Learning to teach with mandated curriculum and public examination of teaching as contexts

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Abstract

This case study explores how a Chinese beginning teacher developed her professional knowledge of mathematics instruction under the influences of a mandated curriculum and a contrived teaching organization. It finds that the teacher was able to develop a mathematics lesson that engaged students in discovering mathematics ideas and making sense of their relationships and her way of teaching was influenced directly and indirectly by the nature of the mandated curriculum and teaching organization in the context of her work. Her exploration of the mandated curriculum individually and with her colleagues contributed to her understanding about mathematics concepts and their representations. Other teachers' systematic observations and discussions about her teaching with a focus on pedagogical content knowledge helped her develop and refine her teaching strategies. Such a focus was again shaped by the ways in which the mandated curriculum and teaching organization are structured. Some shared concepts in mandated curriculum and the teachers' working language mediated her understanding of the curriculum and other teachers' examinations about her instruction. The study indicates that the ways in which the mandated curriculum is structured and teachers are organized may help teachers develop the necessary professional knowledge for teaching.

Keywords: Teacher education in China; Case study; Mandated curriculum; Learning to teach; Teachers' professional knowledge

Scholars often hold different ideas regarding whether contrived curriculum and teaching organization or teachers' autonomy in making teaching decisions is necessary for developing teachers' professional knowledge and quality teaching practice. Drawing on data from a Chinese beginning teacher and her colleagues, we argue that the contrived curriculum and teaching organization and the autonomy teachers have in making their teaching decisions are not always contradictory in influencing the quality of teachers' knowledge and their teaching practice. Depending on the ways in which they are organized, the contrived curriculum and teachers' relationships can play an important role in developing teachers' professional knowledge and offering them the necessary autonomy to make teaching decisions.
1. Teachers’ professional knowledge: functions and questions

A specialized body of professional knowledge, pedagogical content knowledge, is assumed necessary for teachers to develop quality teaching (Darling-Hammond, 1998; Kennedy, 1991a; Shulman, 1987). This knowledge includes a deeper understanding about subject matter, in particular, its content, inquiry, and dispositions (Ball & McDiarmid, 1989) and a proper representation of these ideas for particular groups of students in instruction (Grossman, 1990; Grossman, Wilson, & Shulman, 1989; Shulman, 1986).

Several conditions are identified as necessary for teachers to develop their professional knowledge. They need opportunities to reason about subject matter in relation to pedagogy, argue the alternatives (Kennedy, 1991a; National Center for Research on Teacher Learning, 1993), and apply their thoughts to uncertain and irregular contexts of teaching (Clark, 1988; Leinhardt & Greeno, 1986). They need a collegial professional community in the context of teaching in which they can interdepend in reflecting, exploring, and improving their teaching practice (Little, 1987; Putnam & Borko, 2000). They also need shared technical terms and concepts in their working language for reflecting on, discussing about, and advancing their professional knowledge like professionals in the fields of law and medicine (Jackson, 1986; Lortie, 1975).

However, teacher educators and staff developers in the US face serious challenges when supporting teachers to develop professional knowledge. First, teachers often lack shared technical terms and concepts in their working languages. Such a situation not only lowers the social status of teachers as professionals but also makes it difficult for the teaching profession to attract talented minds that can contribute to professional knowledge (Gitlin & Labaree, 1996). It also forces teachers to rely on their practical and personal experiences instead of specialized professional knowledge in their work (Carter, 1990; Clandinin & Connelly, 1995; Elbaz, 1983; Hargreaves, 1984). Second, teachers are not accustomed to conducting pedagogical reflections on their practice and learning to teach with principled knowledge as a guide (Carter, 1990; Feiman-Nemser & Buchmann, 1987; Kagan & Tippins, 1991; Schram, Feiman-Nemser, & Ball, 1990). Third, the individualized nature of teaching prevents teachers from sharing and examining each other’s teaching practice and reflecting on the assumptions underlying what they are doing (Feiman-Nemser & Floden, 1986; Lieberman, 1992; Little, 1990).

Two conflicting perspectives have developed regarding how to create a collegial professional community of teachers in which they can develop professional knowledge for quality teaching. One perspective emphasizes teachers’ autonomy in producing a collegial professional culture where teachers can reflect and critique each other’s teaching practice (Hargreaves & Dawe, 1990). It suggests that a collaborative culture comprises evolutionary relationships of openness, trust, and support among teachers where they have the autonomy to define and develop their own purpose and curriculum. Any kind of contrived collegiality where colleagueship and partnership are administratively structured and imposed presents even further difficulties for creation and persistence of a collaborative culture. According to this assumption, all teachers are the leaders of their students and preside over the production of professional knowledge and, thus, should have autonomy in initiating a culture of professionalism (Devaney & Sykes, 1988). This perspective is supported by a study using a survey with 2000 teachers and semi-structured interviews with 200 teachers in schools in England (Helsby & McCulloch, 1996). This study reported that the recent National Curriculum and testing reform in England weakened teachers’ professional confidence, lowered their moral, and left them uncertain of their ability and right to make major curriculum decisions. This perspective also echoes the complaints of many US teachers who reported that the current movement of curriculum and teaching standards in the US does more harm than good to their creativity and inquiry related to instruction. It pushes them to chase examinations and focus on the restricted content and goals of teaching instead of the authentic learning of their students.
The other perspective (Ball, 1994; Little, 1990) regards teachers’ autonomy in defining their own purpose, content, and teaching approaches as detrimental to the collegial professional relationship among teachers. Such autonomy makes it difficult for teachers to develop any sense of common standards or to disagree with each other and it helps teachers to hide their individual struggles in learning to practice wisely, and, thus, removes the opportunity for collaborative support, critical reflection, and mutual examination of teaching practice (Ball, 1994). It also weakens the intellectual, social, and emotional demands for interdependence among teachers and reduces their collaboration, if any, to story sharing and informational assistance instead of joint-work that requires consensus of thought and uniformity of action (Little, 1990).

Recent international studies fuel this debate with more complicated cases and examples that support the latter assumption. Hargreaves (1994) found that the government-initiated educational reforms, like the New National Curriculum and testing, are resulting in an unintended professional culture in the schools of England and Wales in which “teachers are not merely working more collaboratively but feel a stronger obligation towards and responsibility for their colleagues” (p. 424). The recent video study from the Third International Mathematics and Science Study (Stigler, Feiman, & Yoshida, 1996; Stigler & Hiebert, 1999) also found that Japanese teachers, working under a centralized curriculum system, were more likely than their US counterparts to teach authentic mathematics content, focus on student conceptual understanding, and engage students in inventing solutions to solve problems. A particular organization of Japanese teachers, lesson study groups, is seen as having important influences on Japanese teachers’ instruction (Lewis, 2000; Lewis & Tsuchida, 1998; Stigler & Hiebert, 1999). The in-depth interviews with Chinese and US elementary mathematics teachers (Ma, 1999) revealed that Chinese teachers developed a more sophisticated understanding about mathematics content and more flexible and stronger representations of mathematics concepts than their US counterparts. Their intensive study of a national curriculum and teaching materials as well as a teaching organization (teaching research groups) that encourages teachers to plan lessons together, and to observe and reflect about one another’s instruction, are assumed to shape their pedagogical content knowledge (Paine & Ma, 1993).

