**Title: Mentoring of Early Career Mathematics Teachers from the Mentees' Perspective –
A Case-study from China**

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Mentoring Early Career Mathematics Teachers From the Mentees' Perspective – A

Case Study From China

Abstract

Although mentoring has been considered to be important for beginning teachers to situate themselves within the school community, only a few studies on the opportunities of mentoring and possible difficulties from the perceptions of the mentee have been carried out, especially in East Asia. In this paper, a study based on a multiple case approach that investigated how three early career mathematics teachers from Shanghai were mentored is presented. Qualitative text analysis is used to analyse interviews with the beginning teachers during their initial two years of teaching. Four types of one-to-one mentoring could be identified: unnecessary, demonstrative, supportive and collaborative, taking into consideration both the mentor's and the mentee's activities during the mentoring process as well as the mentee's perception of the supportiveness of the mentoring activities. Different opportunities and difficulties in the various types of mentoring could be identified, offering insight for a possible advancement of research regarding this important phase of teachers' professional development.

Keywords: beginning teachers, mentee's perspective, mentoring, professional development

Introduction

Current discussion on the professional development of teachers has placed increasing importance on mentoring for both prospective teachers and early career teachers who are learning to teach (Heikkinen, Wilkinson, Aspfors, & Bristol, 2018; Mena, Hennissen, &

Loughran, 2017). Four factors have been identified as relevant to mentoring in empirical studies (Hennissen, Crasborn, Brouwer, Korthagen, & Bergen, 2008): the scientifically approved value of learning in practical situations (Eraut, 2000); criticism of the dominance of theory in programmes for teacher education and development; teacher shortages in many countries; and the concern that training in practical situations is too expensive (Caldwell & Carter, 1993).

The transition from initial teacher education to classroom teaching is a critical phase for teachers (Jokikokko, Uitto, Deketelaere, & Estola, 2017). Teachers in various countries share common challenges, such as feeling that they are not knowledgeable enough, feelings of low self-efficacy and increased stress, uncertainty about their role and position in the teacher community as new members and threats of job loss due to precarious employment conditions (Tynjälä & Heikkinen, 2011). In the past years, these problems have resulted in attrition of teachers, which has become an international issue (Smith & Ingersoll, 2004). Amongst others, mentoring activities for early career teachers, which have a long tradition in East Asia, have been proposed internationally as a possible measure to counteract this. Mentoring is considered as supportive (e.g., Hobson, Ashby, Malderez, & Tomlinson, 2009; Wang, Odell, & Schwille, 2008), as it aims to assist early career teachers in situating themselves within the school community and helps them to comply with the requirements of their new position in the induction phase (Kemmis, Heikkinen, Fransson, Aspfors, & Edwards-Groves, 2014).

The practices of mentoring vary from one country to another, because the accompanying activities and the underlying concepts and concomitant social relations are contextualised (Heikkinen et al., 2018). However, a comprehensive literature review of mentoring (Orland-

Barak, 2014) notes that relatively few studies focus on the context, despite the fact that in

East Asia, it is a central practice of the induction phase for early career teachers (Salleh &

Tan, 2013). Overall, despite the importance of mentoring, only a few studies exist on its

effects and the possible difficulties, particularly in studies from East Asia. In this study, we

examine how early career teachers are mentored in schools, and what opportunities and

difficulties of mentoring can be identified from the perspective of early career teachers.

Literature Review and Research Questions

Mentoring Across Different Contexts

In an extensive review on mentoring for preservice mathematics teachers at primary and

secondary level, Mewborn (2005) found that mentoring needed to be more broadly

conceived, rather than limited to a specific subject. Compared to the large number of studies

on mentoring, only a small number of studies focused on mentoring for teaching a specific

subject like mathematics. Due to the importance and difficulty of the teaching and learning of

mathematics subject knowledge, mentoring for mathematics teachers has become

increasingly important and is used as a subject within case studies (Nilssen, 2003). Thus, our

investigation into mentoring is broadly set in the frame of general teacher education, but

focuses on the important field of mentoring mathematics teachers.

