Learning in Mentoring Through the School-University Partnership

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Abstract

This study provided an innovative method of the internship through the partnership of school-university. The concept of school-university partnership was redefined in the study. The mathematics mentoring program affiliated in the integrated research project investigated by the faculties of the National Hsinchu University of Education was reported here. The course with 78 hours for developing mentors' theoretical and professional knowledge in which underpins mentoring practices was carried out in half-year internship. The mechanism of the mentoring program including four phases was introduced in the paper. Mentors' improvement of expanding the aspects of lesson plan while mentoring future teachers preparing a lesson and of mentoring on the meaning and the importance of the problems to be posed were as a result of the mentoring program.

Key words: Mentoring, Future teacher, Mentoring group, School-university partnership

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Introduction

The teacher education reform under the impact of economic, political and social contexts has demonstrated a drastic change since the Teacher Education Act (TEA) of Taiwan was issued in 1994. The major changes are: 1) School-based practicum is reduced into half year from a whole year and attached in the fourth year of a four-year teacher preparation program; 2) Teachers are certified by the processes consisting of qualified a teacher while completed four-year courses, half-year practicum, and then certified a teacher after passing a certified teacher examination. 3) The teacher preparation is opened to any institution which has teacher education program. Due to the enactment of the TEA, the number of TE programs set by regular universities has accelerated, from the initial 9 programs in 1994 to 88 programs approved by the MOE in the year 2006. Mushrooming of these programs has indicated the variance of the teacher quality. Due to the variance in training process at individual universities, the MOE is worried that the increment of the TE programs in the past few years might result in a decline in teacher quality. Thus, it is necessary to establish a professional standard to assure teacher quality.

The TEA declared that all four-year public and private universities and colleges are allowed to run teacher education programs for training teachers as long as they meet the requirement of the MOE. As a result, deprived of the privileges in teacher training, teachers colleges suffer from lower popularity among high school graduates and a decrease in students' academic level. Under the situations, some teachers colleges upgrade to be a university of education or a comprehensive university. The declining government budget for higher education and the limited quantify and quality in faculty and facilities make the transformation of universities of education or to seek opportunities to integrate them into nearby universities. In addition, with the decreasing population of baby born, the supply of teachers from teacher education programs is much more than the demand. The number of teachers to be prepared from each university of education is required to be reduced into 50% as many as before.

The establishment of teacher education programs by any university or college needs to be approved by the MOE according to a set of official criteria for quality in the faculty, curriculum, and facilities of the programs. However, in the process of training, curriculum, instruction, and practicum vary among the different teacher education programs. Some programs in universities exist an inadequate number of faculties and a lack of practical experience in internship. To control teacher quality, a national examination of teacher inspection was ignited in 2004. However, only FTs' knowledge of general pedagogy instead of subject matter is assessed in inspection.

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The inspection is not able to assess if a future teachers (FTs) has learned the ability performing in teaching from teacher education program.

Excepting the high percentage of FTs passing the national examination teacher inspection to be achieved, the faculties of National Hsinchu University of Education (NHSCUE)   reported in this paper are aware of the importance of FTs' performing in classroom. Some faculties in this university recognize the practicum as an important component in teacher education. We believe that teaching is a form of highly complex and skilled practice depending on teachers' knowledge and skill. A knowledge base including a theoretical and a professional component underpins teaching. The theoretical component is taught in the years of teacher preparation program, while the professional component needs to be developed in the professional practice. Traditionally, the practicum provides FTs with an opportunity to develop the professional knowledge but it often result in FTs developing the technical skills of classroom management, rather than the wisdom of professional practice (Field & Latta, 2001; Odell, Huling, & Sweeny, 1999). Alternatively, a method of assisting FTs to develop professional knowledge is partnerships formed between schools and universities where FTs have opportunities to be involved with day-to-day activities of professional practice. The studies on teacher preparation show that FTs complain that they are required to devote a great deal of time to administrative affairs of schools (Lo, Hung, & Liu, 2002). Their professional knowledge is not developed during the internship although the school-university partnership is implemented. The failure of the partnership could be resulted from the unsuccessful mechanism of collaboration between school and university. Thus, the NHSUE is intended to reconstruct a new concept of the school-university partnership that is designed to enhance the mentors' knowledge and skill such that improving the quality of .practicum by providing FTs with greater involvement with mentors in teaching.

