How Could Cultural-Historical Activity Theory Inspire Lesson Study?

Ge Wei

Contents

Abstract Lesson study, originating from East Asia, has been widely spread and accepted as a vehicle for teacher continuing professional development. With its features of openness (beginning with a question instead of an answer), involvement (driven by teachers rather than experts), dialogicality (reciprocal learning instead of hierarchical interpersonal relationships), and practicality (linking research and practice), lesson study contributes new energy to educational research. Finding an appropriate theoretical perspective to approach lesson study and glean its advantages is challenging. When cultural-historical activity theory is used to contextualize lesson study, numerous insights are gained by both teachers and researchers. This conceptual chapter introduces the use of cultural-historical activity theory as an analytical lens, followed by a brief overview of the commonalities of various modes of lesson study. Some central tenets of cultural-historical activity theory that echo the essential points of lesson study are elaborated. By collecting data for and analyzing a lesson study case involving an elementary mathematics lesson in Beijing, the author shows that cultural-historical activity theory illuminates the significance of lesson study at the ontological, epistemological, methodological, and axiological levels.

Keywords Lesson study · Cultural-historical activity theory (CHAT) · Teacher professional development

G. Wei (✉)
College of Elementary Education, Capital Normal University, Beijing, China
e-mail: ge.wei@cnu.edu.cn

R. Huang et al. (eds.), *Theory and Practice of Lesson Study in Mathematics*,
Advances in Mathematics Education, https://doi.org/10.1007/978-3-030-04031-4_3

1 Introduction

Over the past few years, the high performance of East Asian students in international academic assessments, such as the Program for International Student Assessment (PISA) and the Trends in International Math and Science Study (TIMSS), has attracted increasingly wide attention from the Western world. Another global program, the Teaching and Learning International Survey (TALIS), aims to explore how teacher knowledge base impacts student learning outcomes, especially from an international perspective comparing the East and the West (OECD 2017). The sustainable growth of East Asian education is a "learning myth" (Stigler and Hiebert 1999) for educators: what contributes to East Asia's educational success (see also, e.g., Zhao 2014)?

In East Asian societies, especially the Chinese, the teachers' knowledge and competence affect the students' learning achievement more directly than some peripheral factors of teaching and learning activity, such as cultural and institutional factors (Ma 1999). In the process of improving teacher quality, lesson study in China plays an important role in incorporating professional development activities into the teachers' daily tasks. According to Lewis (2009), lesson study challenges the traditional ways of teacher professional development, most of which inform teachers on what to do in a designated manner. However, lesson study activities allow teachers to learn how to teach through collaborative inquiry into the methods of analyzing, designing, developing, implementing, and evaluating a lesson while focusing on student learning (Hart et al. 2011).

Given its essential merits, lesson study as a form of teacher development has been adopted by many schools and districts around the world (Huang and Shimizu 2016). Various perspectives have been employed to interpret the advantages of lesson study for teacher professional learning and development in school-based settings. For example, Pang and Marton (2005, 2013, 2017) adopted "variation theory" to reframe teachers' and researchers' insight, transforming lesson study into learning study; they focused more on students' learning activities instead of teachers' actions. Chen and Yang (2013) used Little's (2003) idea of "decontextualization and recontextualization" to approach teachers' meaning making of curriculum policies and their local actions in school-based lesson study activities. More recently, Fang (2017) employed Lave and Wenger's (1991) conceptualizations of "legitimate peripheral participation" and "transparency" to discern novice teachers' professional learning in teacher research groups, under the discursive circumstances of district curriculum reform. Huang et al. (2016) applied theories of "learning trajectory" and "variation pedagogy" to guide lesson study activities, through which both the teachers' teaching and the students' mathematical understanding were improved as a result. Despite previous inquiry into the subject of lesson study, few scholars have paid intensive attention to cultural-historical activity theory (hereafter CHAT; Engeström 1987/2015) as a robust theoretical underpinning for lesson study.

CHAT, originally inspired by Hegel's dialectics and Marx's historical materialism, effectively integrates various elements in human activities (e.g., subjects, tools,

objects, rules, community, division of labor, and outcomes) in a systemic and interacting manner (Wei 2017b). CHAT is a cross-disciplinary theory for understanding human activity and human development in collaborative settings, incorporating the social and historical roots of a specific event into a collaborative inquiry process. Considering lesson study as a collaborative human activity conducted by a group of teachers focusing on student learning and certain subject matters, CHAT could bring about opportunities for researchers and teachers to address the complexity of and dynamics within the holistic process of lesson study. Specially, CHAT is useful for discerning the what and the how of teacher professional learning and development in lesson study activities, which are currently one of the most challenging issues in the research fields of both lesson study and teacher education.

This chapter thus aims to bridge the theoretical perspective of CHAT with lesson study as a practical mode for teacher continuing professional development. The overarching question of this chapter, reflected in the title, is "How could cultural-historical activity theory (CHAT) inspire lesson study?". In order to answer this question, this conceptual chapter first reviews the commonalities and essential characteristics of different modes of lesson study worldwide. Then, CHAT, with its three generations of evolvement, is scrutinized, with the results depicted in representative figures. The central tenets and most innovative conceptualizations in CHAT are discussed. It is argued that the merits of lesson study could be better utilized by incorporating CHAT (e.g., Mosvold and Bjuland 2011; Wake et al. 2016; Wei 2017b). Finally, the author's audio recording of a series of lesson study activities in a mathematics teacher group in an elementary school in Beijing in 2013 is described. This case study demonstrates that CHAT helps to illuminate the broader and deeper significance of the uses of lesson study.

