Invited Lecture

Chinese Lesson Study in Mathematics: A Local Practice or a Global Innovation?

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ABSTRACT This chapter aims to provide a holistic portrayal of the features of Chinese lesson study (LS), the mechanisms of Chinese LS, and its recent development. Recommendations for further improvement of Chinese LS are provided and implications of Chinese LS on the practice of LS internationally are discussed.

Keywords: Lesson study; Chinese Lesson study; Teaching research system; Teacher professional learning; Improvement science, LS in Education 4.0.

1. Background

1.1. Japanese lesson study and its adaption internationally

Due to Japanese students' high performance in math in the 1995 Trends in International Mathematics and Science Study (TIMSS), Japanese mathematics teaching has drawn international attention (Jacobs et al., 2006). The 1999 TIMSS video study examining nationally representative eighth-grade mathematics classrooms (81 in the US, 100 in Germany, and 50 in Japan) (Stigler and Hiebert, 1999) revealed high-quality mathematics teaching in Japan (90% of classrooms studied were rated as medium and high) in comparison with the classrooms studied in Germany (66%) and in the US (11%). The reason for the Japanese success was uncovered in Stigler and Hiebert's (1999) seminal book, *The Teaching Gap,* in which the authors detailed a Japanese "structured problem solving" mathematics teaching model which includes four major phases. The phases are: (1) teacher poses the problem, (2) students work out the problem individually, (3) the whole class discusses students' solutions, carefully orchestrated by the teacher, and (4) the teacher and students jointly summarize big ideas learned. Stigler and Hiebert further described a unique way of teacher professional development (PD), which aims to ensure teachers can teach mathematics through "structured problem solving" nationwide. This Japanese PD approach typically includes collaborative study of teaching materials, joint design of a lesson, and teaching of the lesson observed by colleagues with a post-lesson debriefing followed by a revision of the lesson plan. This Japanese PD approach has been coined

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as lesson study (jugyou kenkyuu, 授業研究). LS is a nationwide practice with multiple models and with a long history (Lewis, 2016; Makinae, 2019). This approach has been adopted in the US in 1990s (Lewis and Tsuchida, 1998) and then has spreaded globally (Huang et al., 2019a). Japanese LS has demonstrated its effects of promoting teacher professional learning and improving student learning outcomes (Lewis, 2016; Lewis and Perry, 2017), as well as developing a teacher professional learning community (Huang and Shimizu, 2016)

1.2. Chinese LS and PISA studies

The outstanding performance of Chinese Mainland students in mathematics and science on Programme for Student Assessment (PISA) (OECD, 2013; 2019) has prompted international scholars to study mathematics education and mathematics teacher education in China (Fan et al., 2015; Li and Huang, 2018). The Shanghai teaching method has been characterized as mastering teaching and learning through variation (Huang Huang et al., 2021d), while Shanghai lessons have been recommended as exemplary lessons in a popular book, *Mathematics Mindset* (Boaler, 2018). Naturally, how to prepare and ensure teachers can teach mathematics in such a way has become an interesting question. Prevalent in China is a job-embedded, hierarchical PD system of teaching research activity includes studying of teaching materials, jointly planning a lesson, teaching the lesson, observing the lesson, and having a post-lesson discussion as a core component (Huang et al., 2016; Yang, 2009). The Chinese approach to PD which focuses on examining and polishing a lesson aligned with reform-oriented teaching is coined as Keli (exemplary lesson) study (Huang and Bao, 2006). Further, it has been theorized as Chinese lesson study (Chinese LS) from cultural, institutional, and instructional expertise perspectives in a journal special issue on Chinese LS and its adaptation internationally (see Huang et al., 2017). Li (2019) further tracked and interpreted Chinese LS from cultural and historical perspectives. The recent development of Chinese LS within the context of 21st century competency-oriented curriculum reform is discussed in a follow-up special issue on Chinese LS (Fang et al., 2022). In the following sections, I will provide more details about the features of Chinese LS and interpretation of why and how Chinese LS works in China.