The School-University Partnership Reported in the Study

In developing the school-university partnership to enhance mentors' knowledge and skill on FT preparation, there were five main considerations. First, the school to be recruited was dependent on the goodwill of the mentors and the FTs. Second, the school to be recruited at least consists of three groups of mentors from three subject areas, mathematics, Chinese, and science. Therefore, the number of FT in the school during practicum is no less than six, two for each subject area. Third, the school has a commitment to maximize the FTs' involvement in the community of mentors while at the same time minimizing the possible disruption this participation might cause the mentors and schools. Third, some kind of ancillary benefits and feedbacks for giving

back to the school from the partnership were also a consideration for the university when designing the mentoring program, for instance, minor finical support and certified hours of institutes. Fourth, the school needs to offer mentors and FTs the supports on professional practices as possible. The final consideration was that the supervisors (or teacher educators) of the FTs during practicum are the researchers involving in the integrated research project. This consideration is intended to reduce FTs' burden from the researchers and supervisor of practicum as possible.

We assumed that it is not possible for developing FTs' professional knowledge if the mentors' mentoring knowledge and skills have not been developed well. The school-university partnership reported in the study was to develop a mentoring program that was designed to assist mentors in developing mentoring knowledge and skills, and then to enhance FTs' professional practice during practicum. The mentoring program includes three subject mentoring programs, mentoring in mathematics, mentoring in Chinese, and mentoring in science, as part of an integrated research project. Due to FTs to be a primary school teacher who teach several subjects, mathematics and Chinese are required to be taught for a home-room teacher. To meet this need, the FTs participating in the study were mentored in mathematics and Chinese at this moment. Mathematics future teachers group consisting of FTm1, FTm2, FTm3, and FTm4 were mainly mentored to be a professional teaching in mathematics and were mentored by mathematics mentors group consisting of A, B, C, and D, they are also mentored to be a professional teaching in Chinese assisted by Chinese mentors group consisting of P, Q, R, and S. Each FT in mathematics group was mentored by a mentor of mathematics mentor group and a mentor of Chinese mentor group. Likewise, Chinese future teachers group consisting of FTc1, FTc2, FTc3, and FTc4 were mainly mentored to be a professional teaching in Chinese mentored by Chinese mentors group and also were mentored by mathematics mentors group. Each FT in Chinese group was mentored by a mentor in Chinese mentor group and a mentor of mathematics mentor group. Science future teachers group consisting of FTs1 and FTs2 were mentored to be a professional teaching in science and were mentored by science mentors group consisting of I and J. Each FT in science group was mentored by a mentor in science mentor group.

However, to reduce mentors' tension and over load from their participation in the mentoring program, each mentor was only trained to be specialized in one subject by subject teacher educator of the university. The subject teacher educators were the researchers, who participated in the integrated research project. For instance, the mentors A, B, C, and D were trained to be an expert in mathematics teaching assisted by the researcher from mathematics department, while mentors P, Q, R, and S were

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trained to be an expert in Chinese teaching assisted by the teacher educator from Chinese department. Mentors I, and J are trained to be an expert in science teaching assisted by a science teacher educator. It is called as a model of one-subject mentors with multiple-subject future teachers (OSM-MSFT). The connection among future teachers, teacher educators of university, and mentors in a school is described in Figure 1.
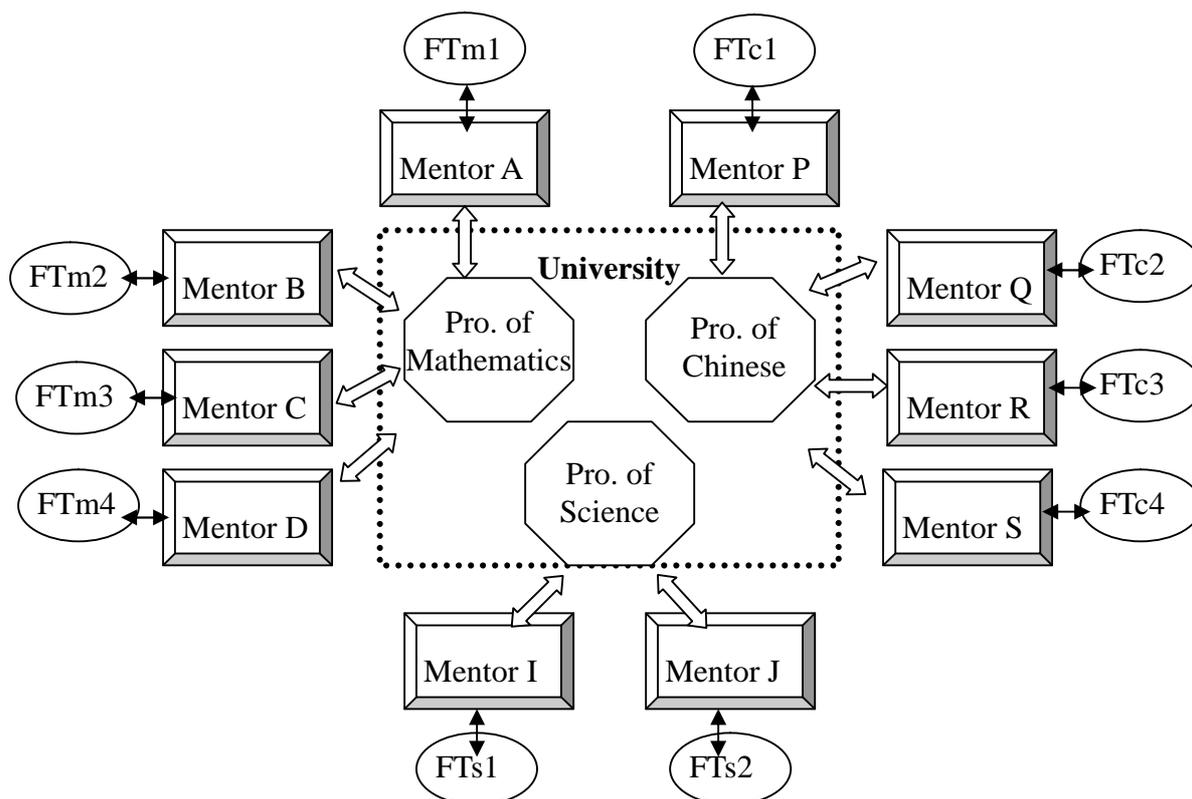