Currently, there is only one systematic literature review on mentoring across various

contexts, namely the study by Orland-Barak (2014). In her literature review, she focused on

the mentor's functions and reviewed 39 articles published from 1991 to 2014, 38 based on

empirical studies. Three domains could be identified: (1) *mentors' performance and*

behaviours (14 papers), (2) *mentors' reasoning, beliefs and identity formation* (16 papers) and

(3) *the place of culture, context and discourse* (7 papers), including only one paper covering an East Asian context. Although these reviewed studies have yielded a significant corpus of knowledge for mentoring, Orland-Barak pointed out that these studies were fragmented because they focused on local contexts in a particular mentoring setting, not recognising the multifaceted networks of interactions for defining a mentor's role. In particular, there are hardly any studies on mentoring in East Asian contexts.

Mentoring in East Asia. In mainland China, there exists a comprehensive framework for teacher mentoring (Salleh & Tan, 2013), and, in addition, all early career teachers are required to participate in mentoring programmes (OECD, 2015). One-to-one mentoring is considered as an important approach to help early career teachers develop their teaching careers in schools in the first one to three years, within the interactional context of one experienced teacher as the mentor and one early career teacher as the mentee (Chen, 2006). Wang (2009) conducted a survey with beginning teachers in Shanghai from 2008 to 2009, distributing a questionnaire to 325 teachers, conducting individual interviews with 21 persons and carrying out 12 group interviews. She found that "mentoring led to beginning teachers' improvement in daily teaching", so "they could adapt to the school culture rapidly" (p. 69). However, as most of the mentors did not receive training on mentoring and the mentoring relied strongly on mentors' roles, Wang pointed out that not all mentoring activities were effective. Many mentees appreciated discussions with experienced teachers as a better way of improving their teaching after a period of teaching (e.g., three years), rather than following the mentors' ways of teaching at the initial stage; however, discussing with other teachers felt like a betrayal of the mentors from the mentees' perspective. That is, mentoring became more

of a constraint than a source of support for the novices. Wang's study (2009) described, at a general level, opportunities and difficulties for mentees during mentoring, but did not consider the various types of mentoring that exist in China. In their study, Ma and Song (1998) identified four global types of mentoring through investigating 128 groups of mentoring activities: (1) matching and mutually beneficial, (2) one (the mentor or mentee) is not willing to be involved, (3) either the mentor or the mentee barely completing the required tasks and (4) working against each other.

Japan also provides mentoring for early career teachers, and, since 2008, Japanese teachers are required to participate in a one-year programme, which consists of two training courses, one of which is a 300-hour course of mentoring in early career teachers' own schools (Asada, 2012). Four mentees share the same mentor, whose tasks include observing the lessons, guiding mentees to improve their teaching and helping them institutionally.

In 2006, the Singaporean Ministry of Education (MOE) developed a systemic framework for school-based mentoring, namely the Structured Mentoring Programme (SMP), to level up the standard of mentoring practices (Chong & Tan, 2006). The SMP consists of three dimensions for beginning teachers' development: induction, school-level mentoring and a teacher learning programme. Three mentor roles are formalised in SMP: a *mentor coordinator* as the leader and the driver of the school's mentoring programme, a *mentor*, who is an experienced or senior teacher assigned to look after early career teachers and a *mentor* (specialised), who is a specialist coach to an early career teacher in specific areas of skills development. Mentors are equipped with mentoring skills from a training programme provided by the MOE (Ng, 2012).

These three Eastern Asian countries emphasise school-based mentoring, through which early career teachers can develop within their school activities; however, hardly any in-depth studies exist about mentoring and its functioning in schools.

Mentoring outside of East Asia. Based on a meta-analysis of multiple data, the study by Kemmis et al. (2014) examined mentoring for early career teachers within and between three contexts and identified three forms of mentoring:

Mentoring as supervision in New South Wales in Australia. The mentoring process is structured as a way to support early career teachers in their induction phase: the mentor helps the mentee in meeting professional standards, documenting evidence of performance and complying with the official requirements. The mentee documents his or her own performance in a portfolio and follows the mentor's recommendations.