2 Reviewing the Commonalities of Various Lesson Study Modes

"Lesson study" is a translation of the Japanese term "*jugyou kenkyuu*." *Jugyou* means "live instruction" (e.g., a single lesson or many lessons); *kenkyuu* means "research" or "study" (Lewis 2016). Lesson study is a form of practice-based teacher professional development that originated from East Asia; it has been widely adopted around the world due to its benefits for continuing teacher professional learning. The Japanese lesson study has been adapted into different modes mainly in China, the United Kingdom, Hong Kong, and Sweden (Huang and Shimizu 2016).

According to the literature, the essential characteristics of lesson study include being focused on the knowledge of the subject matter, the curriculum, and student learning; being ongoing, inquiry-based, and integrated into the daily tasks of teachers; providing opportunities for teachers to become actively engaged in the meaningful analysis of teaching and learning; and promoting coherence between

teachers' professional development and other professional experiences (e.g., Fernandez 2002; Lee and Lo 2013; Lewis 2015, 2016; Murata et al. 2012).

According to Lewis (2002) and Lewis and Hurd (2011), lesson study does not refer to a single practice but a series of practices of teaching experimentation and reflection. With regard to the Chinese models of lesson study, three featured types have been distinguished: (1) public lessons, with their different types conducted by teachers at different stages of their professional development; (2) deliberate practice of teaching the same lesson repeatedly in order to refine its execution; and (3) institutionalized apprenticeship during which novice teachers learn from the "excellent" exemplars of expert teachers (Chen 2017).

Regardless of the location, be it Japan, China, the United Kingdom, or the United States, lesson study has been practiced for decades and has contributed a great deal to the improvement of teacher professionality (e.g., Chen 2017; Huang and Shimizu 2016; Lewis 2015). As a common method of implementing teachers' school-based professional development, lesson study is embedded into the teachers' daily tasks in an integrated way. Lewis (2002, 2015) compared the traditional teacher professional development model with lesson study as the new approach. She argued that lesson study enables openness (beginning with a question instead of an answer), involvement (driven by teachers rather than experts), dialogicality (reciprocal learning instead of hierarchical interpersonal relationships), and practicality (linking research and practice). This leads to an urgent question of how the merits of lesson study may be employed by using an appropriate theoretical lens.

The purpose of this chapter is to review and introduce CHAT and its central tenets to researchers and practitioners who are interested in lesson study. In fact, CHAT is a theoretical perspective within the field of psychology that originated from Lev Seminovich Vygotsky's work in the pre-Soviet era during the 1920s. Since Vygotsky's work, there have been a growing number of European and North American scholars examining the usefulness of CHAT for educational activities (Yamagata-Lynch 2010, p. vii). Some educational researchers (e.g., Mosvold and Bjuland 2011; Tsui and Law 2007; Wake et al. 2016) have incorporated the well-known triangle model of CHAT (see Fig. 1) into their projects and subsequently divided the model into seven elements (i.e., subject, object, artifacts, community, rules, division of labor, and outcomes) using their collected data. Despite the previous literature on this topic, little attention has been paid to the underpinnings and hidden tenets of CHAT, which constrains our deeper understanding of the inner mechanisms of human development.

The following part of this chapter first reviews the historical development of CHAT through its three generations of evolvement. Then, the four central tenets of CHAT, according to the latest interpretations of Yrjö Engeström (2015), a Finnish interventionist researcher, are illustrated theoretically.

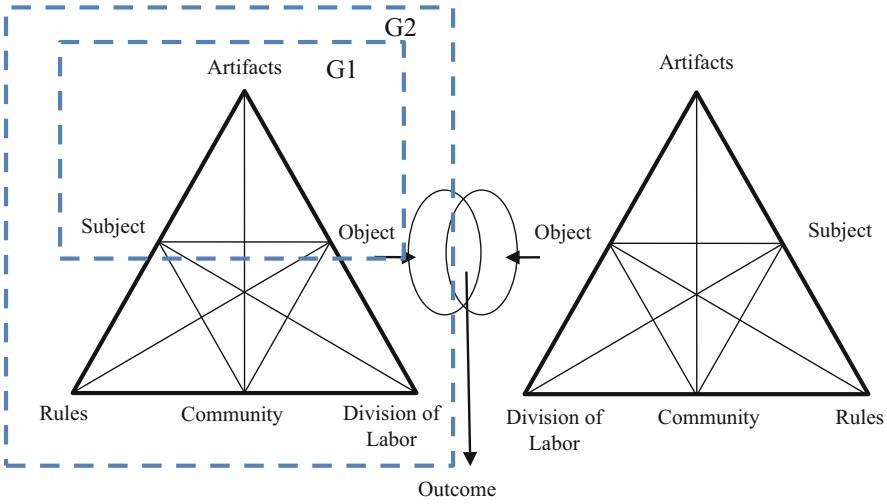

Fig. 1 The theoretical model of CHAT. (Revised from Engeström and Sannino 2010)

3 Scrutinizing Cultural-Historical Activity Theory

According to Engeström (1996), activity theory has evolved through three generations of research. In this section, I focus on the contributions of Vygotsky and the post-Vygotskian scholars who played critical roles in the development of CHAT, using the keywords created by different pioneers as a guide (Engeström 2001).