Figure 1: The Partnership of School-University

The partnership of school-university was designed to form three different professional mentoring groups, mathematics, science, and Chinese in the school. This creates the maximum opportunity for FTs to learn the professional knowledge. The purpose of this paper is to introduce the mechanism of school-university partnership and examine the aspects of mathematics teaching mentors learned from the mentoring program were implemented into mentoring practice. For the purpose of the study, only data related to mathematics mentoring group were described here.

METHODOLOGY

Participants

There were 10 mentors from an elementary school involving in a mentoring

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program which was developed in an integrated research project investigated by the NSHCUE. Four of them were involved in mathematics mentor group assisting FTs in mathematics teaching; four of them in Chinese mentor group, and the rest of them were in science mentor group. All of them had from 5 to 14 years of experience teaching at the elementary school, but they have never been a mentor. None of them received any training of mentors. The four pairs of mentors and FTs involving in mathematics group are (Lang, Ting), (Yeu, Ching), (Ju, Jong), and (Xing, Shiao) respectively. The four FTs have accomplished all courses of four-year preservice teacher education. The year of the half-year internship is the school-based placement attached in the fifth year of the teacher preparation program. Three (Ting, Ching, and Jong) of the four FTs were accomplished their undergraduate study in mathematics education department. One was graduated from social study department. The mentors reported in this paper are only who are in the mathematics mentor group.

The Mentoring Program

The aim of the half-year mentoring program for mathematics mentors group is to enhance mentors' knowledge and skill of mentoring. The mentoring program was based on the professional standards of mentors that were conducted by the authors in previous year of the study (Lin & Tsai, 2007). The professional standards describe the indicators of preliminary knowledge and skill of a teacher to be a mentor.

The course of mentoring program includes two parts, professional knowledge and skills of mathematical teaching and mentoring. Each part includes five topics: curriculum, pedagogy, assessment, social mathematics norm, topics about individual students. Curriculum topics refers to the objectives for instruction, the scope and sequence of the content to be learned, the sequence of activities, textbook, resources of teaching, and the plans and schedules for teaching. Pedagogical topics cover the discussions on subject mater knowledge, instructional strategies, clarity of explanation, questioning, problem-posing, and analyzing students' various solutions. Assessment topic related to assessing students' learning and performance as well as their progress. Social mathematics norm topic is the issues about social interaction in mathematics classroom, the norms of groups of students in a class. Topic about individual students included discussions about the background, learners' needs, behavior, and progress of an individual student (Lin, 2007).

The courses of mentoring program provided by the researchers, who are teacher educators of the university, including theory and practice of mathematics teaching and mentoring were implemented in a six-day summer workshop with 36 hours and half-year school year with 42 hours. The summer workshop was to conceptualize

mentors' knowledge of teaching mathematics toward learner-oriented, while the course of the school year was to enhance mentors' knowledge and skills in mentoring.