Mentoring as support in Sweden. Mentoring is a process of professional support and guidance for early career teachers; mentors do not supervise but assist their mentees in their professional development. The mentee collects evidence about his or her own practice and reflects on the evidence either individually or with the mentor, based on the mentor's observations.

Mentoring as collaborative self-development in Finland. Mentoring is a process to help early career teachers become equal members of a professional community. The community aims at teachers' individual and collective self-development, and it decides the aims and issues for discussion collectively.

The framework for mentoring developed by Kemmis et al. (2014) can be characterised as a global approach, examining mentoring from different dimensions. However, mentoring is

quite diverse, and more than one type exists in any one context; for example, Sweden follows the *collaborative self-development* mentoring approach as well (Kemmis et al., 2014).

Therefore, to portray multifaceted mentoring in an international context, more fine-grained approaches are needed, which will be described in the following section.

Fine-Grained Approaches Focusing on Mentoring Dialogues

As mentoring is shaped by interactions between mentors and mentees in a professional setting, one important aspect that needs to be considered is the analysis of mentoring dialogues. Based on a literature survey, Hennissen et al. (2008) analysed 26 publications and identified 5 aspects of mentoring dialogues: (1) *content and topics* refer to the content of the dialogues, such as instructional and organisational issues; (2) *style and supervisory skills* focus on the specific supervision skills of the mentor, of which, one important category is a directive versus a non-directive style; (3) *mentor's input* refers to the person who is initiating dialogues and the level of participation (active versus reactive mentors); (4) *time aspects* refer to the duration of the mentoring dialogues and mentors' speaking time during such dialogues; and (5) *phases* focus on topics concerning the stage of the dialogue, and the differences between trained and untrained mentors.

Based on those five aspects, Hennissen et al. (2008, p. 177) developed a two-dimensional model entitled mentor roles in dialogues (MERID), focusing on the aspects of *style/supervisory skills* and *mentor's input* including the aspect of *time*. The aspects of *content* and *phases* were not considered as they were not backed by the empirical data. The *input* dimension of the model displays the degree to which the mentor introduces topics into mentoring dialogues; the *style* dimension presents the degree to which the mentor steers the

course of the dialogue. Combining the two dimensions, four mentor roles were constructed: *initiator (*introduces topics and uses non-directive skills; short speaking time), *imperator* (introduces topics and uses directive skills; long speaking time), *advisor* (does not introduce topics and uses directive skills; long speaking time) and *encourager* (does not introduce topics and uses non-directive skills; short speaking time).

Using the MERID model, several empirical studies have been carried out; for example, the role of the *imperator* mentor was examined by Hennissen et al. (2008). Mena et al. (2017) found, in further studies, that neither the mentor's *input* nor *style* could be clearly identified as every conversation takes place in a singular educational context. Overall, the studies point out that the MERID model needs to be adapted to the specific context and cannot be generalised. Further limitations of the model become clear within the dimensions of *style and supervisory skills,* where two different forms of interactions between the mentor and the mentee can be distinguished theoretically: *conversations* and *observations*. Within the *conversations* between the mentee and his or her mentor, the mentors can express their own opinions, offer strategies and give feedback, which indicates *directive* mentoring. When the mentee observes the mentor's teaching, reflects on it and learns from the *observations*, it is more *indirective* mentoring. However, when the mentor comes to observe the mentee's teaching and comments on the observation, it is *directive* mentoring. Overall, in contrast to the descriptions of the MERID model, both *directive* and *indirective* aspects exist in the mentoring process of the same mentor-mentee dyad. This ambiguity can be described as the central limitation of the MERID model and is empirically addressed by our own study described in this paper. Furthermore, the studies on which the development of the model is

based come from a Western context and do not consider East Asian approaches, in which mentoring processes have a long tradition. To summarise: the three weaknesses of the MERID model discussed above, namely the missing identification of input and style of the mentor's input, the simultaneous existence of directive and indirective aspects in the mentoring process of the same mentor-mentee dyad and the missing consideration of East Asian contexts, clearly point to the necessity to modify and further develop the MERID model for different cultural contexts and with modified dimensions.