These studies point to a possible positive influence of the contrived curriculum and teaching organization on teachers’ collaboration and collegiality and, thus, their professional knowledge necessary for quality teaching (Lewis, 1995; Ma, 1999; Schmidt, Houang, & Wolfe, 1999; Stigler et al., 1996; Stigler & Hiebert, 1999). However, few studies are developed to understand the following two questions:

What are teachers working in a contrived curriculum and teaching organization able to learn about teaching?

How do the contrived national curriculum and teaching organization influence the development of teachers’ professional knowledge and practice?

Without a proper understanding of influences, the impact of the contrived curriculum and teaching organization on teachers’ collegiality and their professional knowledge is still speculative rather than supported by research. In this study, we explore and develop a deeper understanding of these issues.

2. Participants, data, and methods

2.1. Participants and context of the study

This case study examines the experiences of a Chinese middle school beginning teacher, Ms. Zhen,² in developing a public mathematics lesson for special observation. We chose Ms. Zhen as the subject of this study because she shares a similar background with many Chinese beginning teachers.

²All the names used here or in the other places of this paper are pseudonyms.
Ms. Zhen graduated from a teacher education program in the nearby university a year before our data collection started and was assigned to teach mathematics to two 6th grade classes in her school. Like many of her counterparts, Ms. Zhen had no teaching experience except for her student teaching, which provided few chances to develop an understanding about students, although student teaching did help her develop a sense of how to plan and teach a lesson. Like other beginning teachers, Ms. Zhen experienced a tough period in her first year of teaching. Classroom management became the major focus of her struggle. Moving to her second year, she started to gain confidence in classroom management and directed her attention to learning to teach mathematics and understanding student learning.

The school where Ms. Zhen worked was similar to other Chinese secondary school contexts with both middle and high school grades. In contrast to a few selective “key” secondary schools, this school admitted students from a population left over after “key” high schools made selection based upon scores in the city level high school entrance examination. Its middle school portion draws students from surrounding areas like other Chinese secondary schools. Like many other secondary schools in the city, her school was experiencing a shortage of experienced teachers because of school expansion resulting from the area’s economic boom and the retirement of senior teachers. Most teachers there were young, female, and inexperienced.

We chose to focus on Ms. Zhen’s experience in developing and teaching a public lesson. We assumed that such experiences offered us an opportunity to examine the relationship between the contrived curriculum and teaching organization and teachers’ professional knowledge development.

Like many beginning teachers in China, Ms. Zhen was often required to give public lessons for teachers, researchers, and school administrators to observe and examine. The observation focused on the requirements and standards of the mandated curriculum. According to the principal and the leader of the teaching research group in the school, such public lessons occurred at the levels of the teaching research group, school, and school district and involved the collaborative efforts of teachers in the school. Thus, such a public lesson allowed us to observe Ms. Zhen’s best effort in teaching using mandated curriculum.

Mathematics teaching, whether teaching public or regular lessons, in Ms. Zhen’s school strictly followed the mandated curriculum. It included a teaching and learning framework for mathematics, a textbook, and a teachers’ manual. The National Department of Education published the teaching and learning framework and specified what students in each grade level should learn along with standards for their learning. The City’s Department of Education developed and published the textbooks and teachers’ manuals consistent with the national teaching and learning framework. Like all the other Chinese teachers, Ms. Zhen had no choice but to follow the mandated curriculum materials. Her goals of teaching were pre-determined. She was obligated to help students reach the standards specified in the framework. Student learning was then checked by the district-level examinations that were based on the mandated curriculum and administered twice each semester.

Ms. Zhen was also a part of two different teaching research organizations contrived in the school to facilitate and organize teaching activities (Ma, 1999; Paine & Ma, 1993). The teaching research group for individuals teaching the same subject matter in the school was organized for teachers to observe and reflect on each other’s lessons and discuss teaching and examination. The lesson preparation group, a sub-organization of the teaching research group, included teachers in the same subject area teaching at the same grade level. This group studied the mandated curriculum materials, planned lessons and units together, and shared teaching experiences on a regular basis.

Although Ms. Zhen shared many characteristics of beginning teachers in ordinary school situations, our intention is not to generalize the findings from this case to beginning teachers in similar situations. Instead, this study, like most other case studies, focuses on attaining a deeper understanding about the relationship between teachers’ professional knowledge and instruction and the
contrived curriculum and organization contexts and questioning some assumptions about that relationship.

2.2. Sources of data collected

The data for this study come from a larger data set in a comparative research project, Induction of Middle Grades Mathematics and Science Teachers in Select Countries, funded by the National Science Foundation, which was developed to understand how middle grade beginning teachers learn to teach mathematics in different national contexts. The comparative project conducted interviews with 26 beginning teachers, 41 experienced teachers, 22 school-level administrators, 39 district-level administrators and professional development providers. It also observed 29 public mathematics lessons taught by beginning teachers and the discussions of the teaching research groups around most of these lessons in 21 schools in a big city in the east part of China where Ms. Zhen taught. We chose to focus on Ms. Zhen because the data collected around her case were richer and more comprehensive compared with other Chinese beginning teachers in the project. Specifically, the following data were collected and analyzed to address our questions.

A videotaped public lesson on fraction multiplication taught by Ms. Zhen was analyzed to capture the important features of her teaching in light of mathematics representation and mathematics learning. An interview with Ms. Zhen provided information about how she planned the lesson, how she thought about it, and the factors that she perceived as influential to her teaching and learning to teach. The national teaching and learning framework, textbook, and teachers’ manual that Ms. Zhen used to prepare and teach her public lesson offered information about the relationship between the mandated curriculum and her teaching. An audiotaped discussion in the teaching research group about Ms. Zhen’s public lesson was coded and analyzed to identify the opportunities that she had in learning about her teaching through formal teaching organizations. In addition, we conducted interviews with Ms. Zhen’s mentor, the leader of the teaching research group, the director of the Teaching Guidance Office, and the principal of the school. These interviews offered more general information about Ms. Zhen’s lesson and about her learning to teach from the perspectives of school teachers and administrators, as well as information about mathematics teaching, teaching organization, public lessons, and the professional development of beginning teachers in the school.

2.3. Method of data analysis

All the data for this study were translated from Chinese into English and then transcribed. To address our research questions more directly, we analyzed Ms. Zhen’s public lesson to attempt to capture the ways in which she represented mathematics concepts, engaged students in learning the concepts, and dealt with dilemmas and problems of student learning. The features of this lesson were then analyzed in light of the expectations of mathematics education reformers in the US (National Council of Teachers of Mathematics, 1989, 1991, 2000) and China (Dai, 1998; Gu, 1991; Liu, 1995). According these expectations, mathematics instruction needs to encourage students to reason, conjecture, and prove mathematical ideas carefully in a community of learners, and to conceptualize and solve mathematical problems through flexible use of various mathematics ideas and their connections.