The Process of Mentoring

The four mentors had no experience of mentoring. To help them putting their visions for mentoring into practice, we supported the mentors four phases in the internship. We had a one-hour classroom observation on every Thursday morning and had a follow-up three-hour mentoring group meeting in the afternoon throughout each phase of the mentoring program. There are two groups. One is mathematics mentors group consisting of the researchers and four mentors. The other is mathematics FTs group consisting of four pairs of mentors-interns. Afterwards, each mentor required to immediately share FTs with main ideas discussed in the mathematics mentor group meeting. This study takes the critical constructivist perspective on mentoring that knowledge is actively built by learners through the process of active thinking (Wang, & Odell, 2002).. The researchers and the mentors are viewed as learners and generators of new knowledge and practices of mentoring. Likewise, the mentors and the FTs are also viewed as learners and generators of new knowledge, and they have to count on each other. We take the collaborative inquiry model to support mentors in assisting FTs in learning to teach mathematics. This model stresses mentors' active construction of mentoring knowledge through what they have leaned in practice and constant dialogue with teacher educators. The collaborative inquiry model of mentoring in school-university partnership is depicted as follows.
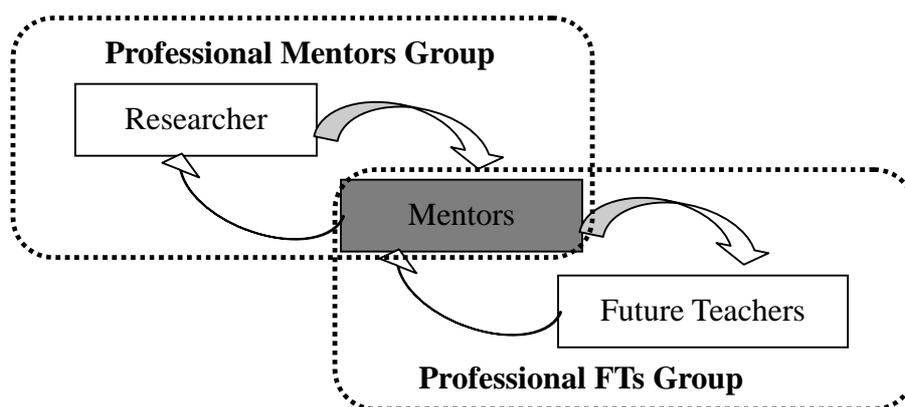

Figure 2: Collaborative Inquiry Model of Mentoring

Phase 1: In the first two weeks of mentoring as the first phase, we supported mentors in gaining the idea of induction through mutually sharing among them. We expected the mentors to offer emotional support for interns to overcome reality shock

and reduce psychological stresses caused by the conflicts between their personal lives and professional requirement. Each mentor took turns to report in public how she introduced her intern to students and parents in the first few days of the school year.

Phase 2: In the second phase, from week 3 to 6, we supported the mentors in gaining a general picture of the kind of teaching and in understanding the basic procedures in their teaching through observation and reflection about other mentors' lessons. We expected the mentors to be able to see and reflect on what they were going to do. Each mentor was asked to teach several lessons for FTs in their own classroom and was encouraged to observe other mentors' lessons. In this way, each FT could see how their mentor taught a lesson on the content that was going to teach. It was followed by a short conversation with the mentor concerning the relationship between the syllabus, students' performance in classroom, and the lesson actually taught. Before the FTs' observation, each mentor must elaborate the purposes of teaching she had for that lesson. Then, each mentor required FT to observe her lesson with these purposes in mind and to understand the reasons underlying the teaching. This phase provided the mentors an opportunity to support FTs on learning how to observe a lesson focusing on learners and supported mentors' learned the teaching with a learned-oriented approach.

Phase 3: As the mentors were able to teach a lesson with learner-oriented approach, we then moved them into the third phase, from week 7 to 10. We supported the mentors working with the FTs together in preparing a lesson and a peer observation (called as LPPO). The LPPO was grounded in the activities of practice and provided the mentors with opportunities to investigate and conceptualize their knowledge of mentoring. The first opportunity was observing a mentor preparing a lesson with her FT sitting together and then observed the mentor to teach the lesson. It was followed by peers' observation on how the mentor carried out the lesson, and then observing the mentor asking her intern a series of questions, such as explaining how well the lesson plan was carried out, how well the objectives she have achieved in the lesson, identifying the changes she made in the lesson compared to the lesson plan. During the third phase, other mentors not only learned from the pair of mentor-intern about mentoring on lesson plan and teaching, but also gave the mentor comments or suggestion on mentoring. Each pair of mentor-intern took turns engaging in the activities of LPPO. This activity of LPPO was designed to get access to what the mentors was noticing and shared perceptive mutually, and thus enlarged various perspectives.

Later, we had a mentor group meeting to discuss about what they had noticed.. The mentor group discussion consists of two aspects. The first aspect focused on

mentoring and the second aspect focused on mathematics teaching. Regarding the discussion on mentoring, each mentor (e.g., Lang) and her intern (Ting) were first invited to report what they had attended to. It was followed by the other mentors to examine the observations of Lang's teaching to identify things they felt would be important for the FTs to notice, then we contrasted that with what Lang had attended to.