Furthermore, despite the comprehensive character of the five aspects of the mentoring interactions identified by Hennissen et al. (2008), they did not directly include the mentee's perspective, and, in particular, affective issues of the mentee are missing. As the objective of mentoring is to promote the mentee's professional learning, the mentee's perspective on mentoring needs to be included in a comprehensive study on mentoring for early career teachers. Currently, only a few studies have done that; for example, the study by Richter et al. (2013) examined how constructivist- and transmission-oriented mentoring affected early career teachers' development by analysing teacher efficacy and teaching enthusiasm. However, mentoring, especially in the Eastern context, is school-based, and it advocates a situated learning perspective for the mentee (e.g., Chong & Tan, 2006). The situated learning perspective emphasises that learning is situated within socially shaped contexts (Cobb & Bowers, 1999). Considering mentees' perceptions of mentoring in actual teaching situations by going beyond discussions before and after mentoring may enrich the multifaceted network of mentoring.

Research Questions

Departing from the request of Orland-Barak (2014) for a more integrative research agenda for the field of mentoring, this study analysed mentoring from the perspective of China as a prominent East Asian country. Specifically, we investigated how early career teachers are mentored in China by addressing the following two research questions:

(1) Can various types of mentoring be empirically distinguished and further developed by expanding well-known models of mentoring and taking explicitly into account the mentee's perspective? If yes, which types can be empirically identified?

(2) What chances for professional development are offered within these types of mentoring for early career teachers, and what difficulties may arise within these types of mentoring?

Methodology

Methodological Grounding: A Case Study Approach

This study investigated mentoring practice in Shanghai using a qualitative research approach, due to its aim of studying real-world settings, discovering how people cope and thrive in these settings and capturing contextual richness (Yin, 2010). More specifically, the study employed a multiple case study approach (Stake, 2013) to investigate three early career mathematics teachers in Shanghai and their perceptions of mentoring during their initial two years of teaching. Mentoring consists of activities between the early career teachers and their mentors and is shaped by norms, expectations and institutional conditions. The investigation focuses on the dynamics of these activities within real-life contexts, which makes a case study approach suitable (Roth, 1999; Yin, 2010).

The participants. The study investigated three early career teachers: Doris, Jerry and

Tommy (all pseudonyms). They had obtained their master's degrees in mathematics or mathematics education from universities and were recruited as high school programme mathematics teachers in Shanghai in 2013. Doris and Jerry had received their Bachelor of Science degrees on mathematics programmes at normal universities, which are traditionally teacher preparation institutions providing courses related to mathematics and pedagogy (Fan, Miao, & Mok, 2014, p. 49). Doris had completed a voluntary one-year teaching job in the west of China to support educational development in less-developed areas in China, which was a necessary requirement for her enrolment onto a master's as an outstanding student. Tommy had gained his Bachelor's and Master's Degrees in Mathematics from a comprehensive university, and had only attended courses in advanced mathematics without any teaching-related training. Jerry, like Tommy, had obtained a Master's Degree in Mathematics. Overall, the educational background of the three participants was quite diverse; Doris was the one who had the most experience in teacher training, and Tommy had the least out of the three participants. These three cases are quite typical of the academic background of mathematics high school teachers in Shanghai.

Context of the study. In 2012, the Shanghai educational administration launched an induction programme called *Compulsory Training for First-Year Teachers at Elementary (including Kindergarten) and Secondary Schools* (*Compulsory Training*, for short), making mentoring a compulsory activity for every newly recruited teacher in Shanghai. To improve the opportunities for early career teachers to learn from more experienced teachers, the programme assigns not only two mentors for each early career teacher from his or her own school to support subject teaching and classroom management, but also two mentors from a

base school, sometimes different from their own schools but located in the same district, and with a good reputation for teacher quality.