1.3. Similarities and differences between Japanese LS and Chinese LS

Embedded in a nationwide, hierarchical teaching research system (school-based, district-based, city-based, province-based, nation-based), Chinese LS includes multiple modes with different purposes at different levels as well. In general, various types of Chinese LS focus on polishing the research lesson based on classroom observation and collective reflection and emphasize the LS product as "public lessons" or "exemplary lessons" (Huang et al., 2017; Yang, 2019). There are "report lessons" for novice teachers to demonstrate their professional growth, "exemplar lessons" for expert teachers to demonstrate reform-oriented good practice, and "contest lessons" for winning awards being excellence in teaching (Huang et al., 2017a).

With regard to the Chinese LS process, Gu and his team have theorized a mode of LS within the context of curriculum reform in Shanghai (Wang and Gu, 2007). It is called "three foci (teacher belief, gaps identification, and adaptive change) in two rounds of reflections between the iterative research lesson planning for improvement（三关注，两反思）" (Wang and Gu, 2007, p. 37). More specifically, a teacher starts with planning a lesson aiming at making visible his or her own existing teaching beliefs and behaviors by reflecting on feedback from colleagues and identifying the gaps from what the reform requires. Then the teacher redesigns and teaches the lesson aiming at gaining lived experience of the new standards, ending with reflecting, redesigning, teaching it again based on colleagues' observation feedback and evidence of student learning in order to arrive at a new behavior phase. Gu and colleagues' work also marked the first time that researchers were called upon to work with schools to provide experts guidance (zhuanjia yinglin, 专家引领) (Huang and Bao, 2006).

There are similarities between Japanse and Chinese LS regarding focus on examining and reflecting upon classroom pratice and the nature of job-embedded and nationwide PD activity, with each having a long history and a cultural and institutional support system (Lewis, 2016; Li, 2019; Yang, 2019). Yet, some essential differences between Chinese and Japanse LS are identfied. Specially, the essential components of Chinese LS are: (1) repeated teaching of the same topic; (2) focusing on both content and pedogogy; (3) the involvement of knowledgeable others throughout the LS process; and (4) examplary lessons as products of LS (Huang et al., 2017a; Li, 2019).

2. Why Chinese Lesson Study Works

Chinese LS has played important roles in implementing curriculum reform and improving mathematics instruction over decades (Wang and Gu, 2007; Huang et al., 2019b). In this section, the reasons for why Chinese LS works are explored from multiple perspectives.

2.1. An analysis from a historical and cultural perspective

From a cultural perspective, Chen (2017) argues that the following three core cultural orientations are features of Chinese LS. First, unity of knowing and doing（知行合一）rather than conceptual explication is behind teacher knowing and understanding through embodied actions and practical discourse. Ontologically, in Chinese culture, knowing and doing are integrated. Second, practical reasoning（实践推理）drives the deliberate practice of repeated teaching through group inquiry and reflection. Epistemologically, knowledge of good teaching is not so much talked about in verbal concepts as enacted in teachers' actions in deliberate practice through critical inquiry and reflection. As a Chinese saying states, "Proficiency comes from familiarity"（熟能生巧）. Third, a tendency of emulating those better than oneself（见贤思齐）motivates teachers to learn from "good" exemplars of expert teachers. Methodologically, it is believed that watching model teaching, practicing for making prefect, and learning from making errors are valuable opportunities for teachers. This corresponds to the statements: "doing things" cannot be separated from "being humane," and "respecting virtues" should go hand in hand with "learning knowledge." These cultural values about teacher professional learning could help explain why in Chinese LS, repeated teaching of the same topic, developing an exemplary lesson, and knowledgeable others' involvement throughout the LS process are emphasized.