3.1 Vygotsky and the Mediated Mechanism

Tracing back to Hegel and Marx's philosophical thoughts on dialectics and historical materialism, Vygotsky challenged behaviorism and constructed a social constructivist model of thought to interpret human learning and development (Wei 2017a). As the positivistic paradigm of the social sciences (especially developmental psychology) established in the European continent did not satisfy his inquiry, Vygotsky proposed a new epistemology and methodology to study human development, called the cultural-historical theory (CHT). Different from Pavlov, who developed "stimulation-reflection," Vygotsky introduced *mediation* as a constellation of tools and signs to bridge the subject and the object, which opened a new space for subject-

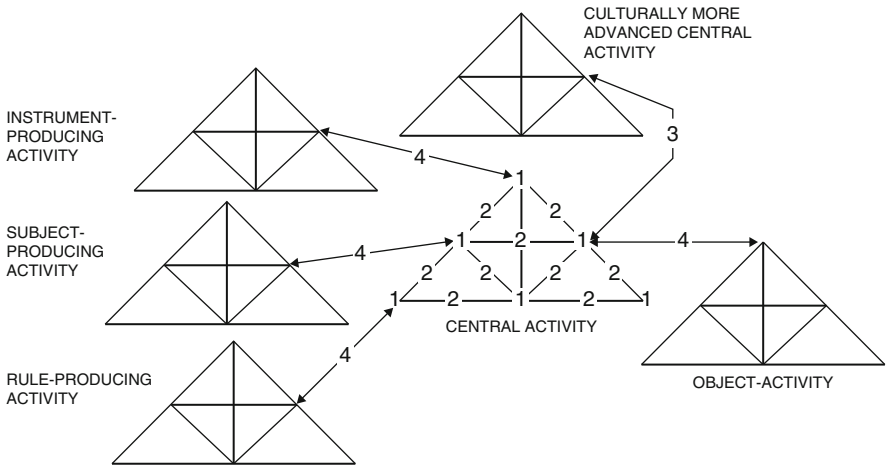

Fig. 2 Four levels of contradictions in human activity. (Engeström 1987/2015)

object relationships (see G1 in the dashed box, the uppermost sub-triangle in Fig. 2). Vygotsky based his psychology on Marxian theory to describe the relationship between individuals and their social environment (Cole 1985; Wertsch 1985). Moreover, he used Marx's political theory regarding collective exchanges and material production to examine the organism and the environment as an organic unit of analysis. Through this reformulation of psychology, Vygotsky attempted to capture the coevolutionary process that individuals encounter in their environment while learning to engage in shared activities (Stetsenko 2005).

Vygotsky further introduced *mediated action* as a concept to explain the relation between thinking and speech that enables human consciousness development through interaction with artifacts and knowledgeable others in a certain environment (Vygotsky 1978). The interactions in which individuals engage allow opportunities for mediated action that contributes to the social formation of their consciousness (Wertsch 1985). In this interaction, individuals are not passive participants waiting for the environment to instigate meaning-making processes for them; rather, through their interactions, individuals make meaning of the world while they modify and create activities that trigger the transformations of artifacts and people in their environment (Scribner 1997).

3.2 Leontiev and the Object-Directed Activity

Contributing to the development of activity theory, Leontiev, a Russian psychologist, identified object-oriented activity, instead of the goal-oriented action, as the unit of analysis. Leontiev (1978, p. 10) defined object-oriented activity as:

> A molar and non-additive unit of a material subject's life. In a narrower and more psychological sense, activity is a unit of life mediated by mental reflection whose real function is to orient the subject to the world of objects. Activity is thus not a reaction or a totality of reactions, but rather a system possessing structure, inner transformations, conversations, and development.

Leontiev provided a clear distinction between object-oriented activity and goal-directed actions. Goal-directed actions are much more temporary in nature and may be a step that subjects take in the process of participating in an object-oriented activity. Goal-directed actions are often individually focused and involve fewer collective endeavors of community improvement (Leontiev 1978). In other words, the object is shared with individuals in a community of practice, with rules and the division of labor (see G2 in the dashed box, the left-side triangle in Fig. 1). Leontiev was the scholar who depicted the fundamental elements of human activity in a systematic way.

3.3 Engeström and the Inter-system Analysis

Based on the scholarship of Marxism and the Vygotskian School, Engeström (1987) challenged traditional theories that considered learning as a process of acquisition or a restructuring of cognition within the individual mind. In contrast, Engeström held a collective and dialectical view of learning and human development based on his work at the University of Helsinki during the past decades (Wei 2017a).

Upon observing the dominant Cartesian views of learning and development, Engeström questioned the legitimacy of cognition abstracted from its contexts. Engeström (1987/2015) further developed analytical methods beyond the single activity system analysis. The third and current generation of activity theory aims to understand dialogues, multiple perspectives, and networks of interacting activity systems. It extends the single activity system into inter-system analysis, considering the complexity and dynamics of human activities (see the whole image in Fig. 1). It specifically addresses both the individual and the sociocultural contexts of the activity in order to move away from former CHAT methods that were too individual focused.

The third generation of CHAT argues that human learning is embedded in object-oriented and artifact-mediated collective activity systems, historically triggered by inner contradictions (Engeström 2015, p. xvi). Under this rationality, Engeström proved that a new type of "learning by expanding" always exists in human history, which implies the existence of potential objects, conscious mastery, and transformative agency (Wei 2017a). Expansive learning takes place in the interaction between two or more activity systems, which is a historically new type of learning moving across collective zones of proximal development, where understanding and changing the world are integrated (Wei 2017b).

Briefly, according to Engeström's (1996, 2001) summary, the three generations of activity theory encompass distinct approaches to understanding human

development. Vygotsky's identification of the mediated action triangle refers to the activity theory of the first generation. Second-generation activity theory is attributed to Leontiev's work that emphasized the collective nature of human activity, along with Engeström's own work in 1987 that developed the activity systems model. Finally, based on Engeström's later works, the third generation of activity theory involves explorations of multiple system interactions in developmental research where the investigator often takes a participatory and interventionist role in the participants' activity to help participants experience change.