We coded the patterns that emerged from the interview with Ms. Zhen to capture the ways in which she came up with her ideas and approaches for teaching this lesson.

It is worth noting that one public lesson could not necessarily represent all kinds of lessons that Ms. Zhen might teach at the time of our data collection. However, it did represent the best effort that she put in the teaching based upon the curriculum and expectations of her colleagues.

3Instruction guidance office is an organization that is responsible for organizing and coordinating the activities of teaching research groups in different subject areas, student enrollment and graduation, and teacher professional development. A formal organization exists in all kinds of elementary and middle schools in China, although its functions can be varied to an extent.
because of the nature of a public lesson and the ways in which such a lesson was used.

The mathematics topics, representations, and instructional suggestions emerging from the mandated curriculum materials that Ms. Zhen used for her public lesson were also coded. The relationships between her ideas and those in the curriculum materials were identified through the constant comparison technique suggested by Strauss and Corbin (1990). A similar analysis of the discussion about the lesson with the teaching research group was also done to capture the relationship between the ideas and topics discussed in the teaching research group and Ms. Zhen’s thinking about and learning from these experiences.

To strengthen the data interpretation and identify other possible factors that influenced Ms. Zhen’s public lesson and learning to teach in this experience, the remaining interviews were coded to triangulate the findings from the analysis of Ms. Zhen’s public lesson, the interview with her, the curriculum materials that she used, and the lesson discussion in the teaching research group.

In the following sections, we analyze Ms. Zhen’s public lesson, her ideas, and the approaches that she used. We also illustrate the relationship between her teaching, the mandated curriculum materials she used, and the kinds of supports that Ms. Zhen received from the teaching organization for her teaching. Then, we discuss how the focus of support she received from her colleagues was shaped. We also look at her understanding of curriculum and how the suggestions of her colleagues were mediated by the mandated curriculum and the contrived teaching organization. In the final section, we synthesize our findings and discuss the implications of this study.

3. Public lesson: a fraction multiplied by a fraction

3.1. Lesson description

This lesson was prepared for observation and discussion by school administrators, the teaching research group, and the researchers from school district. Two researchers from our comparative project also observed and videotaped the lesson.

Fifty students were sitting in pairs at desks arranged in four rows facing a teaching platform at the front. Showing a prepared square of 1 m in length on the blackboard, Ms. Zhen started the lesson by stating, “We have learned a fraction times a number. Today we are going to learn a fraction times a fraction. We have a square here and what is its length?” The class responded together, “It is one meter.” Ms. Zhen pursued a further question, “Can anyone draw a rectangle with 4/5 meter length and 2/3 meter width within this square?” She called one volunteer to draw on the blackboard and asked the class to do it on their own at their desks.

A few minutes later, most students finished drawing and anxiously raised their hands to show Ms. Zhen their answer. After checking a few students, Ms. Zhen pointed to the graphic on the blackboard and asked the volunteer, “How did you draw it?” The student told the class that he cut the bottom line of the square into 5 even pieces, the left line into 3 pieces, and divided the square into 15 evenly cut segments. Then he highlighted the rectangle (see Fig. 1).

“What is the area of the rectangle? Let’s calculate the area based upon the graph you drew?” Ms. Zhen asked. She walked around,
checked some students’ work, and praised those who finished both graph and calculation fast and then called a boy, Chang, to explain his answer. Chang told the class, “It is 8/15. The square is divided into 15 pieces, the rectangle is 8 pieces, and so the area is 8/15.” After restating the Chang’s answer, Ms. Zhen showed a rectangle with the same length and width but without the original square on an overhead and asked the class, “What is the area of this rectangle?” “8/15.” The class responded.

Ms. Zhen pointed to the rectangle and said, “Let’s look at this problem, how do we calculate it? What theorem do you use to calculate the area of rectangle?” “S = LW,” the class responded. Ms. Zhen wrote the theorem on the blackboard and asked the class to calculate the area of the rectangle with the theorem they proposed. A girl, Wei, was called on and she answered, “It is 4/5 x 2/3.” Ms. Zhen moved to today’s topic and asked, “Can anyone infer the theorem of fraction multiplication from this problem?”

A girl, Shen, raised her hand and told the class, “I find that 5 x 3 = 15, that is denominator and 4 x 2 = 8, that is nominator. So, I say a denominator times a denominator is the denominator. And a nominator times a nominator is the nominator.” Ms. Zhen showed the definition of a fraction times a fraction on the overhead projector and asked the class to read after her, “Fraction multiplication, denominator x denominator, its result is a denominator and nominator x nominator, its result is a nominator.” She asked the class to cut out the rectangle that they drew and compare it with each other’s answer and then divided the class into groups of four to discuss and calculate to see if they could come to the same conclusion with other mathematics ideas that they learned before.

A few minutes later, a student, Jiang, was called on and told the class nervously, “We learned a fraction times a whole number before, so I think… We can use this knowledge to infer an alternative way.” Being encouraged by Ms. Zhen, Jiang continued her answer, “We can use 4/5 x 2/3 = 4/5 x (2 + 3).”

“How did you get this? We do not know if it is right, let’s calculate to see if it is OK.” Ms. Zhen pursued. Jiang said, “When taking brackets, ( ), away, we do not change the division sign into the multiplication sign inside ( ) because we have multiplication sign before them. So we have 4 x 2/5 + 3. That is 8/5 + 3”

“What theorem did you use to get this?” Ms. Zhen asked. Jiang replied, “When a fraction times a whole number, the denominator does not change, and the nominator times the whole number.” Jiang told the class that she could use the theorem of a fraction divided by a whole number to calculate 8/5 + 3. Ms. Zhen asked, “Is that what we learned last time?” “Yes, a fraction times a whole, the nominator does not change; denominator times the whole number and its result as denominator,” the class replied.

Ms. Zhen summarized Jiang’s answer by writing the following on overhead: (1) take away ( ), (2) fraction times a whole number, (3) fraction divided by a whole number. She praised students’ clear thinking and stressed that the knowledge they learned was related to each other. Then she reaffirmed the theorem that the student had learned today once again, “When a fraction is multiplied by a fraction, we multiply nominators and the result is the nominator, and then we multiply denominators and put the result as the denominator.”

Moving to the guided practice of this lesson, Ms. Zhen put a problem, 5/6 x 5/7 =, on the blackboard and asked three students to work in the front and the rest of the class to do it on their own. As the class finished their calculation, Ms. Zhen checked the steps of calculation on the blackboard with the class. Two students solved the problem using the theorem they learned. The third student did it correctly but used the method that Jiang used to prove the theorem. Ms. Zhen praised the student’s knowledge and then asked the class which method was better in this case. The class agreed with the new method because it solved the problem faster. Ms. Zhen agreed, “We have already found the new theorem, it is better to use the new theorem and it is more efficient.”

