

# Schema, Zone of Proximal Development, and Scaffolding in Real-classroom Settings and Inspired Improvements in Chinese Middle Schools' Classrooms

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**Abstract:** Schools in China are rapidly changing and enhancing their education models in accordance with Double Reduction policies, which urged schools to enhance the quality of classes and homework and reduce the burden on students. Designing courses according to core theories in education and developmental psychology is one of the most effective strategies, and classroom observations may inspire teachers in other nations. In preparation for the case study, this study examines three theories: schema, Zone of Proximal Development, and scaffolding. Based on the case study, the research concludes with the precise approaches to applying such ideas and offers insightful recommendations for prospective changes in Chinese middle schools. It is suggested that Chinese middle schools should attempt to introduce homework assignments online and develop more classroom activities, both of which reduce the load of excessive homework and pursue the nature of education.

**Keywords:** Schema, Zone of Proximal Development, Scaffolding, Real-classroom Settings, Improvements in Chinese Schools

## 1. Introduction

In the framework of “Double Reduction” and the new national curriculum standards, the Chinese educational system is undergoing a brand-new phase of reform. As an important component of compulsory education, junior high schools typically offer grades 7 through 9 and facilitate the transition to high school academics. They have been investigating various approaches to present their students with more effective lessons. In numerous sessions of discussion and research for class design, it is usual for teachers to express their understanding of how education theories can be applied in lectures and their ideas for enhancing their courses based on observations. Consequently, this study follows a similar structure as class design research, investigating the application of developmental psychology theories in real-world contexts.

This study consists of three main sections: a theory review, a case study, and inspired proposals for prospective classroom improvements in Chinese junior high schools, followed by a summary of the study's key concepts. In the review of theory, the research examines Schema, Zone of Proximal Development, and Scaffolding and develops the connections between these concepts in the context of junior high school classrooms. A fifteen-hour observation at Maplewood Middle School in Menasha, Wisconsin, United States, is described in the case study part. By comparing the class settings of Chinese and American schools, the report offers potential improvements in Chinese classrooms based on the theory critique and case study.

## 2. Theory Review

### 2.1. Theories of Schema

The cognitive schema theory of Jean Piaget incorporates adaptation and equilibration, explaining the reasons and strategies for children to absorb and comprehend new information adequately<sup>[1]</sup>. Children's learning technique is an adaptation, which consists of two complementing steps: assimilation and accommodation. The former relates to learning by connecting new knowledge to previously held views,

whereas the latter successfully modifies existing interpretations to avoid misunderstandings. In the interim, equilibration is the learning motivation for the shift from assimilation to accommodation. When youngsters become aware of the mismatch between their perception of the information and the actual situation, they may sense imbalance or disequilibrium and strive to revise and modify.

Assimilation, equilibration, and accommodation are supposed to occur in the specified order in classrooms. When students enter schools, they typically possess developed frameworks of knowledge (schema) that have assisted them in learning previously acquired information. Typically, to effectively perceive, comprehend, and memorize new concepts, children demonstrate assimilation and rely on prior schemas. Due to the imbalance that they experience while internalizing new ideas with old schemas, equilibration pushes them to modify the schemas when they feel uncomfortable or improper. Therefore, students are likely to modify their schemas to accommodate the emergence of new theories.

## ***2.2. Theories of Zone of Proximal Development***

One of the cognitive theoretical traditions, Vygotsky's sociocultural theory, emphasizes the influence of social and cultural elements on children's development<sup>[1]</sup>. Vygotsky once observed, "We become ourselves via others." In general, children are never separated for personal development; rather, they form their ideals and worldviews through interactions. They may develop passively by listening to parents or teachers and imitating the conduct of older peers, or actively by receiving feedback or remarks (e.g., encouragement and criticism). This active growth is related to operant conditioning, as children are more likely to interpret ideas applauded as wonderful or suitable than those reprimanded as damaging or inappropriate.

To comprehend Vygotskian ideas, one must comprehend the Zone of Proximal Development. The theory has been the subject of the most investigation, citations, and criticism among Vygotskian concepts<sup>[2][3]</sup>. In his discussions on the relationship between learning and development, Vygotsky provides the most explicit definition of the ZPD, arguing that it is "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined by problem solving under guidance or in collaboration with more capable peers"<sup>[4]</sup>. The Zone of Proximal Development defines the learning potential of the kids. The ZPD, according to Child, is a hypothetical space between children's current abilities and anticipated future accomplishments, hence projecting children's possible learning outcomes<sup>[1]</sup>. In other words, once children cross the ZPD, they have indisputably mastered something new and advanced to a significantly higher level of skills or knowledge.

