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THE EFFECT OF A MENTORING DEVELOPMENT PROGRAM ON MENTORS' CONCEPTUALIZING IN MATHEMATICS TEACHING AND MENTORING

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ABSTRACT

The study was to develop a mentoring program and examine its effect on mentoring mathematics teaching. A collaborative mentor study group consisting of four mentors and the researcher was set up. The course with 78 hours to develop mentors' theoretical and professional knowledge in which underpins mentoring practice was carried out in the half-year internship. Two surveys, pre- and post-test of pedagogy, self-assessment in mentoring, interview, classroom observation, and reflective journal were the data collected for the study. The satisfaction with the initiates, improvement of mentoring knowledge, and the transfer from the program to support interns on questioning, problem-posing, and anticipating students' solutions were as a result of the mentoring program.

INTRODUCTION

Mentoring as a reform is increasingly used in both preservice programs. Socioculturalists agree that mentoring has greater potential to support teacher learning since knowledge is situated in and grow out of the contexts of mentors use. With support of a mentor working intern's zones of proximal development, the intern can learn to perform beyond his/her independent performance level. This is relevant to the issue of effective mentoring. In recent years, teacher education programs have been encouraged to devote more attention to developing partnerships with schools and helping teachers become equipped to mentor interns (Sutherland, Scanlon, Sperring, 2005). The reformers regard the university-school partnership with the mentor-novice relationship in the context of teaching as one of the important strategies to support novices' learning to teach, thus, to improve the quality of teaching (Odell, Huling, & Sweeny, 1999). A great deal of research on mentoring has identified a wide range of qualities needed (Wang & Odell, 2002). For instance, essential prerequisites include supporting the development of effective classroom practice. This indicates that mentors should be supported to meet the quality of mentoring. Thus, there is a need for a teacher education associated with a school to develop a mentoring development program to support mentors on interns' learning.

Due to the rapidly increased number of preservice teachers has overloaded the teacher education system in Taiwan. One of the shortcomings of the system is the lack of specific subject mentoring by faculty during the internships in schools. With a

heavy mentoring load and widespread geographical locations of interns mentored, much of the responsibility for mentoring interns lies with the mentors in the schools rather than with teacher educators. Moreover, most of the elementary school teachers teach several subjects, it leads to require interns to have teaching in all the subject areas. However, this requirement might not have been fulfilled completely because the mentors had little knowledge or different ideas in their minds about the roles of the interns in teaching mathematics (Lo, Hung, & Liu, 2002). To improve the quality of mentoring, a mentor development joint research project including mathematics, language, and science, as an innovative approach, was initiated at a university associated with a school. The aim of the joint project is to train professional subject mentors and to improve interns' teaching in all subjects. This study involving mathematics as one of the three sub-projects contained in the joint project was intended to develop a mentoring development program that is designed to develop both mentors conceptualizing mathematics teaching and practicing for mentoring interns. The effect of the program on mentors' conceptualizing and practicing in teaching and mentoring will be examined in the study.

Theoretical Framework of the Mentoring Development Program

The theoretical framework of mentoring to support interns learning to teach is based on three models of mentor preparation in which are widely used in both preservice programs. The knowledge transmission model assumes that knowledge of mentoring comes from research rather than from mentors' own experiences and practices, so that such knowledge can be transmitted to mentors in the form of discrete concepts and skills. Although this model helps mentors to develop many mentoring skills and techniques, there is no evidence that mentors are able to apply such learning in their practice with interns (Evertson & Smithey, 2000).

The theory-and-practice connection model assumes that knowledge of mentoring comes both from research and mentors' practical knowledge, so that mentoring skills and knowledge should be actively constructed by mentors and then through integration of their practical knowledge of teaching and learning, with the support of teacher educators. This model, unlike the transmission model influences mentors' sensitivity the needs and problems of interns. This model, teacher educators are still distant from actual mentoring practice (Wang & Odell, 2002).

The collaborative inquiry model stresses mentors' active construction of mentoring knowledge through the integration of their practical knowledge of teaching, the application of what they have learned in practice and constant dialogue with teacher educators. The distinction of this model from the theory-and-practice

connection model in that teacher educators work with mentors and interns residing in the context of teaching and mentored learning to teach. Through this process, the teacher educator helped to deepen the mentor's understanding of practice. This model not only values mentors as learners who actively inquiry into teaching and mentoring but also views teacher educators as learners who examine and develop the knowledge and skills of mentoring in the context of teaching and mentoring. In this model, mentors, interns, and teacher educators are all researchers, learners, contributors of knowledge related to teaching and mentoring.