Ms. Zhen had the class do another problem, 5/8 x 3/9, in a similar way. This time, the first boy did it right by first simplifying 3/9 to the lowest term and then following the theorem they learned.
The second student made a calculation mistake. The third student, Lin, did it correctly by following the theorem without simplifying 3/9 to the lowest term first. Ms. Zhen checked each answer with the class. They corrected the calculation mistake by the second student and pointed out the inefficiency of Lin’s method. Complimenting the students’ effort, she gave two more problems for the class to solve in the same way. All the answers were correctly calculated by following the simplified theorem this time.

Putting the problem, $7 \div 5/21 = \_\_\_\_$, on the blackboard, Ms. Zhen asked if there was a difference between this problem and those they did a moment ago. Students quickly realized this problem was about a whole number times a fraction. A girl, Wang, was called to solve the problem on the blackboard and the rest of the class did it individually on their seats. Wang first turned 7 into 7/1 and then calculated $7/1 \times 5/21$ by following the theorem they learned. Ms. Zhen praised Wang and asked the class, “Can we do it differently?” “Yes!” the class responded together. A boy told the class his idea, “We can use the theorem of a fraction times a whole number by using the exchange property of multiplication.”

Ms. Zhen ended her guided practice by several summative questions. “What theorem did we learn today?” she asked. The whole class responded, “Nominator times nominator and its result is the nominator. Denominator times denominator and its result is the denominator.” “What do we need to be careful about?” The class chorused, “To get the lowest term before you multiply them.” She pointed to the problem $7 \times 5/21$, “If we have this problem, we can do it by following the theorem of a fraction times a fraction.” She wrote on blackboard, “$7/1 \times 5/21$. Or $7 \times 5/21 = 7/21 \times 5$ by following the exchange property of multiplication.”

In the last 10 min, Ms. Zhen did two activities to engage students in practicing what they learned. She first used flash cards with questions of a fraction times a fraction to check how well the class could calculate. All the students who were called to answer did the problem correctly. Then she played a game in which the class was divided into two groups and each member from one group took turns to compete with a member from the other group for calculating the question of fraction multiplication correctly on each flash card that Ms. Zhen showed. Then they had to pick up one of the peaches on a prepared paper tree with a number matching their answer for the question on the flash card. The group that could correctly pick more peaches from the tree was the winner. Two students from each group worked as judges for this game. The result of the competition was a tie. Ms. Zhen praised both groups for their correct calculation and collectivist spirit that, Ms. Zhen stressed, was important for the class to be a big family. She finished this lesson with the following homework question.

Here is the homework for today. One mantis is 1/2 centimeter long. When jumping once, it can reach the distance that is 1 and 5/8 times longer than its body length. We want to know how far it can reach after it jumps 100 times.

3.2. Features of the lesson

Although Ms. Zhen’s lesson looked much like a direct instruction with substantial teaching time on different kinds of practice, our analysis of its substance pointed us to several features of her mathematics instruction. First, in this lesson, students had an opportunity to discover the theorem and identify the relationship between the geometry ideas that they had already learned and the theorem of fraction multiplication that they were learning. For example, the theorem of fraction multiplication was discovered through students’ use of their prior knowledge about rectangle area calculation in exploring about the mathematics problem, a rectangle within a square, carefully designed by the teacher instead of being informed directly by Ms. Zhen.

Second, students had opportunities to develop an alternative proof for the theorem discovered and a different solution for the problems solved in the lesson. Ms. Zhen encouraged students to find an alternative proof for the theorem of fraction multiplication by using their knowledge of multi-step division and multiplication after their exploration about a rectangle within a square. Later,
in calculating a whole number times a fraction, students were again encouraged to come up with an alternative solution by using the exchange property of multiplication.

Third, in the lesson, students were engaged in examining their ideas and solutions carefully along with the teacher and judging which answer was more persuasive and efficient. When presenting their alternative solutions to the problems of fraction multiplication and a whole number times a fraction, students were pushed to provide a proof for each step of their proposed theorems. Later, when students offered different approaches to calculate the problems, 5/6 × 5/7 = ? and 5/8 × 3/9 = ?, their solution pathways were compared by the class in light of their efficiency.

Fourth, in this lesson, the homework and practice section was not only designed simply to reinforce what students had already learned but to expand students’ understanding of what they learned. The homework that Ms. Zhen gave to students was a complicated problem that could not be solved by simply following the theorem or any alternative solutions that they developed in class but required them to use what they learned flexibly along with other mathematical ideas in developing a solution.

These features of Ms. Zhen’s lesson mirror many ideas of mathematics instruction that mathematics education reformers in China and the US encourage, such as: mathematics instruction needs to support students in reasoning, conjecturing, and proving mathematics ideas among a community of learners, and in solving problems through flexible use of various mathematics ideas (National Council of Teachers of Mathematics, 1989, 1991, 2000); and mathematics teachers should encourage students to be active learners, support them to make connections conceptually within and beyond mathematics, and engage them in problem-solving and creative thinking (Dai, 1998; Gu, 1991; Liu, 1995). These features also suggested important progress that a beginning teacher with only 1-year of teaching experience was able to achieve in learning to teach mathematics, a degree of progress that many beginning teachers find difficult to accomplish.

4. Public lesson development

4.1. Process of lesson development

How did Ms. Zhen develop this lesson? Our analysis of the interview with her yields the following findings. In planning this lesson, Ms. Zhen first spent considerable time reading and analyzing the textbook and teachers' manual to understand “what the important and difficult points were, which area needed to be stressed in teaching, and where students would likely make mistakes.” Then she individually developed a preliminary lesson plan by considering “how to teach it in an active way and by involving students in it.” Next, she shared her lesson plan with several senior mathematics teachers in the teaching research group and revised it based upon their suggestions. Ms. Zhen then taught a trial lesson in one of the two 6th grade classes she taught which was observed and critiqued by her colleagues in the teaching research group. She revised the lesson plan again based upon her experiences in teaching the trial lesson and suggestions from her colleagues. In the end, she formally taught this public lesson, which was again observed and critiqued by the teachers in the teaching research group.

It is obvious that the development of such a public lesson requires a huge investment of time and effort on Ms. Zhen’s part. However, according to the principal of the school, such public lessons could happen several times each semester for Ms. Zhen as well as for other beginning teachers. In addition, every beginning teacher in the school was also required to teach public lessons for their teaching research group. In both cases, beginning teachers did not receive any special relief from their ordinary teaching load.

4.2. Articulation about the lesson

From our analysis of the interview with Ms. Zhen, two important decisions that she made in planning this lesson emerged. First, she carefully decided the content and objectives for this lesson:

Today, I taught students a fraction times a fraction and how to calculate it. It included a
fraction times a fraction and a whole number times a fraction... These are the major topics of this lesson. My objectives for this lesson were that students would understand these ideas first, and then I helped them apply the ideas using the game. I wanted to see who was quick. Some of them were really smart. More importantly, I wanted them to develop a sense of collectivism. If you get good grade, it is not enough. Only if we all have good grade, that is good. I wanted them to focus on the group and class, not on individuals.