## ***2.3. Theories of Scaffolding***

The history of scaffolding metaphors is extensive. The authors of Shvarts & Bakker summarize the early history and evolution of the notion of scaffolding effectively. Hegel first used the term in 1812 when it referred to transitory buildings. It eventually developed the idea of temporary assistance from external tools, which Bernstein first mentioned<sup>[5]</sup>. Before Bernstein's theories, Vygotsky also used the term scaffolding to describe a temporary structure approximated a future building<sup>[6]</sup>.

Wood, Bruner, and Ross introduced the oldest modern metaphor of scaffolding, citing Bernstein's theories as to inspiration. There are six scaffolding roles, according to Wood et al., including recruitment, decrease in degrees of freedom, direction maintenance, marking essential characteristics, frustration control, and demonstration<sup>[7]</sup>. They represent the various roles of the individuals who provide scaffolding, such as claiming the learning objective, keeping the children focused on the mission, simplifying the task, correcting the incorrect factors in the children's trials, and most likely demonstrating the correct operations for the learners. Therefore, scaffolding in developmental psychology has a broader meaning than the teaching and learning aid process. There are primarily teacher scaffolding and peer scaffolding in classrooms, where students acquire new knowledge as instructors aid with the entire process, from hearing about new concepts to mastering them, and peers play comparable roles in the learning process.

## ***2.4. Connections of the Theories***

The Zone of Proximal Development is the fundamental link between the three theories, with the schema and scaffolding serving as methods for learners and those around them to aid children in crossing the ZPD, respectively. Typically, scaffolding, particularly teacher scaffolding, facilitates the process of accommodation.

#### **2.4.1. Schema and ZPD**

The schema theory of Jean Piaget focuses primarily on assimilation and accommodation, which enable learners to cross the ZPD by utilizing and modifying knowledge frameworks.

**Assimilation and ZPD.** Assimilation entails integrating new concepts into the existing schema. In such instances, the starting end of the particular ZPD is typically the framework itself, while the additional points are located at the zone's ending end. The capability of the existing schema to make connections enables the learners to construct a bridge between the two ends of the specific ZPD, traverse the zone, and finish their goal in particular new places.

**Accommodation and ZPD.** Accommodation is the enticing modification of previous memorization frameworks. In such situations, both ends of the ZPDs are comparable to those in Assimilation and ZPD but constructing the "bridges" takes additional stages and deliberation. Students will likely find it impossible to directly internalize the concepts, necessitating an update to their knowledge framework to memorize them. When conventional approaches are inapplicable, the procedure is similar to utilizing novel materials and designs to build bridges.

#### **2.4.2. Scaffolding and ZPD**

In classroom settings, scaffolding is typically utilized in conjunction with the ZPD. The last function demonstration or modeling in the study results of Wood et al. is strongly related to the notion of ZPD since youngsters are prone to replicate sample solutions<sup>[5][7]</sup>. Regarding instructor scaffolding, instructors typically show the phases of theoretical applications with example questions, urge students to carefully follow comparable steps, and progressively enhance students' level of independence in practice. In other words, learners typically imitate the exhibited processes to apply new theories and concepts in practice, which is important for learners to build bridges between the ends of the ZPD. Peer scaffolding functions similarly that learners can copy the strategies of more knowledgeable peers as solutions to specific questions and internalize the entire process.

#### **2.4.3. Scaffolding and Schema**

Assimilation and accommodation are likely tough for learners. However, scaffolding offers them external forces to aid them through these processes. To utilize assimilation, learners must recognize and communicate the parallels between new concepts and current schema, i.e., conceptually and practically comprehend how and why the points are connected. Even while equilibration may increase the effectiveness of accommodation, it is still required for students to identify the current framework's flaws, comprehend their detrimental effects on the conceptualization of new ideas, and seek appropriate schema-adjustment strategies. Failure to meet any of the aforementioned requirements may result in denying an application for assimilation or accommodation. Fortunately, scaffolding provides external guidance to tackle such issues by examining the current knowledge framework and incoming information from the perspective of more knowledgeable individuals. During lectures, instructors typically link the learning objectives to prior information or compare what has been learned to what is new to scaffold the students' learning. Similar to adult scaffolding, peer scaffolding offers the perspectives of like-aged persons, who may be easier for children to comprehend. Both methods are associated with identifying essential aspects to "give information about the gap between what the child has created and what the tutor would recognize as correct"<sup>[7]</sup>.

