based on discussion and exchange, teachers organize students to discuss relevant questions. Presenting key questions provides students with a way to discover and solve questions to explore knowledge in the process, cultivate their ability to solve questions and innovative consciousness, and promote students' overall development (Tian, 2017).

## **The Design of the Question in the Protocol-Guided Case**

"Protocol-guided case" is a learning plan and basis prepared by teachers to guide students' autonomous learning and inquiry. From teacher preparation, writing "protocol-guided case" is a creative work, and the key lays in question design. Therefore, to grasp the design requirements according to question design and design valuable, engaging, and creative questions that can stimulate thinking. The key to maximizing the protocol-guided case's benefits is to design the learning content near and break through the key and difficult learning points.

### ***The Basis of Question Design in Protocol-Guided Learning***

The case question design in protocol-guided learning and the questions appearing in classroom teaching are often preset in advance. They are questions that teachers can help and guide students to carry out better learning activities based on their knowledge and understanding of curriculum standards, textbook content, learning conditions, and achievement of goals.

- **Curriculum Standards**

Curriculum standards are the necessary quality requirements in a particular field specified by China at the national level. It is the basis for compiling teaching materials, evaluation, and examination questions.

The protocol-guided case design interprets the curriculum standards and deeply comprehends its requirements and suggestions for teaching to ensure that the goal comes from the curriculum standards. Therefore, a detailed analysis of curriculum standards is a prerequisite for clarifying the protocol-guided case question design's direction and ability requirements (Zan, 2015). Take the structure of curriculum standards as the basis for clarifying the dimensions of subject knowledge.

- **Textbook Content**

Textbooks are necessary teaching materials compiled by experts based on studying curriculum standards. It is the primary learning material and way for students to acquire knowledge. Therefore, the compilation of teaching materials should pay attention to the subject requirements and consider students' development characteristics, including science, representativeness, and universality.

Essentially, the protocol-guided case is a secondary development of the national curriculum (Zhang, 2013). Therefore, in the protocol-guided case, the textbook's content should be taken as the starting point as much as possible during the question design, and the content of the textbook should be analyzed in depth. Should refer to the knowledge points of the textbooks of various subjects, design the best question that cuts into the knowledge and has a reasonable structure.

- **Student's Physical and Mental State**

According to the Swiss psychologist Piaget's four-stage theory of cognitive development, he believes that young people between the ages of 11 and 16 still need to rely on the perception of specific things in their thinking. However, their dependence on specific and perceptible things has weakened, and they can use language to reconstruct them through brain imagination and thinking. For things and solving questions, they can already conclude by deductive reasoning based on concepts and assumptions. Therefore, when designing a protocol-guided case question, it is necessary to grasp middle school students' cognitive development characteristics accurately, and the question designed is appropriate to the students' actual life and stimulates learning motivation. At the same time, we must pay attention to the training of students' abstract thinking. The designed question can mobilize students' abstract thinking and practice.

- **Student’s Learning Status**

The “Zone of Proximal Development (ZPD)” theory proposed by Vygotsky believes that students’ learning should happen in the students’ ZPD. For children in ZPD who need to solve learning tasks, they cannot complete the task independently, but they can do it successfully if they have a partner or teacher to help (Vygotsky, 2010).

Based on Vygotsky’s ZPD theory, the design of the question in the protocol-guided cases should use the student’s ZPD as an intervention space, so that the question formed is within the student’s ZPD and based on the student’s current level. Questions may be challenging for students and may not be solved by themselves, but they would solve them with teachers or other peers’ help. It can be seen that mathematics classroom teaching based on core questions is beneficial to stimulate the development process in the ZPD, which can adapt to and promote the development of students’ thinking.

### ***The Requirements of Question Design in Protocol-Guided Learning***

- **Ask the “True” Question That Stimulates Students to Think**

In teaching, open questions related to real-life background and strong structure can often arouse the desire to explore. In actual teaching, teachers often start from their teaching. The question design is either relatively straightforward or complicated, making some questions conclude without thinking, but some cannot get results after hard thinking. The question cannot make students think it is not the “true” question that we advocate here.