With respect to discussing on mathematics teaching, each mentor (e.g., Lang) was encouraged to describe her opinions and comments on the whole experience in great depth and to explain the reasons for the changes that appeared in the classroom. Other mentors reported what Lang had strengths and weakness in the lesson. These comparisons worked well to demonstrate how mentors' perception differed from others and helped us begin to inquire into their perspective as learners.

Phase 4: Each FT's teaching was arranged in the fourth phase, from week 11 to 14. The final phase was allowed the assigned mentor to passively work with FT altogether on lesson plan. The phase was to examine the effect of mentoring on interns' performance on mathematics teaching. The result accounts for an aspect of the effect of the mentoring program. During this phase, each FT was evaluated by other FTs, mentors and a researcher. The evaluation of mathematics teaching consists of two aspects: teaching preparation and teaching behavior. For the purpose of the study, the data collected in the fourth phase would not be reported here.

Data collected and analyzed

The data of this study as part of the integrated project was designed to enhance mentors' knowledge and skill in mentoring FTs' learning to teach mathematics with a learner-oriented approach. We desired to learn about the teaching practice of both mentors and FTs over time, the interaction between mentors and FTs and mentors' mentoring practice. We collected a range of data for assessing the effect of the program. Kirkpatrick and Kirkpatrick's (2006) three-level model was the basis of data collecting for the study. At the reaction level for measuring what the mentors thought and felt about the mentoring program, the mentors were interviewed on the feedback of summer workshop and half-year school mentoring. At the learning level for measuring the extent to which mentors change attitudes, improve knowledge and skill, pre-test and post-test were conducted aligned with self-assessment 5-scale questionnaire. At the behavior level, classroom observation, interview, and mathematics journal were measured how mentors transferred their knowledge and skill in mentoring as a rest of the mentoring program. Each mentor was conducted individual with a semi-structure interview. The questions to be asked in the interview

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were their views of teaching and mentoring, FTs' expectation of mentoring, and mentoring practices.

Because we wanted to understand what and how the mentors supported interns learned to teach, we paid attention to the mechanism of the mentoring in the context of the collaboration of school and university. We studied closely each of the videotaped lessons over the course of the year, and then moved from observing the lessons to attaching the other data surrounding one lesson---the meetings with mentors, journals, and interview with each mentor. Due to space limitation, the data from four mentors were analyzed, but the instances or scenarios reported in the paper for supporting the data to illustrate were only from one pair of mentor (Lang) and FT (Ting) .

RESULTS

Expanding the Aspects of Lesson Plan in Mentoring

The mentors expanded their views of lesson plan and improved their ability in helping FTs in writing a lesson plan as the mentoring program proceeded. The aspects the mentors attended to a lesson plan from the second phase to the fourth phase of the mentoring program were described in Table 1. The data of each phase was collected from while the mentors worked with the FTs together. FTs working on the lesson plan in different phase had different degree of involvement. FTs were passively receiving the instruction for writing a lesson plan from their mentors in the second phase, while they were able to write a lesson plan independently with minor support from mentors in the fourth phase.

Table 1: The Aspects of a Lesson Plan the Mentors Attended in Different Phase of Mentoring

2nd phase of mentoring	3rd phase of mentoring	4th phase of mentoring
Objectives of the instruction	Objectives of the instruction including objective of each activity	Objectives of the instruction including objective of each activity
	Analysis of the logic structure of the mathematics content involving in the lesson	Analysis of the logic structure of the mathematics content involving in the lesson
Students' prior knowledge and skill	Students' prior knowledge and skill	Students' prior knowledge and skill
Status of the lesson	Status of the lesson	Status of the lesson
Sequence of the activities	Sequence of the activities	Sequence of the activities

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	including the problems to be posed	including the problems to be posed
Settings of teaching a lesson	Settings of teaching a lesson	Settings of teaching a lesson
Instructor's activities	Instructor's activities and key questions to be asked by the instructors	Instructor's activities and key questions to be asked by the instructors
	Students' activities including anticipating students' various solutions	Students' activities including anticipating students' various solutions

The data of the Table 1 shows that comparing to the second phase, two new aspects the mentors learned from the mentoring program on preparing a lesson were the logic structure of mathematics contents and anticipation of students' various solutions. Besides, the mentors paid more attentions to the sequence of the activities to be taught. The sequence of the activities were relied on the objectivities of the lesson, the context of the problems to be posed, the numbers involving in the problems, and students' prior knowledge.