### **3. Case Study**

#### **3.1. Introduction of the Observation Setting**

The observation occurred in Grade Seven Math classes and English Language Arts classes at Maplewood Middle School, a part of the Menasha Joint School District. Twenty-three students in the class are separated into groups of three or four and are furnished with calculators, textbooks, and pencil sharpeners. One of the class's unique features is the duo-teacher model, with one serving as the principal lecturer, introducing new concepts and calculations, and the other, as the specialized teacher for the disabled students, primarily responsible for sharing the mission of checking the students' work to ensure equal and sufficient access to the teachers' guidance of the students. According to the principal, this framework is utilized in every Math and ELA class.

### 3.2. Observation Contents and Application of Theories

The following analysis primarily focuses on a twelve-year-old boy who sits in the center of the classroom and analyzes his behaviors, his peer interactions within the group and between the groups, and his communications by utilizing the theories of schema and scaffolding in the context of Zone of Proximal Development.

#### 3.2.1. Schema and Cognitive Structures of Fractions

During the observation, children's cognitive structures for fractions, particularly improper fractions, must have gone through the following adaptation and equilibration processes.

**Assimilation.** When children first encountered the concept of fractions, they were assisted by the idea of integers. For instance, if the teacher slices 1 apple into 4 pieces and Adam takes one piece, Adam will have one of four pieces, which is  $1/4$ ; if there are 2 apples cut into 4 pieces each and Adam takes 2 pieces, he will have two out of eight pieces, written as  $2/8$  (students can simplify the fraction to  $1/4$  with following concepts of calculation). As a result, they can conceptualize fractions as a specific component of a whole. This move from integers to fractions is all about assimilation, as students make connections between new concepts (part of a unity, about fractions) and existing conceptions (to divide something into several parts and select some, about integers).

**Equilibration.** When students first encountered the notion of improper fractions, students felt strange and struggled to grasp it. What, for example, does  $5/4$  denote? "Take five apple pieces out of four pieces!" the youngster for observation stated, imitating the images above. However, he quickly encountered reservations and inquiries, such as "Where is the fifth piece? There are only four of them!" He, too, began to feel odd. This interrogation or the conflict between their current interpretation of fractions and the actual concept is about equilibration, and it prompted students to pay attention throughout the subsequent lectures. The teacher acknowledged the class's perplexity and began to explain with new examples.

**Accommodation.** When students were confronted with "the fifth piece of apple," students started to employ additional examples, including purchasing eggs besides cutting apples. After the students' interrogation, the teacher first reminded them of the egg case: if Cathy buys 1 kilo of egg and then buys 1 bag out of the 4 bags (the four bags are one kilo in total), she will have  $1\frac{1}{4}$  kilos of the egg. Since they have learned about mixed fractions, students have been able to convert  $1\frac{1}{4}$  to  $5/4$ . The teacher then asked how many  $1/4$  kilo there were in kilo. "Multiplication!  $5 \times 1/4$ !" The observed child shouted, and his response was deemed acceptable and rewarded. The students had successfully resolved their confusion over the fifth piece of apple and altered their concept of fractions such that  $a/b$  means there are  $a$  numbers of items, among which each item is equivalent to 1 thing divided into  $b$  parts, or  $1/b$  item. It is worth noting that students' reliance on mixed fractions and their understanding of multiplication are also assimilations.

#### 3.2.2. Scaffolding and Class Activities

**Instructor Scaffolding.** The instructor scaffolding is seen in the way students advance with the support of their teachers. During the Math lessons, the class, including the target child, learned how to compare and calculate fractions. The instructors first assessed the students' grasp of the general concept. Following that, teachers utilized an example question to explain and demonstrate each of the mentioned steps, and in the subsequent exercise session, students attempted to increase the number of steps they completed independently. Finally, they completed a quiz to assess their knowledge of the topics. With instructor scaffolding, students gradually advanced through the ZPD of fractions and eventually acquired the associated abilities. In the ELA lectures on making arguments, the teachers also carefully explained the characteristics of arguments, which are the functions of recruitment, direction maintenance, and partial frustration control (Wood et al., 1976; Shvarts & Bakker, 2019), demonstrated the process to compose an argument paragraph, required the students to write their paragraphs, and provided them with feedback. Instructor scaffolding enables students to pass their Zone of Proximal Development by giving them guidance and allowing them to write their reasons.

**Peer Scaffolding.** It is typical to see peer scaffolding in group conversations. In the fraction portion, the observed child compared his computation method with that of one girl in his group. He and his peer were calculating  $3 \times (5/6 + 3/4)$ , and they utilized "distribution, multiplication, and addition" and "addition and multiplication" techniques, respectively. Their discussion focused on how their respective methods performed during the computation and what they needed to pay attention to prevent errors. He described the procedure for obtaining  $3 \times 5/6 + 3 \times 3/4$  and emphasized the significance of utilizing

the simplified result  $5/2$  of  $3 \times 5/6$  rather than  $15/6$  for the following steps, while the girl demonstrated how to convert the fractions to those with the same denominator for calculation. These peer displays directed and bolstered their fractional skills, assisting them in crossing their ZPD. Group conversations in ELA classes revealed peer scaffolding since students were compelled to share their takeaways and methods of reading the texts. As a result, students are able to watch, mimic, and absorb more comprehensive strategies.