The effects of each model on mentoring are likely to be different. The mentoring development program with university-school partnership developed in this study takes the assumption of collaborative inquiry model that knowledge and skills of mentoring are constructed through practice-centered conversation and collaborative inquiry with a community of mentors in the contexts of teaching and mentoring.

METHOD

Study Context

In developing the program to enhance mentor development, the main consideration was dependent on the willing of the mentors and interns. There was no agreement that enabled them to be remunerated for their participation. When developing the activities involved in the study were conscious of the need to maximize the interns' involvement in the internship while at the same time minimizing the disruption this participation might cause the mentors and the school.

Four teachers (Yeu, Lang, Ju, and Zue) from an elementary school met regularly with a teacher educator (the researcher) from a university supervising their interns (Huei, Ting, Jong, and Jun) to investigate collective experiences with mentoring. The half-year placement plan enabled four interns to be placed to the school during the study. The researcher was assigned for four hours per week as the university program liaison responsible for interns' supervision at the school.

The Mentoring Development Program

The goal of the program was to create the opportunity of support mentors learning in mentoring such that enhancing the quality of teacher education offered at the university by providing the interns with greater involvement with mentors. The course of the program was designed to develop mentors' theoretical and professional knowledge in which underpins mentoring practice. The theoretical knowledge provides mentors with an understanding of designing principles and gives rise to the professional knowledge when mentors enact it in implementing tasks in classrooms (Shulman, 1998). The two components integrated into the course containing 78 hours

with twenty six 3-hour units were implemented at two stages: (i) a summer workshop with 36 hours containing twelve 3-hour sessions (ii) school-year initiates with 42 hours containing fourteen 3-hour sessions in a half year. Table 1 introduces the contents, units, and periods of the workshop of the course.

During the half-year internship, a collaborative mentor study group (CMSG) consisting of the research and four school teachers was set up. To provide the support of learner-oriented teaching and mentoring to the mentors, the structure of the activities was developed. The lessons of the mentors were scheduled to be observed twice in turn. The first of which was to enable each mentor to watch a pair of mentor-intern's preparation of a lesson, how to carried out the lesson, and de-briefing conversation between them on the lesson. The CMSG met routine weekly with 3 hours allowing mentors mutually support to learn from one another's mentoring in preparing a lesson, observing, and reflecting on a lesson. The intern was asked by the mentor of the observed pair to identify areas which she felt more problematic in implementation and reflection on the lesson observed. Each weekly meeting was audio and video taped.

Contents of the course	# of units	# of units in workshops	
		Summer	School-year
Pedagogy of mathematics contents	7	3	4
Assessment of mathematics	2	1	1
Design of mathematics activities	3	0	3
Classroom observation	1	1	0
Use of teaching aids	2	1	1
Management of mathematics classroom	1	1	0
Mentoring practices	9	1	8
Professional development and reflection	1	0	1
Totally	26	8	18

Table 1: Contents, units, and period of workshops of the course of the mentoring program

The researcher, as a learning partner of the mentors, played the roles in facilitating, probing, and giving feedback to the mentors and created the opportunity for the mentors to discuss how to maximize the opportunities of the interns' learning. The researcher believes that mentors' knowledge of mentoring is actively constructed through the integration of practical knowledge of teaching and experience of learning via social interaction.

Data Collected and Analyzed

Kirkpatrick and Kirkpatrick's (2006) model was the basis of the study to examine

the effect of the mentoring program. At the reaction level, the mentors were interviewed on the feedback of summer workshop and half-year school mentoring activities for measuring what they thought and felt about the program. At the learning level, pre-test and post-test were conducted aligned with self-assessment 5-scale questionnaire professional standards, which was built in previous year of the study (Lin & Tsai, 2007), to assess the extent to which mentors change attitudes, improve knowledge and skill. The instrument with 15 items consisted of 5 items for assessing knowledge of content, 5 items of pedagogical knowledge, and 5 items of knowledge of students' cognition. The constructed validity and reliability of the questionnaires has been examined in previous study (Lin & Tsai, 2007). At the behavior level, classroom observation, interview, and mentors' mathematics journal were measured how mentors transferred their knowledge and skill in mentoring as a resulted of the mentoring program. Each mentor was also conducted individually with a semi-structure interview. The interview included questions about their views of teaching and mentoring, their mentoring practices as well. For the purpose of the study, only some parts of the data in the interview were used.