From a historical and cultural perspective, Li (2019) further argues that the following three principles and practices are crucial for understanding the nature of Chinese LS: (1) respecting and learning from masters and experts; (2) teaching and learning by integrating profound theory and deliberate practice, and (3) learning taking place among learner peers through mutual observation and discussion. They also suggest that these cultural roots could help better understand the nature and features of Chinese LS. Yet, some unintended consequences should be noticed. For example, some teachers have taken a utilitarian or opportunist approach, participating in LS activities mainly for the sake of winning a contest or promotion, social status, and financial incentive (Li, 2019). Furthermore, it is often difficult to agree upon the criteria for "good" lessons during LS amid ongoing curricular reforms (Chen, 2017).

2.2. An analysis from an institutional perspective

From an institutional perspective, both a teacher professional promotion system and an associated teaching research system are fundamentally important for ensuring Chinese LS is implemented at scale. *The professional ranking and promotion system*, established in 1993, has evolved for supporting teachers' professional development. There are three levels of professional titles: senior (高级), intermediate (中级, Level 1), and primary (初级, Level 2 and 3). For each level, political, moral, and academic qualifications are specified. In addition, there are some specific titles for honoring teachers with excellence in teaching, research and leadership such as "exceptional teacher" which is equivalent to university professor status (Huang et al., 2016), or "master teacher" and "subject leader" (Cravens and Drake, 2017). This system not only specifies components of teacher professional expertise, but also provides incentives and a culturally supported mechanism for teacher professional development (Li et al., 2011).

Associated with the teacher promotion system, there is a *teaching research system* supporting teacher professional development (Chen, 2020; Ricks and Yang, 2013). Teaching research (Jiaoyan) is a special term that refers to various activities of professional development at different levels (school, district, city, or national), and is organized by teaching research groups (school-based) and institutes (Jiaoyan Jigou). The teaching research system, initially established in 1956 (Wang, 2009), has evolved into a hierarchical system with school, district, county, city, province, and national levels (Yang, 2019). There are different departments including educational bureaus, educational science research academies, and curriculum development centers at both national and local levels. These are responsible for guiding teaching research, overseeing teaching administration in schools on behalf of educational bureaus, providing consultation for educational authorities, mentoring the implementation and revision of new curricula, building the bridge between modern educational theories and teaching experiences, and promoting high-quality classroom instruction (Huang et al., 2016). There are more than 100,000 teaching researchers (inclusive of other disciplines) working in teaching research institutes (Wang, 2009). The teaching researchers play multiple roles, including: (1) interpreting opinions regarding the implementation of teaching plans, syllabi, and materials based on local contexts; (2) providing evidence and suggestions on decision making for local education authorities; (3) organizing a variety of teaching research activities at different levels; and (4) helping teachers study teaching materials, implement teaching schedules, and improve their teaching efficiency. Specific requirements for recruiting teaching researchers have been set by the Ministry of Education and are further specified by local education authorities (Huang et al., 2012). In general, a teaching research specialist must be an excellent teacher with good teaching research ability and leadership.

Within the teaching research system, many teaching research specialists and educational researchers who have excellence in teaching and doing educational research and with needed skills in facilitating teaching research activity could serve as knowledgeable others for facilitating LS. Some advanced teachers are selected to serve as subject leaders at district or city levels to lead in carrying out school-based teaching research including Chinese LS. These subject leaders help teachers interpret the curriculum standards, demonstrate their own teaching, mentor other teachers, and decode instructional expertise through comparing teaching conducted by experts and regular teachers. Chinese LS and district research projects, with the support of subject leaders (or/and knowledgeable others from universities), have made curriculum reform transparent for teachers to ensure their learning to teach reform-oriented lessons (Cravens and Wang, 2017; Fang, 2017).