The mentors learned and committed the need of anticipating students' various solutions and of asking students follow-up key questions in align with students' responses. They also put these two aspects into their mentoring practices. For instance, Lang prepared a weight lesson before teaching. She anticipated students various possible solutions for resolving a subtraction word problem as part of the lesson plan as follows.

Problem: A tea bag weighs 2 kg 30 g and a coffee bag weighs 1700 g. Which has more weight? How much weight of one has more than the other?
Anticipating students' various solutions:
Solution 1: 2 kg 30 g=2030g, 2030g >1700g 2030-1700=330, so that tea bag is heavier than coffee bag.
Solution 2: 1700g=1kg700g,

$$\begin{array}{cc} 2 & 30 \\ 1 & 700 \\ \hline & 330 \end{array}$$

so that tea bag is heavier 330g as much as coffee.
Solution 3: 2 kg 30 g=2300g, 2030g >1700g 2300-1700=3300, so that tea bag is heavier than coffee bag.
Solution 4: 1700g=1kg700g,

$$\begin{array}{cc} 2 & 30 \\ 1 & 700 \\ \hline 1 & 670 \end{array}$$

so that tea bag is heavier 670g as much as coffee.

Besides the significance of anticipating students' various solutions, the mentors

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also perceived the need of asking follow-up key questions. Lang described her view of asking follow-up questions in a mathematics mentoring group meeting as that

In summer workshop I remembered that I worried about how to ask students follow-up questions as prompts. I felt embarrassed as students do not give me expected answers. Instead, I may rapidly offer students an answer. During these three weeks of teaching, I tried hard to give my students to explain their solutions. They only repeated their solutions rather than gave their explanation on their thinking. To deepen students' thinking, questioning is a necessary skill for me. Therefore, I need to learn to ask follow-up questions (Lang, Mentors group meeting).

Gradually, the mentors recognized the importance of the questioning for helping their students reflecting on their solutions and clarifying their thinking. They tried hard to ask FTs to put the possible follow-up key questions on FTs' lesson plans. The following scenario was excerpted from Ting's lesson plan in which she was assigned to work in the third phase of the mentoring. Ting gave fifth-grade students the following problem to solve as part of the lesson plan. The key question to be asked by Ting depending on students' various solutions is described as Table 2.

Table 2: The key questions to be asked by Ting according to students' solutions.

Problem: Peng wants to listen a CD three times. The CD runs 3 minutes 26 seconds. How much time does Peng need to take for listening the CD?	
Ting's anticipation of students' various solutions:	The key questions Ting asks students:
Solution 1: 3 min 26 sec+3 min 26 sec+3 min 26 sec =9 min 78 sec=10 min 18 sec	What does 「3 min 26 sec」mean? Why did you repeatedly add them three times? Why does 「9 min 78 sec」can be 「10 min 18 sec」?
Solution 2: 3 min 26 sec=206sec 206x3=618 sec	What does 「3 min 26 sec」mean? Why did you multiply 3? Assume Peng does not listen the same CD. Can it be multiply 3? How can you make sure 618 sec=10 min 18 sec as above?
Solution 3: 3 min 26 sec x3 = 9 min 78 sec =10 min 18 sec	Why can it be multiplied by 3? What does it mean by 「9 min 78 sec」?
Solution 4: 　　3　　26 　x　　　3 　9　　78 10　　18　　　Ans: 10 min 18 sec.	Can you explain the mean of the format?

Conceptualizing the Significance of the Problem Posing

Initially, in mentors' view of FTs' expectation for the role of mentors and mentoring in their learning to teach was to provide emotional and technical support. Learning to teach, in their view, was to be left FTs' own accumulation of teaching

experience and lessons based on trial and error. Lang regarded FT learning about pedagogy and students' academic learning was as less important than classroom management. For instance, Lang stated her view of FTs' expectation for the role of mentors in the interview conducted at very beginning of study as follows.

…In my opinion, my intern would expect me to give her a whole set of skill for handling a classroom. My intern would eager to have a good relationship with me and my students. She would be interested in learning how to care and nurture students' self-esteem in general, while giving relatively little attention to pedagogy and students' academic achievement. I do not agree that she is able to view mathematics as learners' actively constructed. Ideally, she would like to learn more about classroom management beyond the pedagogy of mathematics. Practically, she would need more time given by me to prepare an examination for passing the inspection of teacher certification in the following months…. (Lang, Interview).

Lang's conception of FTs' learning to teach was that she attributes FT's learning to her personalities or attitudes, or to the individual FT's innate abilities and background, rather than to mentor's choosing appropriate teaching content and strategies of mentoring. As Lang stated in the interview conducted in the very beginning of the study as follows.