The three participants were involved in this *Compulsory Training* in their first teaching year. The three schools they worked in were recognised due to their good reputations for teacher quality and, thus, also happened to be their base schools; therefore, their own school mentors and base school mentors were the same. Some of the mentors took on both tasks, mentoring for teaching mathematics and for classroom management. In the second teaching year, the mentoring was only provided by their own schools. As the conditions were quite different in the year of mentoring required by *Compulsory Training* and the year provided by their own schools, it is appropriate to divide the mentoring into different cases depending on the assigned mentor. Nine cases with seven mentors can be distinguished (Table 1 shows the different dyads in the training phases). All mentors were mathematics teachers.

Table 1: Mentoring for the three early career teachers during the two years of teaching

Doris	Jerry	Tommy
Doris-1-Tian Tian, female, the mentor for teaching mathematics	*Jerry-1-Tang* Tang, male, the mentor for teaching both mathematics and classroom management	*Tommy-1-Yang* Yang, male, senior mathematics teacher, the mentor for both mathematics teaching and classroom management
Doris-1-Zhang Zhang, male, the mentor for classroom management		*Tommy-1-Hou* Hou, male, the mentor for both mathematics teaching and classroom management
Doris-2-Zhang the mentor for both mathematics teaching and classroom management	*Jerry-2-Zhou* Zhou, male, replacing Tang	*Tommy-2-Yang* *Tommy-2-Li* Li, female, replacing Hou

The mentoring occurred mainly within lesson preparation groups (LPGs) for the teachers teaching the same subject to the same grade, which had already existed in China's school system for a long time and served the purpose of joint lesson preparation (Li, Chen, & Kulm, 2009). Most of the mentors were also the group heads during the mentoring phase.

Data Analysis by Qualitative Text Analysis

The investigation included data collection in four separate rounds during four terms across the two academic years from 2013 to 2015: in September 2013, March 2014, November 2014 and May 2015, and lasted one week for each participant in each round. The main data were the interviews with the mentees before and after their daily classroom teaching. The interviews focused on the mentees' reflections on their observations of the mentors' teaching, the discussions with the mentors and what they had learned from them. All interviews were audio-recorded and then transcribed. The mentees' classroom teaching was observed, and field notes of the teaching and the school context were taken to gain a broader understanding of the whole context. Qualitative methods were used to analyse the data, as the qualitative paradigm seemed to be specifically appropriate in order to evaluate the context-bound and subject-related data (Denzin & Lincoln, 2011). Specifically, the text analysis method by Kuckartz (2014) was implemented, using all three category-based methods, namely thematic text analysis, evaluative text analysis and type-building text analysis, in order to generate generalisable results (Kuckartz, 2014).

Thematic text analysis. Thematic text analysis was used to reconstruct the relevant themes of the mentees' perceptions of mentoring. After a careful review of the data, four categories were identified: *situation*, *observing*, *observed* and *discussion or general*

reflection. *Situation* shows the general descriptions of mentoring from the mentees, such as the main activities of mentoring and their frequency (e.g., observing, observed and discussions).

Observing refers to topics raised when the mentee observes the mentor's classroom teaching, such as the questions the mentee asked and his or her perceptions of the observation. *Observed* refers to the mentee's reflection on the discussions with the mentor after the mentor observes his or her classroom teaching. *Discussion or general reflection* presents their feedback, reflections and comments on the discussions with the mentor on topics not related to observations, and their reflections on mentoring, such as discussions on the problems they had in preparing the lessons. These three types of topics were mainly related to the following three themes: *content and topics in teaching* are similar to the aspect of *content and topics* in mentoring dialogues by Hennissen et al. (2008) and describe the mentee's words about his or her own and the mentor's teaching; *self-reflection* is about the mentee's reflections on the nature of mentoring, including the kind of activities expected by the mentee, the role of the mentor in mentoring activities and the influence of mentoring on him or her learning to teach; and *attitudes* describe the mentee's attitudes and emotions towards mentoring.