When designing a question, it is necessary to create an open dialogue situation to guide students to “how to think” and make the question inspiring. According to the characteristics of each knowledge point and students’ psychological features, start with questions that students are interested in to be active and open-minded, and can radiate from their knowledge (Peng, 2018).

Let us take the ninth grade physics “digital protocol-guided case” as an example published by the People’s Education Edition. In the third subsection, “Resistance” of Chapter 16, in order to stimulate students’ interest in thinking, the question is first raised in the preview navigation: “Mostly, the wire is made out of copper or aluminum. Iron is also a conductor, and it is both abundant and cheap. Why do we not use iron as the conductor material?”. Use this daily question to trigger students to think about the difference between iron and copper and aluminum and conclude that different conductors have different resistances. This question starts from a familiar life situation, allowing students to think and explore their knowledge to connect textbook knowledge with life to think frankly.

- **Core Questions Should be Raised for Teaching Materials and Student Development**



Teachers should carefully study the syllabus and textbooks before class, dig out the internal connections between various knowledge points, and carefully design questions according to students' actual situation. The questions can focus on teaching goals and closely follow the key to teaching.

### **(i) In-Depth Study of Teaching Materials and Focus on Key Points**

The question's design should be based on the teaching objectives and focus on the problematic points to implement the critical teaching tasks. Focusing on vital and challenging points embodies the teacher's student-oriented thinking and requires teachers to think and design questions from the students' perspective. As for the questions dynamically generated by students in self-study, they must be rationally processed and optimized. These questions may squeeze the limited dialogue time, may also generate redundant information, and interfere with the achievement of teaching goals. This requires teachers to regulate and integrate them into core questions centered on students' inquiry.

### **(ii) Starting from the Students' Perspective**

The question designed by the teacher should suit the age characteristics of the students, and develop its "ZPD" according to their cognitive level. The design of questions encourages students to integrate their own life experience into text interpretation. To allow students to have a real and effective dialogue with the text, it is necessary to shift the perspective of the "question" to the student and become an intermediary between the world of text and life. The question should connect with the students' knowledge background and life experience and belong to the lack of cognition or blankness and guide them to use the experience as the growth point of new knowledge. This requires reforming the question structure to allow students to fully integrate, thus opening up ideas, using their perceptual accumulation as a teaching resource, and constructing independently in the process of integrating and refining text information.

Only by designing questions that conform to the essence of the text can we truly respect the subject in the classroom, guide, experience, organize, communicate, promote and improve, so that the classroom's teaching and learning can show the abundance of life.

- **The Question Must Be Hierarchical**

In Bloom's taxonomy theory, thinking is divided into three levels. Similarly, in the question design should also pay attention to its hierarchy.

First of all, some questions are often lacking in levels and cannot stimulate and guide students to study well. Question design should reflect the hierarchy, easy first and then tricky, pay attention to the gradient, and the question arrangement's logical connection.

Question design should be comfortable first, then intricate, in line with students' actual knowledge and imagination. Questions should start from the shallower to the deeper, asking questions layer by layer, interlocking. As the advanced teacher, Menglong Qian said: "First ask some questions that are easier to understand, so that students can taste the fun of solving the questions, and then gradually increase the difficulty. In this way, the students are like climbing a mountain. After a peak, another peak is in front of them. So the more fun they have in "climbing," the more active the classroom atmosphere" (Cao, 2018). Therefore, when designing the question, attention should be paid to the closed and open coordination, and the convergence and divergence of thinking complement each other. In the sequence of question settings, pay attention to the logical sequence in between.