She also decided to approach this lesson from “what they were familiar with, and then gradually moved toward the abstract ideas.” She developed a particular way of representing the mathematics ideas she needed to teach in order to help students move from the familiar to the abstract with consideration of what the important and difficult points were for students to learn:

The important point of this lesson is to help students understand the idea of a fraction times a fraction while the difficult point is how we can deduce the theorem... So, I asked them to draw the picture to help them see the shape of rectangle with a length of 4/5 meter and width of 2/3 meter. This picture included all the information they had learned about fractions before. They use these fraction ideas to divide the rectangle into 15 parts. If I asked them to multiply two fractions directly, they would have a hard time understanding why the theorem worked. Then we discussed the theorem of a fraction times a fraction. We proved it step by step. This time, the representation they used included what they learned in elementary school, like calculating multi-step addition, subtraction, multiplication, and division involving ()

It is clear that Ms. Zhen’s public lesson was influenced by her understanding of the mandated curriculum and her interactions with her colleagues. Her well-articulated ideas of what and how students needed to learn and how to facilitate their learning in planning were also factors in her success. Such efforts and articulation are impressive for a beginning teacher considering that teachers’ knowledge is experiential and practical (Carter, 1990; Clandinin & Connelly, 1987; Elbaz, 1983). Even successful teachers often have difficulty in articulating and sharing their thoughts with others (Feiman-Nemser & Remillard, 1996; Kennedy, 1991b; Little, 1990).

5. Direct influences of curriculum and teaching organization

5.1. Textbook and teachers’ manual

The mandated mathematics textbook and teacher’s manual designed especially for 6th graders directly influenced Ms. Zhen’s effort in developing and implementing her public lesson. The textbook covers various theorems and concepts about fractions and circles. Each theorem or concept section contains the representation, proof, definition of the theorem or concept, and examples and exercises related to its use. The teachers’ manual specifies the goals and objectives of teaching each theorem or concept based upon the national framework of teaching and learning. Consideration is also given to what students already learned, are learning, and are going to learn. The manual also provides specific suggestions for timing the lesson and for using representations and extension activities to reinforce students’ learning. The influences of these curriculum materials were significant in the following ways.

First, the teachers’ manual shaped the objectives of Ms. Zhen’s lesson. She attended to each of the requirements but also integrated her own ideas in establishing her lesson objectives.

The teacher’s manual (Shanghai Curriculum and Teaching Materials Reform Committee for Elementary and Secondary Schools, 1995a) suggests that teachers who teach fraction multiplication help students “know the meaning of fractions addition, subtraction, multiplication, and division, understand the concepts, theorem, and process related to fraction calculation, and be able to calculate problems of fraction addition, subtraction, multiplication, division, and solve the word problems of such calculations correctly” (p. 5). It
also suggests that teachers pay special attention to “calculation” and “developing students’ calculation ability” (p. 6).

These suggestions were clearly reflected in Ms. Zhen’s thinking about her lesson objectives to help students understand the theorem of fraction multiplication and to calculate efficiently. They were also evident in her teaching when she divided the lesson into three relevant parts: (1) understand the theorem of fraction multiplication through the rectangle example, (2) prove it from different approaches, and (3) practice it with different calculation activities.

However, Ms. Zhen did not just follow all the suggestions in the teachers’ manual. She thought that the important point of her lesson was “how to understand the ideas of a fraction times a fraction, and how we deduce the theorem” instead of calculation ability. She devoted most of her teaching time to helping students understand and prove the theorem rather than practicing calculations. She also developed an objective that was not specified in the teachers’ manual: to engage students in working collaboratively in small groups that competed with each other in practicing what they had learned.

Second, the mandated textbook and teachers’ manual offered Ms. Zhen the rectangle example to represent the theorem of fraction multiplication. However, she used it in a different way.

The text (Shanghai Curriculum and Teaching Materials Reform Committee for Elementary and Secondary Schools, 1995b) offered the example to introduce the calculation of fraction multiplication. It showed that the area of a rectangle with 4/5 meter in length and 2/3 meter in width could be calculated by multiplying its length and width. Then, it recommended the following method to do the calculation: 4/5 × 2/3 = 4/5 × (2 ÷ 3) = 4/5 × 2 ÷ 3 = 4 × 2/5 ÷ 3 = 4 × 2/5 ÷ 3 = 8/15 (square meters) (pp. 64–65). The teachers’ manual (Shanghai Curriculum and Teaching Materials Reform Committee for Elementary and Secondary Schools, 1995a) suggested teachers use the example to apply the theorem instead of using it to prove the theorem for two reasons: (1) Since students have just learned how to turn a problem of a whole number times a fraction into a multiplication and division problem, it is better for them to apply the knowledge to prove the theorem of a fraction times a fraction to reduce the difficulty level of their thinking (p. 37); and (2) The rectangle example is not consistent with a suggestion that appeared in the teachers’ manual earlier that it is important for students at this grade level to think of a fraction as the result of two whole numbers being divided (p. 8).

However, in teaching this lesson, Ms. Zhen used the rectangle example in the way even though the text and teachers’ manual suggested otherwise. She engaged students in proving the theorem by dividing the square into 15 equal pieces in comparison to the rectangle of 8 pieces within the square and then pushed her students to come up with a theorem for fraction multiplication. She thought such an example “covers all the knowledge they learned,” geometry and fractions. She thought it useful to move students from the familiar to the abstract.

Third, the textbook and teachers’ manual also influenced the way in which Ms. Zhen structured practice questions and activities in the lesson. However, it did not limit her ways of engaging students in applying the theorem that they learned.

In her lesson, Ms. Zhen used some of the similar fraction multiplication problems from the text to guide students’ practicing the theorem and encouraged them to use their prior knowledge of a whole number times a fraction. She spent time helping them develop the ability of efficient calculation as the teachers’ manual suggests. However, the text and teachers’ manual did not limit the practice activities only to the simple application of what was taught in Ms. Zhen’s lesson. Instead, she had opportunities to design some practice activities to deepen students’ understanding about fraction multiplication and its application. For instance, she designed the homework assignment so that the solution required students to understand the theorem of fraction multiplication and to use the steps of calculation and kinds of prior knowledge that were not covered in the lesson.

It is obvious that the mandated curriculum materials were direct guidance and important resources for Ms. Zhen in developing the
objectives, representations of the concept, and practice activities for her lesson. However, they did not limit her autonomy in incorporating her own objectives, restructuring the textbook example, and designing the practice activity that was beyond the requirements and suggestions of the mandated curriculum materials.