CHAT helps us to understand educational activities in a systemic way, by analyzing the elements within and between different activity systems (Yamagata-Lynch 2010). In a school context, for example, a mathematics teacher (*subject 1*) would like to improve his/her students' (*subject 2*) academic performance (*object 1*) within an urban school (*community*). He/she intends to introduce a new strategy for teaching (*tool*). Depending on the management structure within the school (*division of labor*), the teacher might be constrained on the basis that the new idea is being interpreted as deviating from implicit norms (*rules*). If so, the teacher would need to negotiate with his/her students about how to employ this new pedagogical method in their teaching and learning activities (*outcome*). This is a simple example of using CHAT as a lens to analyze the day-to-day work of teachers. The use of this theory finds that almost all perceived factors of teachers' work are included and that some interesting issues (e.g., the school's micropolitics) emerge within this context. CHAT also supplies an effective view of lesson study when teachers and researchers reflect on their coworking. In other words, CHAT is not only a lens with which to analyze, conduct research, or *reflect on* teachers' lesson study processes but also a methodological approach to guide teachers' *reflection in* the lesson study process as well.

4 Distilling the Central Tenets of CHAT

The above interpretation exemplifies the benefits of using CHAT as a framework to analyze complicated lesson study activities. Furthermore, it is necessary to delve deeper and determine the core tenets of CHAT emerging from the analysis process.

4.1 Activity System as the Unit of Analysis

Activity system is the fundamental unit of "the whole" (Vygotsky 1978) for analyzing human activity from the perspective of CHAT (Engeström 1987/2015). In the classical triangle model, seven elements constitute the whole system, which describes the complex context of human learning and development in the real world. In the triangle model (see G2 in Fig. 2), the *subject* is the individual or groups of individuals involved in a certain activity. The *artifacts* include tools and

signs that can act as resources for the subject during the activity. The *object* is the motive behind the activity. The *community* is the social group to which the subject belongs and in which the subject is engaged in an activity. The *rules* are both formal and informal regulations that can affect how the activity takes place in varying degrees. The *division of labor* refers to how the object is shared among the community. The *outcome* of an activity system is the result of the activity, which is normally unexpected by the subject (Engeström 1987/2015). The seven elements compose a holistic system by which this analysis method enhances an understanding of the human activity situated in a collective context.

4.2 Contradiction as the Inner Force for Change

Contradiction is positioned as the driving force for change and transformation (Il'enkov 1977); it enables a new object of activity to be identified and conceptualized. Consequently, the concept of "contradiction" has been a central focal point of a number of studies inspired by CHAT (Engeström 2016). According to Il'enkov (1977, p. 330), contradictions are not just inevitable features of activity. They are the principle of the self-movement of activity and the form in which the development is cast. This means that new stages and forms of activity emerge as solutions to the contradictions of the preceding stages and forms. This in turn takes place in the form of invisible breakthroughs (Wei 2017b). In the analysis of human activity, four levels or layers of contradictions could be discerned. These levels are illustrated in Fig. 2.

Each level of contradiction is labeled with numbers in Fig. 3. The four-level contradictions in the activity systems could be interpreted as:

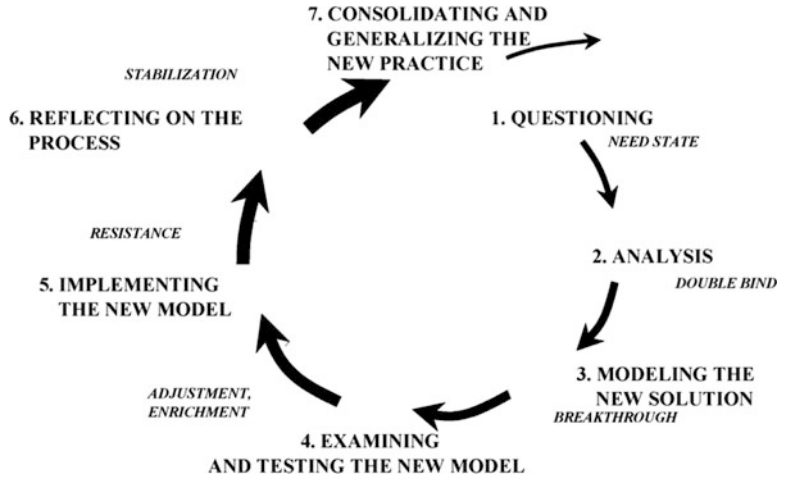

Fig. 3 The cycle of expansive learning. (Engeström and Sannino 2010)

- Level 1: Primary inner contradiction (double nature) within each constituent component of the central activity
- Level 2: Secondary contradictions between the constituents of the central activity
- Level 3: Tertiary contradiction[s] between the object/motive of the dominant form of the central activity and the object/motive of a culturally more advanced form of the central activity
- Level 4: Quaternary contradictions between the central activity and its neighbor [ing] activities (Engeström 1987/2015, p. 71)

More specifically, in CHAT, "contradiction" is the inner force triggering the occurrence of expansive learning. If historically accumulated contradictions are not encountered by the subjects, the crisis would most likely not be solved completely.

4.3 Expansive Learning as an Approach to Transformation

CHAT focuses on the dynamics of human learning. Sfard (1998) suggested two basic metaphors for learning activities: the *metaphor of acquisition* and the *metaphor of participation*. According to the interpretations of Paavola and Hakkarainen (2005), the former emphasizes individual mental processes, and the latter examines the transmission of cultural knowledge and competence from one generation to the next. Neither one of these metaphors appears, however, to examine the knowledge creation that is critical to an advanced knowledge society.

From the point of view of expansive learning, both acquisition-based and participation-based approaches share much of the same conservative bias. Both have little to say about the transformation and creation of culture (Wei 2017b). On the contrary, the theory of expansive learning places importance on the following: communities as learners, the transformation and creation of culture, horizontal movement and hybridization, and the formation of theoretical concepts (Engeström and Sannino 2010). Hence, the theory of expansive learning relies on its own metaphor: *expansion*. In expansive learning, learners learn something that is not yet there (Engeström 2016). In other words, the learners construct a new object and concept for their collective activity and implement this new object and concept in practice. This shift in metaphors has been noted by Paavola et al. (2004), who suggested knowledge creation as the new, third metaphor for theorizing work-based learning.