2.3. Studies on Chinese lesson study

Similar to Japanese LS, Chinese LS has played roles in improving mathematics teaching (Huang et al., 2011), promoting students' outcomes of learning (Huang et al., 2016), developing both teachers' and specialists' professional knowledge and skills (Huang and Han, 2015; Huang et al., 2017b), implementing reform/innovative ideas (Huang et al., 2019b; Zhao et al., 2022), and building connections between research and practice (Huang et al., 2016). In Huang and Li's (2009) study, with the aim of developing exemplary lessons to supplement the textbook, LS groups from a school, a district and a city supported teachers in developing lessons which demonstrated new curriculum-oriented instruction. Huang et al., (2011) further documented how teachers could develop their instructional expertise through developing exemplary lessons and collaboration within the LS mechanism. Huang et al. (2016) they explored how a LS infused by learning trajectory and variation pedagogy could promote students' conceptual understanding of the mathematical algorithm of division of fraction. Similarly, Huang et al., (2019c) revealed that theory-infused LS could develop students' ability to solve word problems. Regarding the effect of LS on curriculum reform, both Huang et al. (2019b) and Zhao et al. (2022) documented how innovative ideas introduced in curriculum standards could be implemented in the classroom effectively through iterations of LS. Concerning the learning of knowledgeable others (e.g., mathematics teaching research specialists in China), Huang and Han (2015) documented how mathematics specialists and teachers co-learned through boundary crossing during LS. Huang et al., (2017b) detailed what knowledge and skills are needed for being specialists and how specialists develop their professional knowledge. With regard to the roles in linking theories to practice through Chinese LS, Huang et al. (2016), Han et al. (2019), and Zhao et al. (2022) showed how a certain theory (e.g., learning trajectory, variation pedagogy) could inform the LS process and promote student learning outcomes. Recently, Huang et al. (2022) portrayed teachers' expansive learning process through Chinese LS. In the journal special issue on Chinese LS and its adaptation in other countries (Huang et al., 2017), it was argued that Chinese LS is a deliberate practice for developing instructional expertise, a research methodology for linking research and practice, and an improvement science for instruction and school improvement system wide.

To understand recent developments regarding LS in China, a new journal special issue revisits LS's roles within the context of competency-based curricula (Fang et al., 2022). This special issue argues that LS in China continues to serve as a powerful platform to support change in teaching and reveals a new feature of Chinese LS, namely, research-practice partnerships (RPPs) in LS (Farrell et al., 2022) where researchers, who are university faculty members support teachers to implement competency-based (*hexing suyang* 核心素养) curriculum reform through boundary crossings (Engeström and Sannino, 2010). From the lens of learning at the boundary of research-practice partnerships (RPPs), the features of Chinese LS are highlighted in three major themes: (1) the role of university-school partnerships in meeting the new demands of key competency reform; (2) resourceful tools, strategies and structures to support boundary crossing for teachers; and (3) roles and relationships for mutual learning in university-school partnerships. Thus, it urges the need to redefine Chinese LS to engender versatility and hybridity and to enlist mutual learning relationships in future university-school partnerships.

3. Further Development of Chinese LS for Education 4.0

3.1. Features of teaching and learning in Education 4.0

Research shows the positive effects of Chinese LS on improving teaching, developing teachers and implementing new curricula in China. Yet, the world has entered a new era: Industrial Revolution (IR) 4.0 in which the advancement of new technologies blurs the lines between the physical, digital and biological worlds. These advancements are led by the emergence of artificial intelligence, robotics, the internet, autonomous vehicles, bio and nanotechnology, 3-D printing, material science, quantum computing and energy storage (Diwan, 2017; Shwab, 2016). The Industrial Revolution 4.0 affects not only businesses, governments and people, but also education; thus the name Education 4.0 came into existence. Fisk (2017) identified the following nine trends related to teaching and learning in Education 4. 0. First, learning can be anytime, anywhere. E-learning tools offer opportunities for remote, self-paced learning. The flipped classroom approach allows interactive learning in class, while the theoretical parts can be learned outside the class time.

Second, learning is personalized to individual students. Harder tasks are introduced only after a certain mastery level is achieved. Positive reinforcement promotes positive learning experiences, boosting students' confidence about their academic abilities.