5.2. Teaching organizations

The lesson preparation group and teaching research group in the school also influenced Ms. Zhen’s lesson development and its implementation, as well as her learning to teach in general. From the lesson preparation group, Ms. Zhen had opportunities to meet with colleagues who taught mathematics at the same grade level on a weekly basis. They discussed the curriculum requirements, analyzed a concept and its representations, planned lessons and units, and assessed student learning and their teaching together. As Ms. Zhen said:

In the lesson preparation group, we discuss where we reach so far in teaching, co-plan lessons based upon the national teaching and learning framework, share our teaching experiences. We also analyze how students learn, how to assess them, and the results of examination and tests.

It was through the weekly meetings in the lesson preparation group, especially her interaction with senior teachers in these meetings that Ms. Zhen learned how to plan a lesson by connecting specific teaching content with how students learn.

The meeting of the lesson preparation group helped me learn how to teach. For example, when I first came to this school, I did not know how to teach. I often asked senior teachers about how to teach certain topics and concepts, how to draw students’ attention, and how to help them understand what I am teaching.

For this specific lesson, Ms. Zhen directly benefited from the suggestions of senior mathematics teacher, Mr. Gu, who read her preliminary lesson plan and gave her suggestions on how to use the rectangle to engage students in proving the theorem. In particular, Mr. Gu offered the following specific suggestions:

Ms. Zhen gave it (initial lesson plan) to me last week. When reading it, I had a feeling that it was not too much different from her previous lessons. It was that teacher showed student a theorem, and then students practiced it. I suggested to her, “You should let students participate in learning and help them learn the idea through activities. You do not always have to follow the steps. You need to design a lesson according this idea and have them discuss it in groups.” What she did was to help students understand the meaning of fractions by calculating the area of a rectangle. “You can have them guess the result. After they come up with their answers, then you let them discover the theorem of a fraction times a fraction according to the meaning of the number they come up with. You needed to let them discover. Maybe they will get the wrong answers but it is OK. What you need to do is to help student learn how to learn.”

The teaching research group offered Ms. Zhen opportunities to meet with all the mathematics teachers in the school to discuss “more general issues of mathematics instruction,” “how to improve our examination scores,” and “how to observe and reflect on each others’ lessons together.”

For this specific lesson, Ms. Zhen’s colleagues in the teaching research group did the following things to help her improve this lesson. The teaching research group observed and reflected on Ms. Zhen’s initial lesson and offered her three specific suggestions for improvement: (1) After students drew the rectangle in the square, they should have a chance to share their drawings with each other; (2) Too many peaches were used in her last practice game that took a lot of time away from the instruction; and (3) The rectangle Ms. Zhen presented in the earlier part of the lesson was too small for students at the back to see clearly. Both Ms. Zhen and the leader of the teaching research group agreed in the interview that each of these suggestions had been incorporated into her formal public lesson.
The teaching research group observed and had a debriefing session about Ms. Zhen’s formal public lesson. From this meeting, Ms. Zhen had an opportunity to elaborate on her thinking and the changes that she made in the lesson as well as learn from the further analyses and suggestions offered by her colleagues. Emerging from the analysis of the group discussion were six types of topics.

**General comments** including both positive and negative comments that did not point to any specific process, event, and aspect of Ms. Zhen’s lesson, like, “You did a good job” and “the last lesson is more effective.”

**Pedagogical comments** involving both positive and negative comments that were directed to a specific process, event, or aspect of the lesson, such as, “I also think your students were good at solving that problem step by step” and “I do not like the first few sentences you used in this lesson. Why did you use such formal language to describe the concept?”

**Teaching suggestions** involving pedagogical and technical considerations. The former is related to specific objectives, processes, and ways of student learning and teaching in the lesson, such as, “In planning this lesson, what you need to think first is how students will come to understand the concept and then consider how to design the learning environment.” The latter deals with minor teaching skills or proper use of teaching materials and equipment, like “You need to write the word on the graphic a little bit bigger, it is hard to see it from where I was sitting.”

**Defensive statements** with which Ms. Zhen or other teachers justified what Ms. Zhen did in response to a criticism. For example, “If I let a student make these mistakes, there was no time for me to deal with them in this lesson.” or “I knew Ms. Zhen wanted to put this problem in the lesson, but there was not enough time to deal with it in teaching.”

**Ms. Zhen’s agreement** with the comments on her lesson in the discussion. For example, in responding to a teacher’s comment, “Words for the graphic on blackboard are not clear to read.” Ms. Zhen agreed, “Yes, I planned to write it bigger but forget when using it.”

**Elaboration statements** that Ms. Zhen and other teachers made to describe what happened in the lesson. For instance, in the beginning of the discussion, Ms. Zhen described her thinking about the lesson, “I used two examples to help students learn how to use the idea as well as the things they need to pay attention to when applying the idea in calculation. Especially, we need to get the lowest terms first and then calculate.”

Our analysis of the distribution of these topics in the discussion on Ms. Zhen’s public lesson (see Fig. 2) led us to several interesting patterns in this discussion and opportunities related to these patterns for Ms. Zhen’s learning to teach.

First, 32% of the topics in this discussion were pedagogical comments within which category, the positive and negative comments were quite equally distributed. This situation suggests that the discussion in the meeting was balanced with both compliments and criticism with specific observation as their basis. Such discussion allowed Ms. Zhen the opportunity to hear colleagues’ specific thoughts about her teaching. An example of criticisms about her lesson in the meeting was:

I think Ms. Zhen put too much stress on teacher’s control in this lesson. After students prove the theorem, she still pushed them to follow the logic in the text. I do not think it was necessary. If we recall how we learned mathematics, it was very hard for us to follow the logic and steps. We knew how to do it and that was it. It is intuitive thinking.

Second, topics of specific teaching suggestions were the second most frequent in this discussion (26%). All but two of these topics were pedagogical suggestions related to a specific objective, process, or approach to student learning and teaching. Such a topic pattern indicates that the discussion had a strong focus on the support for Ms. Zhen’s learning to teach instead of assessment on what Ms. Zhen had done right or wrong. One of such suggestions was:

I have been thinking about a problem since observing your first lesson. You had students cut a rectangle in the square. I think you do not have to cut it in this way. It is OK to cut it just
in the same amount. It can be irregular shape with many sides. What we need here is the area comparison. You need to be careful not to limit students’ mathematical thinking.

Third, about 14% of the total topics were justifications that either her colleagues (10%) or Ms. Zhen herself (4%) developed to defend what she did in the lesson. This pattern suggests that neither were all the ideas proposed taken for granted, nor was Ms. Zhen a passive recipient of all the comments and suggestions without question. Instead, she was an active participant in this discussion where what was said could be reasonably rejected.

Fourth, the discussion was encouraging. The general positive comments were 12% of the total topics and the direct criticisms (2%) were few and were always supported with specific observations as bases. The encouraging tone was also evidenced by the fact that among 14% of the topics developed by Ms. Zhen, most were her agreements with what was said (8%) and fewer were defensive statements (4%). Such an atmosphere of suggestive discussion helped Ms. Zhen keep her mind open to all the useful ideas without feeling as though she was a target of criticism. As she said at the end of the this meeting:

When planning this lesson, I wanted to follow the steps in the textbook. Then I realized that it was as if I was telling them everything. I thought I might let them learn it by doing. In teaching this lesson, I really felt nervous. I had already written down all the ideas as you proposed. In the future, I will keep my positive aspects and improve those weaknesses.