Together, these actions form an expansive cycle or spiral (see Fig. 3). An ideal-typical sequence of epistemic actions in an expansive learning cycle is described as follows (Engeström and Sannino 2010, p. 7):

- The first action is that of questioning, criticizing, or rejecting some aspects of the accepted practice and existing wisdom. For the sake of simplicity, we will call this action questioning.
- The second action is that of analyzing the situation. Analysis involves mental, discursive, or practical transformation of the situation in order to find out causes

or explanatory mechanisms. Analysis evokes "why?" questions and explanatory principles. One type of analysis is historical-genetic; it seeks to explain the situation by tracing its origins and evolution. Another type of analysis is actual-empirical; it seeks to explain the situation by constructing a picture of its inner systemic relations.

- The third action is modeling the newly found explanatory relationship in some publicly observable and transmittable medium. This means constructing an explicit, simplified model of the new idea that explains and offers a solution to the problematic situation.
- The fourth action is that of examining the model, running, operating, and experimenting on it in order to fully grasp its dynamics, potentials, and limitations.
- The fifth action is that of implementing the model by means of practical applications, enrichments, and conceptual extensions.
- The sixth and seventh actions are those of reflecting on and evaluating the process and consolidating its outcomes into a new stable form of practice.

In other words, expansive learning as an ideal type of human learning describes the inner mechanism and processual ideology of how people learn.

4.4 Formative Intervention as a Stance of Inquiry

From the perspective of CHAT, Engeström developed the methodology of formative intervention used in *Developmental Work Research* (DWR, Engeström 2005). Engeström (2016) noted that an intervention is meant to be not only disruptive but also developmental in relation to the practice in which the intervention takes place. An intervention such as DWR is meant to be deliberative and systematic; to some extent, it should also halt the daily practice of practitioners to allow them to examine their business-as-usual processes by themselves.

CHAT is not a rigorous framework by which researchers may "research" social phenomena. Rather, the positionality of researchers involves maintaining a stance of inquiry, which means that intervention becomes a new and necessary way to conduct research. Two reasons can explain the importance of intervention. First, when we observe, analyze, and interpret social life, we also influence it, whether we want to or not. Thus, it is advisable for us to analyze our own actions and research practices as they interact with those of our subjects. Second, by intervening deliberately and methodically, we generate knowledge about what is possible. Possibility knowledge opens up insights into what may be possible in a human activity and what alternative directions of development and change are available. Possibility knowledge is generated by setting the activity and its subjects into motion, into some form of focused "time travel" that explores the past, the present, and the future in relation to one another (Virkkunen and Newnham 2013, p. xvii).

The claim of the methodology of formative intervention enables participants to do more than simply work on improving their own performance either through action research methods or through participation in researcher-led design experiments. The aim is the development of what Engeström (2007) called "transformative agency" among the practitioners. It is stimulated by the power of the conceptual tools of CHAT in helping participants to analyze how the object of their collective activity is constructed, how rules and a division of labor have emerged historically within a community of practitioners, how artifacts are appropriated by members of that community, and, moreover, how these might be changed for a better future.

5 Shedding Light on Lesson Study Through CHAT

Based on the illustration of CHAT and its featured contributions to educational research, this section, alongside the section detailing the author's research project, describes a lesson study case that took place in an elementary school in China; it provides justification for the use of CHAT to inspire lesson study theoretically. This section maintains that CHAT offers a robust lens for analyzing lesson study process due to its multilayer perspective from the aspects of ontology, epistemology, methodology, and axiology of lesson study itself. In this section, I connect the keywords and central tenets of CHAT with the merits of lesson study emerging from the aforementioned four layers.

5.1 Introducing the Case

The data for this lesson study case were collected by the author, between September 2013 and November 2013, in an elementary school called Youth School in Beijing, China. Youth School has a long tradition of conducting lesson study in teachers' daily work. Lesson study in Youth School has several formats, including research lessons, public lessons, and performing lessons, which place emphasis on school-based teacher professional development. The case in question involved a more ordinary form of lesson study in a mathematics teaching research group that took place during a whole semester in autumn, which aimed to guide novice teacher's growth.

This lesson study was based on a unit in mathematics: "Learning to Locate" (see Fig. 4). A group of teachers who taught Grade 4 formed a lesson study group to research this lesson (see Table 1).

During the semester, six sessions of lesson study were conducted by the group of teachers in their usual way. Teacher Sun, as a novice teacher, designed this lesson independently and taught it in a class for the first time. Subsequently, the other teachers in this lesson study group analyzed Sun's teaching skills and offered some suggestions for improvement. Sun considered her colleagues' feedback and

Fig. 4 Textbook pages. (Editorial Team 2016, pp. 63–65)

Table 1 Participants

Teachers' name	Gender	Age	Note
Li	M	45	Group leader
Sun	F	25	Novice teacher
Zhou	F	28	Novice teacher
Zheng	M	35	Experienced teacher
Wu	F	42	School director

redesigned the same lesson again; she then taught the lesson in a new class, with new students. In total, this lesson study cycle, expressed as "teaching→discussion→reflection→reteaching," was implemented six times in six classes. Sun was the one who applied the group members' ideas into practice, while her colleagues played roles as critical friends in shaping Sun's instructional improvements. During this process, the other group members without Sun's visions of teaching and learning were transformed to some extent as well. I audio recorded all of these sessions, including the teachers' performance of teaching activities in the classroom and their group discussions in their office. All of the records of Sun's classroom teaching, group discussion meetings, and teachers' reflection journals were in the form of transcripts taken verbatim.