Third, students have a choice in determining how they want to learn. Although the learning outcomes of a course are presented by the institutions, students are free to choose the learning tools or techniques they prefer. Options may include blended learning, flipped classroom, and Bring Your Own Device (BYOD).

Fourth, students will be exposed to more project-based learning. Students apply their knowledge and skills in completing short-term projects which allows them to practice their organizational, collaborative, and time management skills, all of which are useful in their academic careers.

Fifth, students will be exposed to more hands-on learning through field experiences including internships, mentoring projects, and collaborative projects. Technological advancement enables the learning of certain domains, effectively making more room for acquiring skills that involve human knowledge and face-to-face interaction.

Sixth, students will be exposed to data interpretation in which they are required to apply their technological or ethical knowledge to numbers and use their reasoning skills to make inferences based on logic and trends from given sets of data. The manual part of mathematical literacy will become irrelevant as computers and artificial intelligence (AI) will perform the statistical analysis and predict the future trends.

Seventh, students will be assessed differently. The conventional platform to assess students may become irrelevant or insufficient. Factual knowledge can be assessed during the learning process, while the application of knowledge can be tested when students are working on their projects in the field

Eighth, students' opinions will be considered in designing and updating the curriculum. Students' input helps curriculum designers maintain up-to-date, and usefulness.

Lastly, students will become more independent in their own learning. This will force teachers to assume a new role as facilitators who guide the students through their learning processes.

These nine trends of Education 4.0 shift the major learning responsibilities from teachers to students. Hence, teachers should support the transition (Hussin, 2018).

To align with the new responsibility of learning shifted to learners in Education 4.0., a specific set of core skills is needed, which is recommended by the World Economic Forum (2016a). These top 10 skills are: (1) complex problem solving, (2) critical thinking, (3) creativity, (4) people management, (5) coordinating with others, (6) emotional intelligence, (7) judgement and decision making, (8) service orientation,

(9) negotiation, and (10) cognitive flexibility. To promote learners' development of these skills, teachers should create conducive learnin environments.

The following top 14 strategies for developing these core skills are recommended (World Economic Forum, 2016b):

1. Encourage play-based learning.
2. Break down learning into smaller, coordinated pieces.
3. Create a safe environment for learning.
4. Develop a growth mindset.
5. Foster nurturing relationships.
6. Allow time to focus.
7. Foster reflective reasoning and analysis.
8. Offer appropriate praise.
9. Guide a child's discovery to topics.
10. Help children take advantage of their personality and strengths.
11. Provide appropriate challenges.
12. Offer engaged caregiving.
13. Provide clear learning objectives targeting explicit skills.
14. Use hands-on approach.

3.2. Recommendation for developing Chinese LS for Education 4.0

As a traditional and powerful teacher professional development approach, Chinese LS should be improved to meet the needs of Education 4.0. By recognizing weaknesses of Chinese LS such as focusing on teacher performance rather than student thinking and focusing on reflection based on experience rather than analytical analysis, several strategies could be adopted to improve the LS process. First, theoretical notions such as learning trajectory (Simon, 1995) and variation pedagogy (Gu et al., 2004; Huang and Li, 2017) could be used as guiding principles during the LS process. Second, the LS process could be carried out as disciplined inquiry (Bryk et al., 2015) by adopting the ideas (pre, post- tests; intended, enacted and achieved goals of learning) from learning study (Marton and Pang, 2006) and investigating a focus-group of students during LS (Dudley, 2012). Thus, the LS process could be enriched as displayed in Fig. 1 (on the next page).

Within the LS cycle, it is crucial to identify important problems to address, and how to measure the outcomes of solving the problems. Before planning a lesson, it is important to understand student learning readiness through a pre-test or interview with focused students. During the teaching and observation, it is necessary to use certain instruments to capture critical teaching moments and student learning evidence. Immediately after the research lesson, a post-test and/or interview are needed to collect student learning outcomes. During debriefing, based on the collected data, analysis of results should be incorporated for revising the lesson plan for the next cycle of LS.