#### 4. Potential Improvements in Chinese Classrooms

In the context of the Double Reduction policy, schools should return to the center and minimize the excessive amount of homework assigned to students. Some aspects of American middle schools are helpful for Chinese middle schools to replicate and adapt to local situations. Recent research has also found that policies demand schools to pursue adequate teaching of “A with B” rather than “A for B” and to promote the growth of students’ skills in non-academic domains<sup>[8][9]</sup>. This study indicates that Chinese middle schools are attempting to use online platforms for homework and enhance the number of classroom activities.

##### 4.1. Online Homework

The most time-efficient solution is to use online homework help services. It is common practice for students attending schools in the United States to upload their written assignments to specific online platforms or to carry out the corresponding exercises there. According to the principal of Maplewood and the teachers who teach the practical classes, even though computers or tablets may be a distraction for students during classes, for which they are typically banned after the bell rings, the devices and online platforms are more accommodating for students with physical disabilities because they can use voice inputs instead of typing to compose their essays. In other words, the devices and online platforms are more accessible to students with physical disabilities.

Moreover, internet platforms offer a more comfortable method of doing assignments for both teachers and pupils. Teachers will have less responsibility for correcting responses, particularly for multiple-choice and fixed-answer questions, and will only need to manually evaluate free-response questions. With the additional time saved, teachers are able to boost their working efficiency and may use this time to develop homework assignments and their lessons. The reduced homework load in the Guideline is not merely the result of reducing the number of questions from 100 to 10 but also of picking a valuable group of questions that cover all the lecture-illustrated concepts. It also gives time for revision, which is believed to increase pupils’ learning efficiency. Saving time from grading homework means that such a careful selection of practices does not increase instructors’ workload, which is required to maintain the positive cycle of properly prepared homework. Instead of physically copying the questions or bringing a large number of practice books for review, students can easily collect questions with incorrect answers and review them before exams. This saves them time compared to manually copying the questions or carrying a large number of exercise books.

##### 4.2. Class Activities

Activities encourage student participation in class. According to Freire’s book, basic education should be “A plus B.” The students are the key figures in their studies, while the teachers serve as companions and assistants with greater experience<sup>[8]</sup>. Therefore, Chinese school pupils should be more engaged in the classroom. Activities, ranging from group discussions to various sorts of presentations, require students to communicate their understandings and expertise, necessitating greater student participation in comprehending new concepts, formulating their views, and communicating them to instructors and peers. Active participation is significantly more effective than passive listening and note-taking in terms of learning efficiency.

Class activities aid in the reduction of excessive homework loads. Initially, homework is intended to provide additional opportunities for pupils to practice their academic skills, particularly the most substantial component of the burden, the exercise sets. Since the primary educational objective of the majority of Chinese middle schools is the Zhongkao, the High School Entrance Examination, homework has been the most important, if not the sole, training tool for many institutions. However, class activities also provide students with numerous opportunities to apply their academic knowledge and abilities. In presentations and conversations, for instance, students can practice the new words and sentences they

have learned and grasp the new points through such repetitive application. They may serve a similar or even greater function than homework, allowing kids to attain the same level of academic skills with less homework.

## 5. Summary

The education system in China, including middle schools, is undergoing rapid reform and is experimenting with new models as part of the Double Reduction initiative. This initiative requires schools to return to the central role of education, improve the quality of classes, and reduce the amount of excessive homework. In this study, three different theories are analyzed, then applied to an observational case study, and finally, suggestions are derived from both the analysis and the case study.

The theories include Jean Piaget's theories of schema, Lev Vygotsky's concept of Zone of Proximal Development, and the modern metaphor of scaffolding, which first appeared in the studies of Wood et al. According to Jean Piaget's theories of schema, students assimilate new concepts with existing knowledge frameworks and adapt the schemas to master the new ideas due to equilibration. This cognitive development paradigm focuses its attention on the zone of proximal development (ZPD) because schema and scaffolding are both methods that assist individuals in traversing their ZPDs and realizing their full potential as learners. The behavior of the students in the case study throughout the lectures on incorrect fractions and reading comprehension illustrates that these theories are applicable in actual classrooms.

On the basis of this investigation and case study, it has been suggested that middle schools in China should make an effort to post homework assignments online and design more activities to be carried out in the classroom. Both of these measures will assist in lowering the amount of excessive homework and advancing the educational mission of the schools.

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