Take the People's Education Press version of "Digital Protocol-guided Case" Grade 9 Math as an example. When teaching the chapter "Practical Questions and Quadratic Functions (3)," the protocol-guided question design in this chapter ranges from easy to difficult. First, find out the quantitative relationship in the actual question, solve the question using the image and nature of the quadratic function, and combine the two simple parabolic questions in the textbook preview navigation to find the quadratic function relationship actual question. Later, in the classroom interaction, the protocol-guided cases contained two difficult parabolic questions, requiring students to learn to use quadratic functions to solve whether cars can pass through one-way and two-way arch bridges. This allows students to gradually establish function models in arch bridge questions and transform reality into mathematical questions.

- **The Number of Questions Should Be Appropriate**

How many questions are designed for a text that should be based on its level of difficulty? Questions should be carefully designed according to the key and difficult teaching points, the number of questions set should be appropriate, and the course's teaching objectives should be focused. If the question is set too many and too complicated, students will not grasp the essentials and not have a profound grasp of the knowledge points, so the classroom teaching efficiency will not be too high. If there are too few questions, students will not think enough, and course resources may be wasted. Therefore, before teaching, teachers should be familiar with the teaching materials, clarify their ideas, and be very clear about what questions are and how many questions control the classroom and enhance the teaching effect.

Take the seventh-grade Chinese "digital protocol-guided case" as an example. In the protocol-guided case of the subject, four modules are set up in each chapter: "preparatory navigation," "interactive classroom," "picking shells in the ocean of wisdom," and "natural achievements." Three to five questions are set for each module, and the total number of questions is guaranteed to be within the acceptable range of students, avoiding too many and complicated questions to reduce the classroom teaching effect.

- **The Description of the Question Should Be Scientific**

The presentation of the question is inseparable from the expression of language or text. In terms of presentation, the question's description should be simple, clear, and precise, and should not be vague or equivocal.

Questions in class cannot be separated from language, and the accuracy of language is paramount. The so-called accurate language means that the language of the question cannot be ambiguous or make mistakes. At the same time, the language should be concise, not verbose, and repetitive. However, some unsatisfactory questions often appear in classroom questions, which need to be paid attention to and avoided.

This means that the question language must be clear, specific, concise, and clearly expressed; and the question must be meaningful and stimulate students' positive thinking. It is often aimed at essential concepts, theorems, formulas, rules, and ideas and techniques for solving problems from a legal perspective. In terms of content, it should focus on keywords, climactic conditions, and vital variable relationships. Conversely, if the question is not practical, unclear, too simple, or too complicated, it will not achieve the classroom questioning's expected effect. For example, it is not clear enough to ask, "What did we learn in the last class?" It is too simple to ask " $2x = 6$ , how much  $x$  is equal to" and why "double negatives make positives" is too difficult.

## **How to Use the Questions in Protocol-Guided Case for Teaching Practice**

"Questioning" is the most common teaching method of mathematics and the most direct teacher-student bilateral activity. Therefore, how teachers use the questions in the protocol-guided case for teaching practice, and through guidance, let students actively discover questions and solve them in multiple ways is the focus of classroom teaching.

### ***Guide Students to Discover Questions through Independent Learning***

Under the guidance of teachers, students understand the learning requirements and prepare for class. Through the structured learning of knowledge with relevant materials, students will be familiar with the course content and briefly understand and analyze it. From the perspective of personal "learning," the formation includes memorization, understanding, analysis and synthesis, appreciation and evaluation, expression and application, inquiry and derivation, migration, and application, thus generating various levels of "question." This is the "discovery question" of independent learning by students (Xie, 2004).

Based on pre-class learning, students combine the learning goals and requirements of the teacher's guidance to quickly and independently study and think about the new class's knowledge and generate personalized questions that meet the requirements of expression from the problematic and perplexed during the preview process.

### ***Ask Questions for All Students***

Classroom questions should focus on the key and difficult points of knowledge and lead all the teaching content from point to point. The teaching content's overall goal requirements will make it easy for teachers to neglect to set up questions closely related to the content of the teaching materials. Questions should be raised on the essential and challenging points, transitions, and places that arouse students' thinking (Gu, 2017).