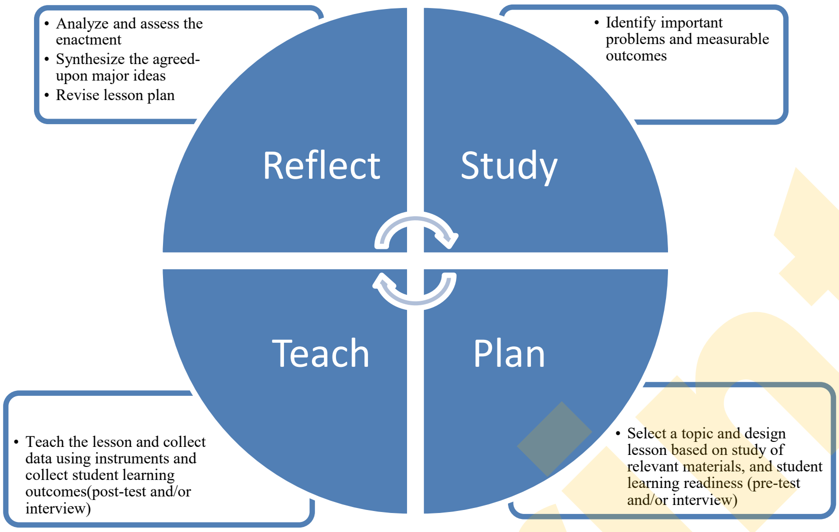

Fig. 1. Enriched Chinese LS process

With regard to promoting the Chinese LS systemwide, some ideas from improvement science (Bryk et al., 2015; Lewis, 2015) and networked improvement community (Russell et al., 2017) could be adopted. There are six core principles of improvement. First is to make the work problem-specific and user-centered. It starts with a single question: "What specifically is the problem we are trying to solve?" Second is that variation in performance is the core problem to address. The critical issue is not what works, but rather what works, for whom and under what set of conditions. The third core principle is seeing the system that produces the current outcomes. It is hard to improve what you do not fully understand. It is important to understand how local conditions shape work processes and make hypotheses for change public and clear. Fourth, we cannot improve at scale what we cannot measure. It is important to embed measures of key outcomes and processes to track if change is an improvement. Fifth is to anchor improvement in disciplined inquiry. Engaging rapid cycles of *Plan, Do, Study, Act (PDSA)* make learning faster and improvement quicker. It is not a problem that failures may occur, but it is a problem if we fail to learn from failures. The last core principle is to accelerate improvements through networked communities. We can accomplish more together than even the best of us can accomplish alone.

An examination of PDSA cycles (core principle 5) (See Fig. 2 on the next page) shows that the PDSA and LS cycles are nicely matched. At each phase of PDSA, there is a detailed description about what needs to be done. For example, Plan: analyzing the cause of problem within the system. Act: we have to make explicit the measurable outcome and hypothesis and have a theory in action (protocol). In the context of LS, it

Fig. 2. Plan-Do-Study-Act (PDSA) circle

is crucial to measure what students learn, and how certain types of intervention link to learning outcomes. The PDSA cycle could be repeated to continuously hypothesize and test the improvement. Regarding LS context, building on the product of a cycle of LS (lesson plan and video lessons, measurement and learning evidence), further cycles of LS could continue to address the identified problem. Thus, this type of LS could be conducted across schools in the same district or across districts. In the last principle, the networked improvement communities (NICs) could accelerate the improvement.

There are six principles for building NICs (See Fig. 3), including: understanding the problem, iteratively refining the theory of practice improvement; learning and using

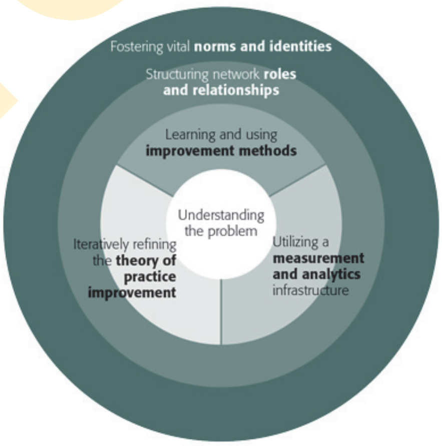

Fig. 3. NICs development framework (adapted fro Russel et al., 2017)

improvement methods; utilizing a measurement and analytics infrastructure; structuring network roles and relationships, fostering vital cultural (norms and identifies (Russel et al., 2017).