Based on the four types of topics the mentees mentioned in the interviews and the three themes, the mentoring of the three beginning teachers could be described comprehensively. However, for further systematic analysis of the data, evaluative and type-building text analyses were also employed in order to further identify patterns within mentoring activities leading to generalisable types of mentoring activities from the mentee's perspective.

Evaluative and type-building text analyses. Based on the data, four forms of input from the mentor and the mentee could be reconstructed.

Table 2: Four forms of *active*/*reactive* behaviour in mentoring

Category	Description
Mentee-active	The mentee is active in observing the mentor's classroom teaching, and/or initiates discussions with the mentor, bringing topics into the conversations.
Mentee-inactive	The mentee observes the mentor's classroom teaching as required. Once there was a chance, he or she would leave.
Mentor-active	The mentor is active in observing the mentee's classroom teaching, even if it is not required, and/or actively initiates discussions with the mentee.
Mentor-inactive	The mentor is inactive and does not observe the mentee's teaching unless it is compulsorily required.

These four forms of behaviour within mentoring activities allowed the construction of four categories of mentoring: (1) ***Type A***, mentor-active and mentee-active; (2) ***Type B***, mentee-active but mentor-inactive; (3) ***Type C***, mentor-active but mentee-inactive; and (4) ***Type D***, mentor-inactive and mentee-inactive.

Findings: A Model for Various Types of Mentoring

Further Development of the Theoretical Framework

In order to answer the first research question of our study on mentoring early career mathematics teachers in China, and more specifically in Shanghai, a further development of the MERID model is proposed, going beyond it by including the mentees' perspective and their affects. In addition to the analysis of the dialogues between mentor and mentees, we include the mentees' own perceptions, reflecting their interpretations of as well as their emotions during the mentoring process.

In detail, in our further development of the MERID model, we include the *input*

dimension of MERID by focusing on both the mentor's and the mentee's input during mentoring, leading to a two-dimensional description focusing on input from both perspectives. Based on our analysis, four types of *input* could be distinguished: *mentee-active*, *mentee-inactive*, *mentor-active* and *mentor-inactive*. Actually, these two dimensions of the mentor's and mentee's input comprise the two dimensions of the MERID model, namely directiveness and input, by interpreting them differently and including the two perspectives of the mentor and the mentee, which is indispensable from our perspective.

The directiveness dimension has been newly conceptualised as *supportiveness* of the mentoring from the mentee's point of view. From the mentee's perspective, their attribution of the nature of mentoring and their attitude towards mentoring could be identified as major dimensions of the mentoring process, which is reflected by the new dimension *supportiveness*. Based on this differentiation, it is possible to conceptualise this dimension of **non-supportive/supportive** mentoring as perceived by the mentee. Mentoring of **supportive** is described as being important to the mentees who are learning to teach. He or she usually has a positive attitude towards such mentoring, and is willing to continue it and to follow the mentor's way of implementing teaching. In contrast, **non-supportive** mentoring usually connects with the mentee's obvious negative attitudes towards mentoring. He or she is neither willing to continue it nor follow the way the mentor teachers teach.

In order to answer the first research question based on our data, we propose a three-dimensional model for mentoring activities including the *mentor's* and *mentee's activeness* and *supportiveness* in the mentoring process from the perspective of the mentee (Figure 1). The axes of mentor's activeness and mentee's activeness represent the degrees of input from

the mentor teacher and the mentee, respectively, and the axis of supportiveness represents the degree of the mentee's attitude towards the mentoring with the mentee.
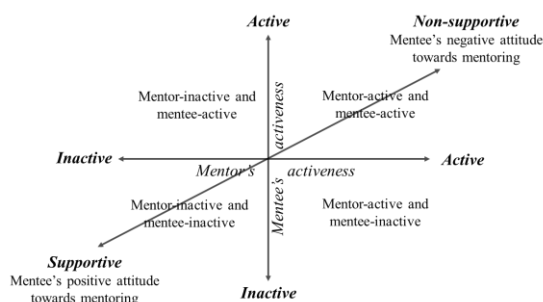

Figure 1: Three-dimensional model for mentoring

We exemplify this new model using different types of monitoring based on our case study with three early career teachers within the two phases of induction and with seven mentors.