Classroom questioning is an essential means for teachers to understand students' learning situation and stimulate their desire for knowledge. Therefore, classroom questions should be oriented to all students, become a platform for information exchange between students and teachers, and not become a "special platform" for a few top students. In actual teaching, the phenomenon of letting the top students "occupy the whole field" and putting students with learning difficulties aside often happens. Over time, students with learning difficulties are bound to be distracted in class.

Therefore, when asking questions, all students should be targeted. First, when designing the question, it is necessary to pay attention to the hierarchy so that students with learning difficulties can follow the teacher's questions and think positively. Second, give priority to students with learning difficulties to answer or play with the board, so that eugenics will never do for questions that they can answer after thinking so that they can also have the opportunity to express themselves and feel the joy of successfully answering. Third, students with learning difficulties should be encouraged to speak boldly and affirm the answers promptly. Do not blame for wrong answers, so as not to discourage their enthusiasm for answering questions.

### ***Guide Students to Solve Questions through Multiple Channels***

Under the teacher's clear teaching guidance, the students take the group as a unit, according to the learning goals and requirements, in the group to carry out cooperative and mutual-aided inquiry learning. Put forward the "question" generated in the process of independent learning, rely on group collaboration and collective wisdom to conduct analysis and discussion, so that the question can be solved as much as possible (Ouyang, 2016).

In this process, the teacher adopts the method of patrolling and raising points to give targeted rather than universal reminders and tips on the organization of each group's learning process, exploring ideas and solutions. In particular, focus on whether the cooperative learning of each group is orderly and effective? Are group members active in participating in assembly learning? Does the "question generation" of each group meet the course objectives and teaching requirements? Are the ideas and methods of "question solution" correct and effective? Each group member's learning status must be reminded in time, and strict requirements and the "guidance" of the group question learning will end at an appropriate time point.

In cooperative inquiry and learning within the group, each group will still have problems solving problems at each node, requiring expanding the scope of assistance and borrowing from within the group to outside the group. The borrowing method can be a clear and complete oral statement, a written statement with a sticker, blackboard

writing, and a physical projection to other groups for help. The group that accepted the request formed a more complete and accurate solution idea, process, and result through the group members' discussion. This can be done through one-to-one assistance or a solution for the whole class.

### ***Pay Attention to the Display and Communication of Results***

Display and communication are indispensable part of classroom teaching. It can allow teachers to understand and control students' actual situation and effectively control the teaching process and teaching methods and stimulate students' desire to explore and encourage students to explore in-depth. The students' mouth, hands, and brain show the results after the question is solved. It aims to achieve the purpose of active thinking, exercise courage, cultivate abilities, and shape personality; let students "move" freely, "speak" freely, actively seek knowledge in a state of zero interference in the classroom, and promote teaching through learning (Jia, 2016).

When the teacher's self-generated questions and the questions preset by the teacher are solved through cooperative inquiry learning, each group can send representatives to briefly display the main learning results of the group through projection, blackboard, written, oral and other forms. This includes teacher preset questions, the group generated questions, and challenging questions from other groups, emphasizing question research and solutions. Teachers must seize the opportunity again, extend learning on time, supplement the context of the question, guide students to expand the depth and breadth of thinking further, strengthen crucial and difficult points so that students' learning achievements can be improved, sublimated, consolidated, and strengthened.

### ***Teachers' Timely Guidance and Evaluation***

Timely guidance and evaluation can promote effective classroom teaching. It is the primary way for students to obtain a proper evaluation, insufficient guidance, learning confidence and praise and encouragement, and strong support for students to construct knowledge, summarize learning experience, summarize question learning methods, and cultivate good learning habits in classroom teaching. Therefore, as the organizer and guide of teaching, teachers' evaluation and guidance are critical (Li, 2012).