Considering the situation of LS in China, there is a culture and a structure (teaching research system and collaborative learning culture), but there is lack of the methodology and theory of practice improvement. The hierarchical and networked teaching research system in China lays a foundation for building networked LS-based improvement communities. If we adopted some principles such as theory of practice improvement and disciplined inquiry, the existing teaching research system could be developed into networked improvement communities (local and nationwide). For example, a school-based LS improvement community could be networked with other school-based LS improvement community within the same district, and the networked improvement communities in a district could be networked across the district, even across cities or regions. Correspondingly, teachers' learning could expand beyond their schools.

In addition, various technologies could be used to strengthen the LS process and develop a networked improvement community. Huang et al. (2021a) proposed a model of technology-assisted LS (Fig. 4). In the special issue on technology and LS (Huang et al., 2021a), studies document the strengths of using technology-assisted LS including: resolving geographical distance; building a productive professional learning community; capturing rich student learning evidence; and promoting deep teachers' reflection. Certainly, technology can assist Chinese LS as well (Huang et al., 2021c). Moreover, an AI-assisted LS model: TEAM model and a Sokrates platform (https://www.habook.com/en/product.php?act=view&id=37) demonstrates its potential to develop a networked improvement community (Huang et al., 2021b). The TEAM model focus on developing smart classroom teaching through four phases: Teaching, assEssing,

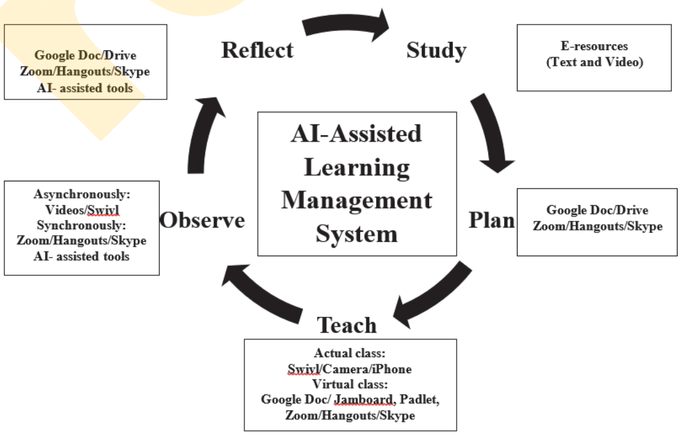

Fig. 4. Technology-assisted Hybrid LS (adapted from Huang et al., 2021a)

diAgnosing and reMediation (TEAM) in an online environment based on the TPACK framework (Mishra and Koehler, 2006). The key feature is data-driven decision-making during the teaching. The TEAM model platform includes lesson observation, AI Sokrates analysis, expert annotation, and Sokrates cloud. The platform can support LS in several different ways significantly.

First, during the process of observing a research lesson, all observing teachers can enter their observations and comments with regard to use of technology, pedagogy and textbooks through their devices. The platform can collect and analyze all teachers' input automatically. Meanwhile, the research lesson is recorded and analyzed automatically (regarding different types of classroom activities). Immediately after the research lesson, the system generates the analytical information for post-lesson discussion, with the facilitator having the ability to promote the discussions based on analytical data (Fig. 5).

More importantly, the platform stored relevant data for future sharing.

On the platform, all shared data could be sorted and searched based on theme, subject, grade level, all those lesson study groups are networked. AI-assisted technology may contribute to building true NICS.