Obviously, Ms. Zhen’s public lesson and learning to teach mathematics in general were influenced directly by the activities at both levels of teaching organizations in the school. The lesson preparation group provided Ms. Zhen a weekly opportunity to discuss the curriculum standards, analyze teaching content, plan lessons and units, and reflect about student learning with mathematics teachers at the same grade. It was from her interaction with a senior teacher in the group that Ms. Zhen learned how to use the rectangle example to engage students in proving the theorem. The teaching research group allowed her an opportunity to discuss general issues of teaching mathematics, observe and discuss other teachers’ instruction, and have her lesson observed and analyzed by her colleagues. These activities around Ms. Zhen’s lesson at this level served to provide her professional comments using specific

### Distribution of Topics Coded from Teaching Research Group Discussion

<table>
<thead>
<tr>
<th>Topic Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive pedagogical comments</td>
<td>16%</td>
</tr>
<tr>
<td>Negative pedagogical comments</td>
<td>14%</td>
</tr>
<tr>
<td>Pedagogical suggestions</td>
<td>22%</td>
</tr>
<tr>
<td>Technical suggestions</td>
<td>4%</td>
</tr>
<tr>
<td>General positive comments</td>
<td>12%</td>
</tr>
<tr>
<td>General negative comments</td>
<td>2%</td>
</tr>
<tr>
<td>Other teachers' defences</td>
<td>10%</td>
</tr>
<tr>
<td>Zhen's defences</td>
<td>4%</td>
</tr>
<tr>
<td>Zhen's agreements</td>
<td>8%</td>
</tr>
<tr>
<td>Zhen's elaboration</td>
<td>2%</td>
</tr>
<tr>
<td>Other teacher's elaboration</td>
<td>2%</td>
</tr>
</tbody>
</table>

Total = 50 topics

Fig. 2. Distribution of topics coded from teaching research group discussion.
observations as support, offer her constructive suggestions and encouragement, and allow her the autonomy to elaborate her reasons for teaching and to justify her instruction.

6. Indirect influences of curriculum and teaching organizations

6.1. Focus of discussion about teaching

Opportunities for teachers to discuss mathematical ideas and their presentation as well as to discuss student learning are assumed to be important for teachers to learn how to teach mathematics effectively (Feiman-Nemser & Parker, 1990; National Center for Research on Teacher Learning, 1993; Wilson & Berne, 1999). Our data suggest that Ms. Zhen worked in a professional community where the focus of discussion about teaching was consistent regarding how a particular mathematics theorem or concept could be represented in instruction. Strategies useful for helping students learn a particular theorem or concept effectively were also a focus.

As shown in Fig. 2, the majority of the topics in the discussion about Ms. Zhen’s lesson were pedagogical comments and suggestions germane to specific processes, issues, and events in Ms. Zhen’s lesson on fraction multiplication. Such foci also became obvious in our interviews with different teachers in the school about teaching and learning to teach. Why were teachers able to sustain such foci in their discussion of teaching? The unique ways in which the curriculum and teaching organizations were structured in the context of Ms. Zhen’s work offered an explanation.

The mandated curriculum materials were structured and implemented in a way to help narrow teachers’ focus of discussion to the issues of how to teach a particular concept and how to help students learn it effectively. In Ms. Zhen’s case, the teachers’ manual specified the objectives for teaching fraction multiplication, its coverage, and its relationship to other mathematics that students had learned and were going to learn. How well Ms. Zhen covered and taught the required topic was also checked twice a semester by the curriculum-based mid-term and final examinations at the district level. Such a structure of curriculum gave Ms. Zhen and her colleagues little autonomy in changing or negotiating this part of the teaching requirements. However, the time and space were provided for teachers to discuss the issues of how to teach and help students learn a particular mathematics topic or concept.

These mandated curriculum materials also provided teachers with suggestions and examples about how a particular topic or concept could be represented. These suggestions and examples offered teachers important references when they considered how to represent a concept or a theorem that they needed to teach. However, the materials do not dictate the exact implementation of them in a particular teaching situation. For example, the teachers’ manual (Shanghai Curriculum and Teaching Materials Reform Committee for Elementary and Secondary Schools, 1995a) states that a teacher should “help students look at fraction as division,” “weaken their conception of fraction as ‘1’ that was previously taught, and help students transfer their knowledge of division” to fraction multiplication (p. 8). It also specifies that “such representations expand students’ understanding about fractions as related to rational number” and “reduce the difficulty level of working on word problems involving fraction multiplication and division” (p. 8). It further indicates that fraction multiplication can be related to the knowledge of geometry, like the rectangle example. However, in regard to implementing these ideas in a particular class, the teachers’ manual offers only recommendations.

In addition, teachers in the school were organized to plan, observe, and discuss teaching regularly in their subject matter oriented organizations, the teaching research group and the lesson preparation group. Such organizations nudged teachers to plan lessons together, observe, and discuss each other’s teaching through the lens of subject matter knowledge and students’ learning of it. This was obviously reflected in Ms. Zhen’s interactions with other teachers in both groups and in the discussions of the teaching research group about her public lesson.
6.2. Shared language for discussing teaching

The shared technical terms and concepts in their working language is assumed to be important for teachers to reflect on and discuss teaching and, thus, advance their professional knowledge (Jackson, 1986; Lortie, 1975). Our analysis of interviews, discussions, and curriculum materials lead us to three terms that were used similarly in teachers’ working language and the mandated curriculum materials: “important points,” “difficult points,” and “hinge to teaching.” These terms played an important role in mediating Ms. Zhen’s understanding of the curriculum materials and her interactions with colleagues about each others’ teaching.

In the teachers’ manual, important points, difficult points, and hinge to teaching were used to describe, respectively, the coverage of a particular concept or theorem, its representations or proof, and its relationship to other concepts that students had learned or needed to learn. For example, the teachers’ manual specified important points, difficult points, and hinges to teaching for the fraction section as follows:

Important points are calculation of fractions and development of students’ calculation ability. Difficult points are how to prove the concepts and theorem relating to fraction calculation or where the rule of calculation comes from. Teaching hinge for students’ learning of text is to relate number with shape by using teaching aids.

These terms were also used widely and similarly by different teachers including Ms. Zhen in various situations when they discussed teaching. In the interview with the mentor of Ms. Zhen, Ms. Fang, on how she helped Ms. Zhen learn to teach, she used the following example to show difficult points for teaching students’ fraction multiplication:

We have a difficult point in helping sixth graders solve word-problems about fraction multiplication... For example, when teaching 4/5 of 3, it means 3 × 4/5. What is the result of three 4/5s? It is 4/5 × 3. We also use multiplication here, but the ideas are different. Sometimes we write number sentence 3 × 4/5, and ask students to explain its meaning. Sometimes, we ask them the result of 4/5 × 3 or three 4/5s. Such problems are difficult for students to understand. We spend a lot of time helping students understand the difference. We finally come up with the idea of using a number line and they finally got the idea. Here is line of 3 meters, we evenly divide it into 5 segments, and you take 4 of them. Three 4/5s is an addition problem. In the examination, we have many problems like these and our students make many mistakes in solving these types of problems.