RESULT

Reaction Level: Satisfaction of the Course of the Program

Table 2 describes the mentors' satisfaction of the activities of the half school-year initiates. They not only had a consistent agreement on the importance but also had a satisfaction with the topics including pedagogy, observation, and sharing practice of mentoring conducted in summer workshop. Nevertheless, for them, classroom arrangement is not as important as other topics. Zue commented that

…I have already developed my own way of classroom management through years of teaching experience. General classroom management is not needed at this moment. Instead, to create the norms of students' discourse in mathematics classroom is my weakness so that it is hard for me to start. I finally realized the significance of instructor's role of playing students' discussion from this summer workshop. … (Zue, Interview).

Contents of the course	Importance		Satisfaction	
	Mean	SD	Mean	SD
School-year workshop on mathematics teaching				
Understanding the logic sequence of activities	4.0	0	4.5	0.5
Enhancing teachers' ability in questioning	4.0	0	4.25	0.83
Enhancing teachers ability in problem posing	4.0	0	4.25	0.83
Designing lesson plan	4.0	0	3.75	0.83
Social mathematics norms	4.0	0	3.5	0.87

Diagnosing students' misconception and remedy	3.75	0.43	3.75	0.83
School-year workshop on mentoring teaching				
Observing peers' lessons	4.0	0	4.0	1.0
Working with intern on lesson plan	3.75	0.43	4.5	0.5
Observing mentor-intern mentoring on lesson plan	3.75	0.43	4.25	0.83
Working with other mentors on lesson plan	3.75	0.43	4.5	0.5
Discussing with intern in post-lesson	3.25	0.43	3.5	0.5
Discussing with the CTSG after their own teaching	4.5	0.5	4.5	0.5
Discussion with the CTSG after peer's teaching	3.75	0.43	4.0	1.0

Table 2 Mentors' Satisfaction of the Course of Mentoring Program

Two kinds of activities engaged in the CMSG were to foster mentors' knowledge of teaching and mentoring in teaching, as described in Table 2. Of the knowledge of mathematics pedagogy, the mentors had a consistent agreement on the importance of mentoring activities including the logic structure of activities, enhancing skills of questioning, and problem posing. Ju reflected on fraction teaching as follows.

…Although having 14 years of teaching, I have never realized various meanings of fraction. In the workshop, I know that the various meanings of fraction including part-whole model, iteration of unit, a value of number line, operator, and ratio. There is a different difficulty for students learning among them. …(Ju, Interview).

The mentors had the least satisfaction with the work of social mathematics norm (Mean=3.5), although they agreed the importance of the social mathematics norm of a learner-oriented approach. The data of Table 2 shows that the mentors were satisfied with the mentoring in teaching, in addition to lesson plan working with intern (Mean=3.5). Lang expressed her opinion on lesson plan working with intern as follows.

…prior to my teaching, I worked a lesson plan with Jong. Initially, I asked him to read textbook and searching for relevant resources of teaching in advance. In the lesson plan meeting, he grasped the objective of each activity, but he was not aware of the need of adaptation of the activities covered in the textbook. While planning a lesson, Jong did not attend to the importance of anticipating students' possible strategies and posing a contextual problem.…. (Ju, Interview).

Learning level: The Extent to Which Mentors Improved Knowledge and Skill.

Comparing the pretest, the mentors had a better performance than on posttest of knowledge. The percentages of pre- and post-test four mentors Yeu, Lang, Ju, and Zue performed were from 40% to 73%, from 53% to 86%, from 40% to 80%, from 40% to 67%, respectively. The result indicates that the mentors improved their content knowledge, pedagogical knowledge, and had better understanding of

students' learning, but they still had a space to improve continually their knowing about teaching. The data also shows that the mentors had very poor understanding of the logic structure of activities performed in the pre-test. With the mutual support of the CMSG, they gradually constructed the structure of teaching in specific topic.