An interesting question that emerged from this case study could be expressed as "How could the teachers' collective professional learning take place during lesson study?" Although the current study is not an empirical one designed to answer this question, the following sections refer directly to the four aspects of inspiration by which the question could be approached using the insights of CHAT.

5.2 Ontological Inspiration

According to CHAT, the minimum unit of analysis is the activity system, instead of the elements. CHAT suggests that we are not isolated individuals interacting with our environment on a purely biological basis; rather, our relationship with the world is mediated by other people and the cultural-historical context in which we live (Yamagata-Lynch 2010). This inspires us to consider lesson study as a collective practice in certain sociocultural contexts. The first essential characteristic of lesson study is its openness, which means that the teaching activity does not focus on a single factor, but a collection of elements that are interconnected with one another. Thus, in this case, the exploration of teacher professional development in lesson study should broaden the view from one of individual teachers to that of the whole group.

Previous research on lesson study has always focused on novice teachers and what they learned in the lesson study process (e.g., Chen and Yang 2013). In fact, as the lesson study involves a community of practice, every member in the lesson study group, even if they are experienced teachers, learns something new during the dialogical process in lesson study. Actions of talking, analyzing, and feedbacking

combined all the teachers together toward a same activity object, namely, teaching better and more effectively. The teacher group, as a subject of learning, continually facilitates each member's reflection on his/her teaching style and their respects to each other.

For example, in this case study, the director of Youth School informed me of the following at the end of the lesson study:

> I did not expect to find our novice teachers to have great competence in critical thinking. I should reflect on how to encourage or even protect the novice teachers' own teaching styles. (Teacher Wu)

In other words, the ontology of lesson study, under the discourse of teacher professional development, concerns the community of teachers and their lesson study activity systems, rather than the individuals. Only by adopting a systemic view of lesson study and observing the group activities could we discern the openness of lesson study that enables the improvement of teacher professional learning in a continuous manner.

5.3 Epistemological Inspiration

Lesson study is driven by teachers instead of educational researchers, which means that the authentic voices of teachers should be considered as the resource that allows insight into teacher professional learning. CHAT uses the concept of "multi-voicedness" to present an activity system as a community of multiple points of view, traditions, and interests (Engeström 2001). Different voices are likely to introduce tension, conflicts, and even contradictions. When I took a closer look at the data of this case, I focused on the contradictions and how they drove the development of a teacher community, thereby facilitating teacher learning in the lesson study group.

CHAT views contradictions as the driving force of human development. To enrich the interpretations of the four-level contradiction system (see Fig. 2), the system can be seen as serving as the "skeleton," while the other tenets of CHAT can be seen as functioning as the "flesh and blood." The following dialogues took place during the second cycle of the lesson study. The teacher learning process was found to be embedded in these contradictory dialogues.

> Li: You (Teacher Sun) should tell your students in a simple way to clarify the definitions of "Row" and "Line."
> Zheng: Yes, I agree. Your kids used a lot of different linguistic formats to describe locations. However, which are the ones typically used? [You should say it out loud.]
> Wu: The more you teach, the more your students communicate more ambiguously. . . By the way, try to add some activities to the beginning of your class.
> Sun: Yep. . .Eh. . .Thanks. But I cannot work out how to incorporate your suggestions into my teaching so quickly. I need time to digest.
> Zhou: Maybe we had better respect and listen to her (Teacher Sun's) ideas.

From an epistemological view, analyzing contradictions is an effective way to recognize the inner mechanism of teacher learning in lesson study.

In this episode, Li, Zheng, and Wu suggested that Sun should revise her oral expression of scientific concepts. While Sun's resistance brought a tensional atmosphere into the group, Zhou's feedback guided the tension toward self-reflection for everyone in the group. Reflection indicates the start of learning. In exposing the contradictions that occur within an activity system of lesson study, CHAT aims to help participants to better understand the processes and to identify any necessary actions required to bring about improvements to the practice.

In brief, the CHAT approach enables researchers to consider the contradictions and different motives within a given context. CHAT provides teachers and researchers participating in or examining lesson study with a theoretical framework to analyze the tangible actions and intangible motives of various participants, by stimulating new professional learning outcomes.

5.4 Methodological Inspiration

In this case study, the basic or inner hypothesis was that teacher professional learning exists in the expansive learning process. In other words, the methods for teacher learning are mainly implemented in the workplace and in a dialogical environment, where teachers can generate something that is not yet there (Engeström 2016). In the CHAT framework, expansive learning leads to the formation of a new, expanded object and pattern of activity oriented to the object. This involves the formation of a theoretical concept of the new activity, based on grasping and modeling the initial simple relationship, the "germ cell" (Davydov 1999), which gives rise to the new activity and generates its diverse concrete manifestations. The formation of an expanded object and corresponding new pattern of activity requires and induces collective and distributed agency, which leads to questioning and breaking away from the constraints of the existing activity and embarking on a journey across the uncharted terrain of the zone of proximal development (Engeström 2001).

In this lesson study case, the teachers' learning, as perceived from the interviews, was examined. Each teacher in the group was found to have learned something new, which was not the initial goal of the lesson study activity.

> What is good teaching? Good teaching does not involve activities, nor careful design, but our understanding of the textbooks (Teacher Wu).

> In terms of novice teacher development, we should respect the novice teachers and leave some space for their maneuvers (Teacher Li).

> I am not an experienced teacher. I learned a lot when I observed Teacher Sun's teaching and listened to the comments given by our colleagues (Teacher Zhou).