This quote points to two things. First, teachers in the school used the term, difficult point, in a similar way to the teachers’ manual. Second, students’ understanding of concepts was to be checked by the examinations. If they failed to develop such understanding, it was the teachers’ responsibility to find a proper representation of the concept to help them figure it out.

The analysis of important and difficult points for teaching a concept or theorem was an important focus of the discussion in meetings of the two teaching organizations and the observations and reflections on each other’s lesson. The leader of the mathematics teaching research group claimed that the analysis of important and difficult points of teaching was a required topic in the weekly meetings of lesson preparation groups and a frequent topic of the regular meetings of the teaching research group. The director of the instruction guidance office also pointed out that these terms provide lenses through which a teacher’s lesson was to be observed and assessed:

We have forms to be used for evaluating a teacher’s lesson. It is designed by our Instruction Guidance Office. For example, in assessing Zhen’s lesson today, we have here (pointing to the relevant part of the assessment form) teaching goals, objectives, important points and difficult points, analysis of teaching, summary, conclusion and feedback. They have to fill out this form after each observation, write
down our assessment, and put it into their file as their professional record.

Although it is not clear whether the mandated curriculum used these terms to define concepts of teaching because they were part of teachers' working language or vice versa, we find that these terms helped teachers in the school plan lessons together, observe, and discuss each other's lessons. In sum, Ms. Zhen clearly benefited from her colleagues’ discussions and observations that focused consistently on subject content, its representations in teaching, and students’ learning of it. The ways in which the mandated curriculum defined subject concepts, their representations, and the ways in which teachers were organized to work together on the bases of subject matter and grade level strongly shaped such a focus. In addition, consistently used concepts or technical terms in mandated curriculum materials and in teachers' working language also played an important role in mediating Ms. Zhen's understanding of the curriculum and other teachers' suggestions for her teaching.

7. Discussions and conclusions

In the beginning of this article, we raised two questions for this study. What are teachers working in a contrived curriculum and teaching organization able to learn about teaching? How do the contrived national curriculum and teaching organization influence the development of their professional knowledge and practice? Our analysis in this case study provides the following answers to the questions.

Teachers in the context of a mandated curriculum and contrived teaching organizations can develop quality teaching practices based upon well-articulated teaching objectives, reasoned representations of content taught, and considerations of what students have learned and what they are going to learn.

Mandated curriculum materials, properly structured, can create a situation in which teachers are pushed to define teaching objectives carefully according to professional standards, supported to analyze subject concepts and their relationships, and provided with suggestions of how to represent teaching content and student learning in a language teachers can understand and use.

Contrived teaching organizations can help teachers focus their interactions on important knowledge about teaching, push them to analyze the requirements of the mandated curriculum, and support them in planning lessons together. It can also help teachers focus as they observe and reflect on each other’s lessons with shared goals and language.

Although focusing on a single teacher’s experience, this case mirrors the features of teacher learning emerging from the larger data collections around 26 Chinese beginning teachers in the comparative project (Paine, 2001). They together support several assumptions about the relationship between curriculum, teaching organization, and the quality of teaching and learning to teach.

The quality of teaching practice and the development of teacher professional knowledge may require the support of curriculum that carries enough authority to influence teachers’ teaching, provides specific standards, suggestions, and resources for instruction, and shows consistency between the guidance, teaching materials, and assessment (Cohen & Spillane, 1992).

These findings also offer one plausible explanation for why teachers working in the centralized curriculum system are more likely to make teaching decisions in relation to subject matter and professional standards, a finding from a large quantitative study (Stevenson & Baker, 1991).

The contrived curriculum system and teaching organization can help create a professional culture in which “teachers are not merely working more collaboratively but feel a stronger responsibility for their colleagues” (Hargreaves, 1994, p. 424) and create situations in which teachers have to rely on each other to learn how to practice wisely (Ball, 1994; Little, 1990).

The study also challenges the assumption that any kind of contrived structure and partnership among teachers will ultimately create difficulties for the persistence of a collaborative culture comprising a relationship of openness, trust, and support among teachers in several ways.
(Hargreaves & Dawe, 1990). It shows that even under an extremely controlled education system, teachers can still enjoy the necessary autonomy in expanding the required objectives for their teaching, deepening the coverage of what they are required to teach, and reasonably defending or accepting criticism and suggestions offered. Thus, the reasonable question we need to ask is not which context will create teachers’ collegial relationships, the contrived curriculum and teaching organization or teachers’ autonomy. Instead, we need to ask how curriculum and teaching organization need to be structured and what kinds of autonomy are necessary for a constructive collaboration among teachers that promotes the development of their professional knowledge. Obviously, this case study alone is not able to provide a definite answer to such a complicated question. However, Ms. Zhen’s case does provide some insights into the conditions that support teacher collaboration and teacher learning. Two factors clearly contributed to her development and implementation of her successful public lesson: her careful study of the curriculum materials that were authoritatively, specifically, and consistently structured; and her continuous and substantial participation in the collaborative observations, discussions, and reflections on each other’s lesson development, teaching, and lesson debriefing based upon a shared curriculum and language in formally structured teaching organizations.

The finding in this case study seems to be in a conflict with the findings that the recent National Curriculum and testing reform in England weakened teachers’ professional confidence, lowered their morale, and left them uncertain of their ability and right to take major curriculum decisions (Helsby & McCulloch, 1996). Two explanations can be reasonably developed to resolve this conflict, each of which needs to be further examined and explored through carefully designed research and substantive studies.

First, any kind of contrived change and reform can create problems among teachers in terms of discomfort, maladjustment, and less confidence in teaching and making teaching decisions, especially for those who used to enjoy making decisions about curriculum and teaching individually without being checked and examined in a professional community. However, these problems that these teachers experienced can be understood as the necessary sign of conceptual discrepancy that may push them to rely more on each other to learn to teach wisely. To validate or reject this explanation, we need to examine carefully what actually happened among teachers including the nature of their interactions, the quality of their teaching practice, and what they actually learned about teaching. The self-report of teachers’ feeling alone are not sufficient to support or disprove it.

Second, it is reasonable to speculate that the kinds of experience that Ms. Zhen developed in planning and teaching a public lesson are different from the prevailing teaching and teacher learning in the contrived curriculum and teaching organization. Thus, it is necessary to develop more substantive research focusing on different teachers in various contexts of the contrived curriculum and teaching organization, although several comparative studies to date have tended to support the relationship between the quality teaching and teacher learning and the contrived curriculum and teaching organizations (Ma, 1999; Paine, 1990, 1997; Paine & Ma, 1993; Stevenson & Stigler, 1992; Stigler et al., 1996).

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