Self-assessment of confidence in mentoring is the indicator of improving mentors' knowledge and skill in mentoring. Before entering the program, the mentors had no confidence in performing 9 items out of 16 items of professional literacy, 20 items out of 34 items of mathematics teaching, and 24 items out of 36 items of mentoring practice, respectively. With the help of the program, they gained more confidence in mathematics teaching and mentoring their interns. The items they had no confidence in performing were from 53 decreasing to 15 items including 9 items of teaching and 6 items of mentoring teaching. Their improved knowledge and skill of questioning and problem-posing was also supported by their reflective journals.

…in terms of asking key question, I know it is important to clarify students' thought but I had an anxiety with this after summer workshop. With the help of classroom observation, I know that it is important to give students longer time to think about the question I asked. Before entering the program, most of the questions I asked were too closed to stimulating students' various solutions (Lang, Journal).

Behavior Level: Transfer occurred in Interns' Teaching Mentored by Mentors

Classroom observation was measured how mentors transferred their knowledge and skill in mentoring interns' teaching as a result of the program. As observed, the mentors not only improved their pedagogical knowledge but also enhanced their ability in transferring to guide interns' on problem-posing, asking key questions, and anticipating students' possible solutions. Yeu reminded Huei of connecting to students' daily context while giving students a problem to solve.

…I worked with my intern on reviewing the structure to examine whether the problems given in teacher guide are relevant to students' daily life. I suggested them keep the objective of the lesson but using more attractive problems to replace the de-contextualized problems if needed. … (Yeu, CMSG meeting).

The four interns' performing in teaching is one of the indicators of examining the effect of the mentoring program. Each intern's lesson was assessed by eight assessors consisting of the researcher, four mentors, and three interns. The average score of each of the 10 items of classroom behavior for each intern was listed in Table 3. The data shows that excepting the item of encouraging students to figure out various solutions and comparing them, they performed well in other items of teaching behavior. The average score of each item has greater than 4.0. The result indicates

that mentors' mentoring in interns' knowledge and skill dealing with encouraging students to figure out solution is not so easy as other teaching skills.

Teaching behaviors	Huei	Ting	Jong	Jun	Mean
1. Drawing students' attention by using various strategies	3.7	4.8	4.5	4.6	4.4
2. Appropriateness of using teaching aids (e.g. technology).	3.6	4.9	4.9	4.6	4.5
3. Asking key questions to support students' thinking.	3.8	4.4	4.1	4.5	4.2
4. Posing problems relevant to students' daily life.	4.3	4.4	3.5	4.5	4.2
5. High interaction with students.	3.6	4.9	4.5	4.0	4.3
6. Encouraging students' to figure out various solutions	4.1	3.6	4.1	3.9	3.9
7. Enable to diagnose students' difficulty and misconception.	3.6	4.3	4.3	3.8	4.0
8. Giving students' feedback at a right time.	3.9	4.7	4.4	4.1	4.3
9. Giving a creative teaching.	3.3	4.9	4.8	4.8	4.5
10. Reaching the objective of the lesson.	3.4	4.1	4.3	4.4	4.1

Table 3: The average score of each item of teaching behavior for each intern

DISCUSSION

One of the challenges of mentoring is to provide mentors with opportunities for authentic experiences. Through the university-school partnership, the mentors and the teacher educator created more opportunities of the dialectics and justification between theory and practice of mentoring in mathematics teaching. This study supporting mentors to engage with the practice provided an example of innovative method of mentoring on conceptualizing mentoring and practicing, and then enhanced the interns learning to teach. For the mentoring development program to be successful required the willing participation of the mentors who were asked to accept an extra load by assisting the interns. Besides, the course structure of the program provided opportunities for the mentors to relate the theoretical knowledge and the practical mentoring. In these experiences, the mentors were not focused on the technical skills of mentoring. Instead, they were engaged in meaningful professional-related tasks. Engaging in meaningful tasks appeared to facilitate the development of the mentors professional knowledge and skill in teaching and mentoring. They were able to relate the theory offered by the teacher educator to the practical needs of mentoring. In this way, the theory or model of mentoring became more meaning for the mentors.

This study also suggests that collaborative mentor study group with offered one promising avenue for supporting mentors learning in teaching and mentoring. Although focused on developing mentors' understating about and practice of mentoring in mathematics teaching, this study also provide an example of the kind of

professional learning needed to promote inquiry-oriented practice more generally. The teacher educator and the mentors jointly constructed understanding of mentoring practice by fostering interactive conversation around artifacts of mentoring practices, developed out of the practice of CMSG participants,

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