> We expect to learn something new from our collaboration (Teacher Zheng).
>
> What a precious opportunity it was for me to receive criticisms from the leaders of our teaching research group! I learned a lot from our democratic communication (Teacher Sun)!

Contextualizing lesson study with CHAT in a methodological way highlights lesson study as a process of expansive learning for teachers. As a dialectical theory, CHAT views human relationships as interwoven with multiple contradictions and conceptualizes learning as a dynamic and nonlinear process. Expansive learning is an ideal type of this kind of learning. Expansive learning is not only a learning theory but also a methodological instrument with which to design and promote teacher professional learning in an extensive manner.

5.5 Axiological Inspiration

The axiology of CHAT stems from its formative intervention, which implicates a possible change and the responsibility of researchers and participants to join together to witness the (successful) process of reforming.

According to Lewis (2015), lesson study is also an improvement science, which guides researchers and teachers in their design, implementation, analysis, and development of conclusions in the lesson study process. It supports a systematic and systemic approach of understanding human activities and interactions in complex, real-world environments.

Formative intervention is the pursuance of the value of CHAT, which is also the basic method to achieve change and transformation. Formative intervention can help researchers and practitioners understand individual activity in relation to its context and how the individual, his/her activities, and the context affect one another. Additionally, it can help document the historical relationships among multiple activities by identifying how the results from a past activity affect new activities. As Engeström (2015) noted, CHAT was developed on an interventionist premise, which means that educational research needs to be actively involved in making the world better. From this perspective, the value of lesson study, different from that of rigorous research, is intervening in the teacher practice and combining theory and practice together.

6 Concluding Remarks

The main advantage of incorporating CHAT into lesson study is that this theoretical lens can help both teachers and researchers make sense of complex contexts in a manageable and meaningful manner. In the lesson study process, CHAT also

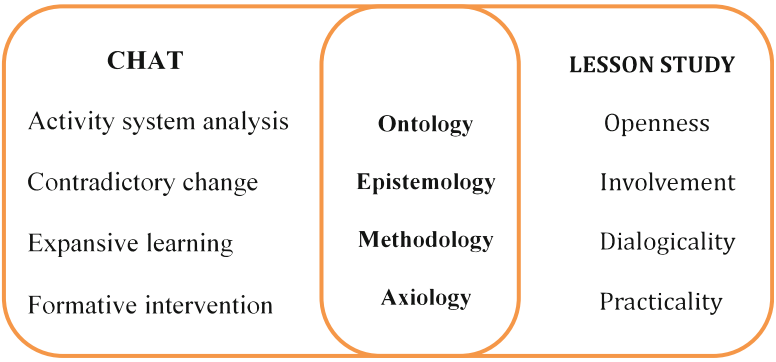

Fig. 5 Intersections between CHAT and lesson study

provides opportunities for teachers and researchers to work with a manageable unit of analysis, to understand systemic contradictions, to discover teacher learning mechanisms, and to transform findings into next-stage changes and practices.

I paired the four tenets of CHAT with the four essential commonalities of various modes of lesson study as their counterparts (see Fig. 5). The analysis results of the case of lesson study practiced in a teachers' group showed that CHAT invites further insight into the ontological, epistemological, methodological, and axiological aspects of lesson study. The CHAT approach, with a focus on systematic analysis, contradictions as the driving force, the learning process as a form of expansion, and the interventionist stance, could inspire and promote the merits of lesson study from various perspectives in the future.

Acknowledgments This work was supported by the Hong Kong Yuen Yuen Foundation (grant no. JY14003). I thank the anonymous reviewers for their invaluable feedback on the revisions of this paper. I would also like to thank Prof. Rongjin Huang from Middle Tennessee State University and Prof. Xiangming Chen from Peking University for their comments which contributed to the improvement of this article.

I would like to thank Anthony Abram for proofreading this manuscript.

References

Chen, X. (2017). Theorizing Chinese lesson study from a cultural perspective. *International Journal of Lesson and Learning Studies., 6*(4), 283–292.

Chen, X., & Yang, F. (2013). Chinese teachers' reconstruction of the curriculum reform through lesson study. *International Journal for Lesson and Learning Studies, 2*, 218–236.

Cole, M. (1985). The zone of proximal development: Where cultural and cognition create each other. In J. Wertsch (Ed.), *Culture, communication, and cognition* (pp. 146–161). New York: Cambridge University Press.

Davydov, V. V. (1999). The content and unsolved problems of activity theory. In Y. Engeström, R. Miettinent, & R.-L. Punamaki (Eds.), *Perspectives on activity theory* (pp. 39–52). New York: Cambridge University Press.