…In emotional aspect, I treated her respectively. I asked my students to treat her and me equally. I gave her a seat next to me. In learning aspect, I treated Ting as an apprentice. I provided her an opportunity with observing what I did in daily teaching. If she is an active learner, then she would become a good teacher. Otherwise, I would not like to force her to work on the things she is unwilling to do…. (Lang, Interview).

However, as the mentors proceeded in the mentoring program, they became more focused on the scope and sequence of the instructional materials in the textbook and students' learning. They also conceptualized the significance of the problem posing. The significance means the meaning and the importance. The meaning of the problem posing means posing an appropriate problem such that students' specific solution can be anticipated, the size of the number involved in the problem should be considered, the semantic structure of the problems should be attended.

The mentors did not know the importance of the problem to be posed until we observed a lesson taught by Yeu. The researcher, as a partner of the mentors, addressed an issue of problem-posing after Yeu's teaching. The problem was given by Yeu as *"A strip of paper with 8 meters in length. What other fraction can be reduced into as the length same as 4/8 of the paper?"* The following vignette was excerpted from a group discussion.

R: Students did not learn the meaning of "reduce strategy for finding an equivalent fraction" yet. It was not surprised that they were not able to solve this problem. The problem should be revised as *"A strip of paper with 8 meters in length. What*

other fraction can be have the length as same as 4/8 of the paper?"

R: If we expect students to use "expanding strategy for finding an equivalent fraction", then the problem should be posed as *"A strip of paper with 8 meters in length. What other fraction can be have the length as same as 1/2 of the paper?"* If we expect students to use both expanding strategy and reducing strategy for find an equivalent fraction, then the problems should be posed as *"A strip of paper with 8 meters in length. What other fraction can be have the length as same as 6/12 of the paper?"*(Mentors discussion group)

Lang finally realized the anticipated strategy tying tightly with the size of the number involving in the problem from this vignette. She described about her conceptualizing the ideas of the problem to be posed meeting the need of solution strategy in mathematics journal as follows.

…I finally knew the importance of posing an appropriate problem. I did not appreciate the meaning of the problem to be tied with the need of a specific solution until the professor gave us the explanation by using this example. At this moment, I was puzzled with the meaning of the problem to be tied with the need of a specific solution in my integer teaching. I made sense of the meaning of problem-posing now…(Lang, Mathematics Journal).

Mentoring on the Significance of the Problem Posing

The mentors transferred their knowledge of problem posing into mentoring practice. The researchers encouraged them to share what they learned from the mentors group with their interns after each group meeting. The interns appreciated the knowledge shared by their mentors carried from the mentors group. Ting described in her journal as follows.

…I look forward to the coming of every Thursday, since it is a rich day for me. However, it is highly pity I could not attend the routine weekly mentoring group meeting, because I as an intern need to stay in the classroom with students. Fortunately, my mentor shared me the ideas which were discussed in the mentor group meeting. (Ting, Mathematics Journal)

The mentors put their attentions to educate their interns on the meaning and importance of the problem-posing on playing the role of an effective mathematics teaching. They put eight dimensions of problems posing on mentoring FTs. The eight dimensions consisted of the resources, presentations, semantic structures, contexts, representations, materials, the number of the problems, and the problem meeting the need of students' strategy of solution.

Regarding resources of problems, Lang asked Ting to reflect if the problems presented in the textbook is enough to motivate students' attractions or interesting by checking either the size of the numbers or the contexts involving in the problems. As a result, they discussed on revising the size of the numbers involving in the equivalent

fraction. The problem presented in the textbook was that *"A box has 12 oranges. What fraction of 4 oranges in the box?"* Students can only have three equivalent fractions to find out, 4/12, 1/3, and 2/6. Lang asked Ting to figure out in what way have more equivalent fractions. The problem was revised by Ting as *"A box has 24 oranges. What fraction of 12 oranges in the box?"* In such numbers, there are six equivalent fractions, 12/24, 1/2, 2/4, 3/6, 4/8, 6/12.

The mentors also tried hard to give various presentations to present problems in their teaching. The presentations could be one-step, multiple-step, and dynamic problem-posing. Each presentation was varied with the mathematics content embedded in the problems. For instance, the problems involving in geometry can be presented to students with the way of multiple-step or dynamic problem-psoing.

The semantic structure was the major concern as the mentors helped the FTs to read the problems covered in the textbook. Lang's mathematics journal showed that the concern of the multiplicative structure on her mentoring practice as below.