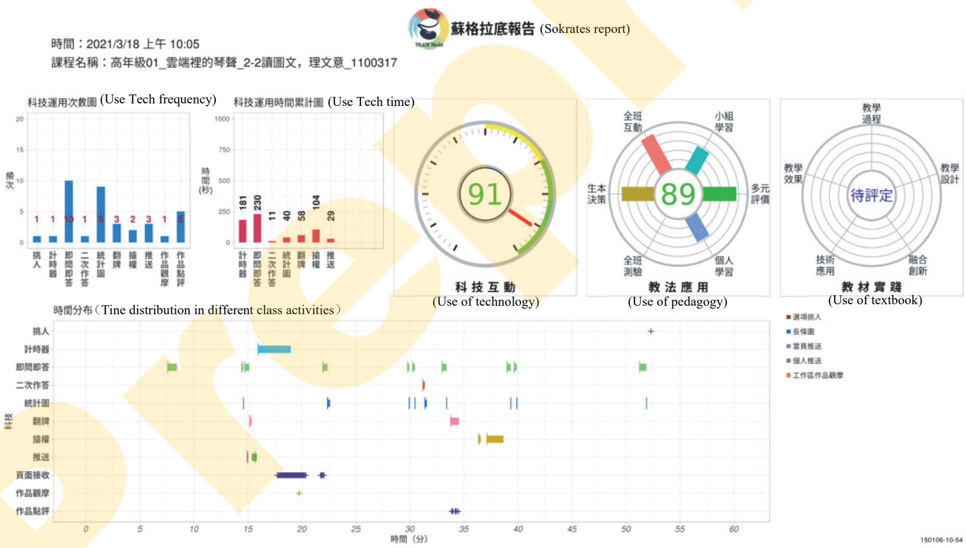

Fig. 5. Dashboard of the Sokrates platform

Second, both research lessons and participants' comments and analysis are stored in the cloud. Teachers can watch and add comments to the research lessons. On the platform, users can search research lessons based on subject, grade level and teaching research activities (expert comments, self-practicing, professional development analysis report and exemplar lessons). These features of the platform show the possibility for developing a networked LS improvement community substantially at scale although some more adjustments are needed. Examples are how to consider the features of mathematics subject to provide a framework for teachers to enter their subject-specific comments in depth; when emphasizing data-driven, analytical analysis, how to use expertise of facilitators holistically; and when storing the documents, how to make the search more precise and flexible regarding learning goals, student learning difficulties.

4. Implications of Chinese LS for LS Globally

The key features of Chinese LS such as iteration, the involvement of knowledgeable others, focusing on both process and product, and linking theory and practice may provide insight into enrichment of LS around the world. For example, the repeated teaching of the same content (similar to design-based implementation research) (Fishman et al., 2013) has been adopted by UK-research LS which focuses on using multiple cycles of LS with a deep investigation of a group of focus-students. Involvement of the knowledgeable others (or facilitators) in the LS process has been recognized as one of the important factors impacting the success of LS (Takahashi and McDougal, 2016; Seleznyov, 2019). Focusing on both process and products of LS is critical for scaling up LS and building a networked improvement community (Hiebert and Morris, 2011). However, when adopting lessons originated in Asia to other countries, cultural transposition (cultural beliefs, institutional intentions) should be considered (Bartolini Bussi et al., 2017; Ramploud et al., 2022) and necessary modifications made by incorporating local culture and traditions.

5. Concluding Marks

Rooted in Chinese cultural values and supported by the teaching research system and teacher promotion system, Chinese LS has contributed to the improvement of mathematics and science education nationwide over the decades. Meanwhile Chinese LS itself has evolved and developed into new forms and connotations to meet teacher professional development needs in changing contexts. The continuity and change keep the Chinese LS a dynamic and vital professional development vehicle for teachers to meet changing challenges. Chinese LS is local tradition with a long history, but it has evolved to meet the challenges of teacher professional development by taking innovative ideas from the West. At the same, the practice and development of Chinese LS may provide insights into teacher professional development in other countries.

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