Editorial Team. (2016). *Mathematics (Grade4-Vol.2)*. Beijing: Beijing Normal University Press.
Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit Oy.
Engeström, Y. (1996). Developmental work research as educational research. *Nordisk Pedagogik: Journal of Nordic Educational Research, 16*(5), 131–143.
Engeström, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization. *Journal of Education and Work, 14*(1), 133–156.
Engeström, Y. (2005). *Developmental work research: Expanding activity theory in practice*. Berlin: Lehmanns Media.
Engeström, Y. (2007). Enriching the theory of expansive learning: Lessons from journeys toward coconfiguration. *Mind, Culture, and Activity, 14*(1–2), 23–39.
Engeström, Y. (2015). *Learning by expanding: An activity-theoretical approach to developmental research* (2nd ed.). Cambridge: Cambridge University Press.
Engeström, Y. (2016). *Studies in expansive learning: Learning what is not yet there*. Cambridge: Cambridge University Press.
Engeström, Y., & Sannino, A. (2010). A. Studies of expansive learning: Foundations, findings and future challenges. *Educational Research Review, 5*(1), 1–24.
Fang, Y. (2017). School-based teaching research and lesson-case study in mediating the second-cycle curriculum reform in Shanghai. *International Journal for Lesson and Learning Studies, 6* (4), 293–305.
Fernandez, C. (2002). Learning from Japanese approaches to professional development: The case of lesson study. *Journal of Teacher Education, 16*(1), 49–65.
Hart, L. C., Alston, A., & Murata, A. (Eds.). (2011). *Lesson study research and practice in mathematics education: Learning together*. Dordrecht: Springer.
Huang, R., & Shimizu, Y. (2016). Improving teaching, developing teachers and teacher developers, and linking theory and practice through lesson study in mathematics: An international perspective. *ZDM-Mathematics Education, 48*, 393–409.
Huang, R., Gong, Z., & Han, X. (2016). Implementing mathematics teaching that promotes students' understanding through theory-driven lesson study. *ZDM-Mathematics Education, 48*, 425–439.
Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. London: Cambridge University Press.
Lee, C. K., & Lo, M. L. (2013). The role of lesson study in facilitating curriculum reforms. *International Journal for Lesson and Learning Studies, 2*, 200–206.
Leontiev, A. N. (1978). The problem of activity and psychology. In A. N. Leont'ev (Ed.), *Activity, consciousness, and personality* (pp. 45–74). Englewood Cliffs: Prentice Hall.
Lewis, C. (2002). *Lesson study: A handbook of teacher-led instructional change*. Philadelphia: Research for Better Schools Inc.
Lewis, C. (2009). What is the nature of knowledge development in lesson study? *Educational Action Research, 17*, 95–110.
Lewis, C. (2015). What is improvement science? Do we need it in education? *Educational Researcher, 44*(1), 54–61.
Lewis, C. (2016). How does lesson study improve mathematics instruction? *ZDM Mathematics Education, 48*, 571–580.
Little, J. W. (2003). Inside teacher community: Representations of classroom practice. *Teacher College Record, 105*(6), 913–945.
Lewis, C., & Hurd, J. (2011). *Lesson study step by step: How teacher learning communities improve instruction*. Portsmouth, NH: Heinneman.
Il'enkov, E. V. (1977). *Dialectical logic: Essays in its history and theory*. Moscow: Progress.
Ma, L. (1999). *Knowing and teaching elementary mathematics*. Mahwah: Lawrence Erlbaum Associates.
Mosvold, R., & Bjuland, R. (2011). An activity theory view on learning studies. *International Journal of Early Childhood, 43*, 261–275.

Murata, A., Bofferding, L., Pothen, B., Taylor, M., & Wischnia, S. (2012). Making connections among student learning, content, and teaching: Teacher talk paths in elementary mathematics lesson study. *Journal for Research in Mathematics Education, 43*, 616–650.

OECD. (2017). *Empowering and enabling teachers to improve equity and outcomes for all*. Paris: OECD Publishing.

Paavola, S., & Hakkarainen, K. (2005). The knowledge creation metaphor–An emergent epistemological approach to learning. *Science & Education, 14*(6), 535–557.

Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of innovative knowledge communities and three metaphors of learning. *Review of Educational Research, 74*, 557–576.

Pang, M. F., & Marton, F. (2005). Learning theory as teaching resource: Another example of radical enhancement of students' understanding of economic aspects of the world around them. *Instructional Science, 33*(2), 159–191.

Pang, M. F., & Marton, F. (2013). Interaction between the learners' initial grasp of the object of learning and the learning resource afforded. *Instructional Science, 41*(6), 1065–1082.

Pang, M. F., & Marton, F. (2017). Chinese lesson study, learning study and keys to learning. *International Journal for Lesson and Learning Studies, 6*(4), 336–347.

Scribner, S. (1997). A sociocultural approach to the study of mind). In E. Toback, R. J. Flamagne, M. B. Parlee, L. M. W. Martin, & A. S. Kapelman (Eds.), *Mind and social practice: Selected writings of Sylvia Scribner* (pp. 266–280). New York: Cambridge University Press.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher, 27*, 4–13.

Stetsenko, A. (2005). Activity as object-related: Resolving the dichotomy of individual and collective planes of activity. *Mind, Culture, and Activity, 12*(1), 70–88.

Stigler, J. W., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: The Free Press.

Tsui, A. B. M., & Law, D. Y. K. (2007). Learning as boundary-crossing in school–university partnership. *Teaching and Teacher Education, 23*(8), 1289–1301.

Virkkunen, J., & Newnham, D. S. (2013). *The change laboratory: A tool for collaborative development of work and education*. Rotterdam: Sense.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wake, G., Swan, M., & Foster, C. (2016). Professional learning through the collaborative design of problem solving lessons. *Journal of Mathematics Teacher Education, 19*, 243–260.

Wei, G. (2017a). Review of learning by expanding: An activity-theoretical approach to developmental research. *Frontiers of Education in China, 12*(1), 130–132.

Wei, G (2017b). *Dynamics of teacher practical knowledge: From cultural-historical activity theoretical perspective* (Unpublished Doctoral Dissertation), Peking University.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind*. Cambridge, MA: Harvard University Press.

Yamagata-Lynch, L. (2010). *Activity systems analysis methods*. New York: Springer.

Zhao, Y. (2014). *Who's afraid of the big bad dragon? Why China has the best (and worst) education system in the world*. New York: Jossey-Bass.

Ge Wei]is an assistant professor at the College of Elementary Education, Capital Normal University, Beijing, China. He completed his Ph.D. in teacher education at Peking University and the University of Helsinki. His scholarly interests focus on lesson study, cultural-historical activity theory, and teacher education. He recently published a book entitled *Focusing on the Five-Star Instruction* (2015). Dr. Wei is a reviewer of Division K (Teaching and Teacher Education) of AERA, as well as a member of ICSEI.