''In Ting's time lesson observed, we gave her the comment on semantic structures after her teaching. The structure of the problems was only involved in the type of scalar. Ting learned from the mentor about the multiplicative structure including equivalent groups, changes of multiplication, compare of multiplication, cross-product, and array. Afterwards, she went back to recheck the textbook and with a surprise finding was that the problems are merely the type of changes of multiplication. Thus, she revised the structures of problems to be posed in next day lesson …(Lang, Mathematics Journal).

To recognize the problem to be posed meeting the need of students' strategy of solution was a critical and challenge work for the mentors. To help understanding the meaning of the problem meeting the need of students' strategy of solution, the researcher gave them an example. This example was to illustrate an activity of the textbook to achieve students perceiving the distribution property associated multiplication with addition. The problem presented in the textbook was that *"A pencil box costs 64 dollars and a book costs 57 dollars. How much does it cost when Sandy bought 4 pencil boxes and 4 books?"* This two numbers 64 and 57 did not have the need to be added in advance. Thus, the researcher suggested that these two numbers should be revised as 64 and 36. The sum of these two numbers is 100.

The mentors agreed that the problem to be posed meeting the need of students' strategy of solution was very significant. They put this concern on FTs preparing a lesson. A problem involving in the textbook is designed to achieve the associated property of multiplication. The problem is that *"Robert has 17 big boxes. Each big box has 25 median boxes. Each median box has 4 small boxes. How many small boxes has altogether?"* Lang asked Ting to answer if the problem meets the need of

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student using association property of multiplication. They revised the problem to meet students to learn the associated property of multiplication as follows.

The problem was that "*A rectangular has 25cm, 17cm, and 4cm in length, width, and height respectively. What is the volume of this rectangular?*" The volume can be either calculated 25x17 first then multiplied by 4. This leads to the equation (25x17)x4. The volume can also be calculated 17x4 first, then 25 multiplied the product of 17x4. This leads to the equation of 25x(17x4).It naturally leads to the equivalence between (25x17)x4 and 25x(17x4).

DISCUSSIONS

Through the school-university partnership, FTs were able to be provided the maxima learning opportunity from school and mentors, since the mentors were provided the opportunity to learn to teach and to educate FTs and the school was educated to learn how to offer the FTs' actual practice instead of to do administrative affairs of school. The partnership of school-university as an example of innovative method provided FTs the maximum opportunity of engaging with the mathematics mentors group. This was resulted from the mentoring program taking the approach of critical constructivist perspective and collaborative inquiry model creating practice-centered conversations among FTs, mentors, and teacher educators. The learning community creates the opportunity of moving back and forth between issues and aspects of daily teaching and mentoring. Through this process, the teacher educators helped to deepen the mentor's understanding of mathematics teaching and students learning. The mentors learned about the power of focused observation, problem posing, asking follow-up question to students, and practice-centered talk to promote FTs' learning. The FTs learned about how to teach with the mentor's learning as a context. Mentors, FTs, and teacher educators are all researchers, learners, contributors of knowledge related to teaching and mentoring.

For the mentor program to be successful required the support and encouragement of the school administrators and the willing participation of the mentors who were asked to accept an extra load by assisting the FTs. The mentors and the FTs involved in the mentoring program appreciated the opportunity to engage with mentors' practice, the structure of the mentor program provided opportunities for the mentors to relate the theoretical knowledge to the practical realities of schools and classrooms. The mentors participating in the study did not focus on mentoring the technical skills of classroom management. Instead, they provided the FTs with engaging in meaningful professional-related tasks. Engaging in meaningful tasks appeared to help FTs to relate the theory taught at the university to the practical needs of school.

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Challenges Associated with Developing a Mentoring Program

There were three major issues associated with link between school and university. The first issue was that the success of the mentoring program relied heavily on the goodwill of mentors and the support from school, as there was no provision for providing them with remuneration or teaching relief. In order to giving the four mentors opportunity to have a professional discussion altogether on Thursday afternoon, the Dean of Academic Affairs of the school made significant adjustment to have a vacancy for the mentors simultaneously involving in the whole range of the activities. Without this level of cooperation from the school and the mentoring persistence in participation, the survival of the mentoring program would not have been possible.

The second issue was related to the overburden for the participation in the mentoring program. Supervisors of the FTs and mentors found it very difficult to ask FTs establishing a portfolio of the professional development containing their learning in two subject areas. Besides, it is very difficult to make the school and mentors participating in the mentoring program without overloading.

The third issue was relevant to the perspective on teacher mentoring. The critical constructivist perspective stresses the equal value of each participant in collaborative inquiry and assumes a similarity between mentors' needs and the need to FTs. However, mentors' experiences as teachers do not come equally with FTs as students. It is difficult to avoid the danger of inquiry that benefits mentors but sacrifices the needs and the interest of FTs.

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