This link should run through the entire classroom teaching process. In the process of students discovering and solving questions, communicating and displaying results, teachers provide timely guidance. Teachers guide students through learning, especially in solving questions, adopting guidance, and enlightenment methods. For difficult questions asked by groups for help, they can give hints and guidance on their exploration ideas and solutions, but they must not do all of them. Supplement, improve, or correct the ideas, processes, and results of questions explored by other groups. For the essential and challenging points of this course that each group ignores, we will add certain question situations again to guide the cooperation and exploration between groups.

Simultaneously, teachers should focus on the difficulty, importance of each group question, and matching degree with the preset difficulties. To pay attention to whether the solution results of these difficult questions are correct and complete, and pay attention to the study and solution of the critical and challenging questions in this lesson. The point is that teachers must combine the questions presented in the process of “student-student mutual guidance,” grasp the right time and display the questions preset by the teacher for all students to study in-depth, to grasp the key points, and break-through the difficulties. The purpose is to ensure that all students participate in the activities, encourage students to externalize their thinking process, prompt them to evaluate each other, and achieve the three-dimensional teaching goal.

### ***Focus on Training and Consolidate Results***

The practice is an essential means to feedback students’ learning effects and consolidates classroom learning results. Therefore, classroom teaching emphasizes not only the optimization of the process but also the consolidation of results. By strengthening the training during and after class, students can accelerate the internalization of knowledge, promote the self-construction of their cognitive system, and consolidate classroom teaching results.

On the one hand, habitual training strategies should be adopted. Based on strengthening classroom teaching, it is necessary to guide students to form habitual accumulation and effectively digest their knowledge. The exercises and testing must be given feedback in place; the teacher grasps the real situation, and at the same time, guides the students to learn to reflect on learning.

On the other hand, it is necessary to emphasize training methods centered on real-world applications. In the after-school training, teachers should guide students to actively integrate reality, consolidate knowledge, and form language skills and subject literacy with application value (Chen, 2014).

## **Case Study**

Take the eighth-grade mathematics class “Determination of Congruent Triangle Triangles” in a middle school in Jiangsu Province as an example. This course’s learning goal is to explore and master the congruent conditions of triangles and learn to apply the congruent conditions flexibly to solve related questions. Mastering this lesson’s knowledge is very important for students to understand the real world better and develop spatial concepts and reasoning ability.

Before starting the course, the teacher guides students to use the protocol-guided case corresponding to the grade and subject for self-study. It is required to review congruent triangles’ definitions and properties and understand that two triangles that can completely overlap are congruent. The three sides of a congruent triangle correspond to the same, and the three angles correspond to the same. On this basis, teachers design classroom teaching questions based on the feedback of self-study effects, especially questions that puzzle students during self-study before class, and conduct

classroom teaching around these questions that most students cannot solve. In this process, the teacher asks the students a certain amount of hierarchical questions prepared before class and guides them to guide them to solve the questions in various ways.

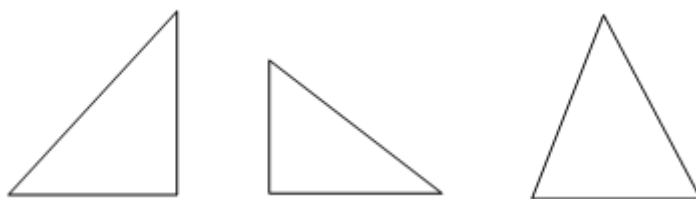
For example, the teacher in the class asks a question about triangles' judgment: Do  $\triangle ABC$  and  $\triangle DEF$  have to satisfy  $AB = DE$ ,  $BC = EF$ ,  $AC = DF$ ,  $\angle A = \angle D$ ,  $\angle B = \angle E$ ,  $\angle C = \angle F$ ? What about these six conditions? If one, two, or three of these six conditions are met, are the two triangles congruent?

- One condition can be divided into a set of equal sides, and a set of angles is equal.
- Two conditions can be divided into two sides are equal, two angles are equal, or a group of sides and a group of angles are equal.

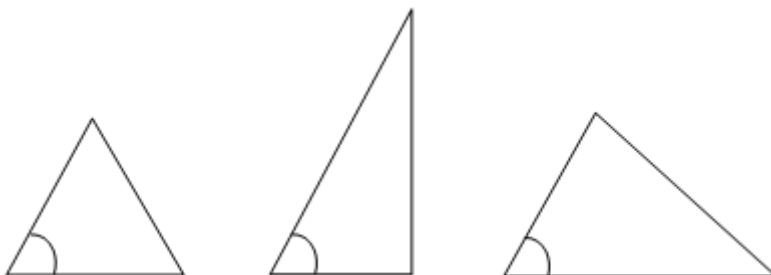
The students discussed according to the question and gave the following studies:

1. Give only one condition (a group of corresponding sides is equal or a group of corresponding angles is equal).

(1) Only one side:



(2) Only one angle:

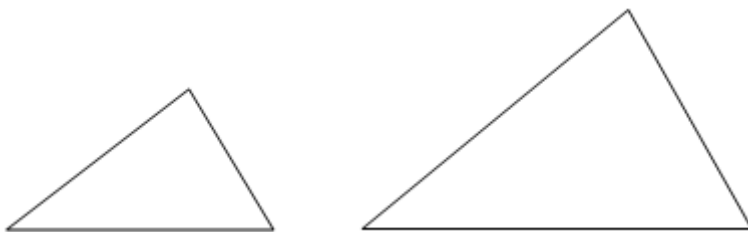


2. Give two conditions.

(1) One side and one inner corner:



(2) Two inner corners:



(3) Two sides:



The teacher immediately asked the third question: If two triangles meet three of these six conditions, can they be guaranteed to be congruent? How many situations are there when three conditions are met?

Under the guidance of the teacher, the students discussed it again. In the end, four conditions must be met for two triangles to be completely equal: (i) three sides are equal; (ii) three angles are equal; (iii) two angles and one side are equal; or (iv) two sides and one angle are equal.

In this process, teachers provide timely guidance and evaluation to help students understand the question, think about it, and solve it.

## **Conclusions**

Teaching the protocol-guided cases is considered the most effective way to cultivate and improve students' ability to solve questions, learn independently, and innovate and practice. The reason is that the protocol-guided cases focus on students' guidance of independent learning methods and combines the setting of ladder questions to explore essential and challenging points. All are designed to make students think with questions, clarify goals, focus on critical points, and stimulate students' learning motivation through the drive of protocol-guided cases. Step-by-step questions can guide students to open up thinking channels in related questions.

This process embodies the guidance of protocol-guided cases, the autonomy of learning, the cooperation of groups, and students' display. Simultaneously, the design and guidance of the question are different according to the subject and content. Several links can be integrated at the same time, which can be divided into independent classes, demonstration classes, feedback classes, training classes, and comprehensive classes; it can also be based on one of them so that the question can be solved to ensure that the learning and teaching goals are successfully achieved.

Meanwhile, in the process of protocol-guided case teaching with questions, the teacher's question design and classroom organization ability occupy a pivotal position.



A study pointed out that in the guidance of questions, if the teacher designs questions in a class: too much too low cognitive level, too random, and purposeless, then such questions is not suitable for teaching (Zhu, 2009).

Besides, students' learning ability is also an essential factor influencing the effectiveness of classroom teaching. In the question guidance, if students do not learn independently and do not cooperate, this will cause the entire teaching to be ineffective or inefficient. Therefore, in-classroom guidance based on the question, we must strengthen students' independent learning and cooperation ability. Only when students acquire a certain degree of autonomous learning ability can the entire teaching process be made more fluent and effective.

The protocol-guided question's primary purpose is to master relevant concepts and knowledge flexibly and cultivate further students' ability to understand, analyze and solve questions, obtain experience in solving real questions, and finally form the consciousness and ability of independent learning. Therefore, question teaching based on the protocol-guided case is the primary practical means to realize school innovation and student development. However, no matter in the design and application of the question, it is necessary to pay attention to localization to avoid formalization and inefficiency caused by inconsistent with the existing foundation of students and teachers.

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