Exemplification of the Different Types of Mentoring

The different types of mentoring are described based on the case studies of Doris, Jerry and Tommy.

The case of Doris. The description of the case of Doris is separated into the first and the second year.

The mentoring of Doris by Ms Tian in the first year. The mentoring of Doris by Ms Tian, focusing on mathematics in her first year at the school, can be characterised as *Type D* mentoring (i.e., *mentor-inactive* and *mentee-inactive).* Furthermore, Doris *did not express a clear attitude* towards mentoring, and, therefore, it cannot be decided whether she evaluated the mentoring as being supportive or not. According to Doris, the main way of mentoring at the beginning of her work in the school was through observation of the mentors' classroom teaching, which was apparently not really appreciated by Doris, as "actually any other

teachers' classes (in the LPG) are open for me to observe". Due to her one year of teaching experience in the West of China, Doris was already confident in her teaching ability. She could conduct teaching independently, and her focus was on students' feedback, with which she could adjust her teaching properly to cater to students' learning. Therefore, she did not observe Ms Tian's classroom teaching very frequently, and Ms Tian was too busy to observe hers.

The mentoring of Doris by Mr Zhang in the first and second years. The mentoring between Doris and Mr Zhang can be mainly described as _Type B_ (i.e., _mentee-active_ and _mentor-inactive),_ and sometimes _Type A_, where both are active. Doris evaluated the mentoring as _supportive_. Mr Zhang was originally assigned as Doris' mentor for classroom management, but took over the mentoring of mathematics teaching in the second year too. The data clearly show that Mr Zhang was a real "_shifu_" (Master) in Doris' perception.

Contents and topics in teaching. The contents and topics of the mentoring activities centre on "typical mathematical examples" and different ways of introducing mathematical topics. Doris focused on these aspects by observing Mr Zhang's classroom teaching and in the discussions with him. Doris usually initiated discussions when she had problems in preparing lessons and conducting teaching on her own. Mr Zhang directly gave his suggestions to Doris, which additionally confirms that the mentoring between Doris and Mr Zhang can be described as _Type B_. However, the mentoring of Doris by Mr Zhang can be described as _Type A_ at least once, namely when Doris integrated mathematical history into teaching. Mr Zhang became more active, came on his own initiative to observe her teaching and discussed the teaching with Doris as she was more experienced concerning this topic.

Self-reflection and attitude. Doris can be characterised as being highly self-reflective. She mentioned that she usually had an aim when observing each lesson, such as the kind of mathematical examples Mr Zhang used. From a general perspective, it becomes clear that the environmental atmosphere within the mentoring activities was very important for Doris. She emphasised that the atmosphere of the LPG, in which she and her mentor jointly worked, encouraged teachers to discuss things with each other. Moreover, Doris held the position that the mentee should be more active in the mentoring process, posing questions and initiating discussions. She preferred to teach first in her own way, and then observe Mr Zhang's classroom instructions and discuss with him possible problems with her own teaching, which was helpful, especially because Mr Zhang's teaching approach was, according to Doris, consistent with hers, namely encouraging student initiative in learning mathematics. These descriptions provide additional evidence that the mentoring between Doris and Mr Zhang can often be described as *mentee-active* but sometimes as *mentor-active*.

Generally, Doris had a positive attitude towards the mentoring by Mr Zhang, which can be described as *supportive*. From *observing*, she thought that Mr Zhang's classroom instructions were interesting, and she developed her own skills by reflecting on the observations. Doris found Mr Zhang's encouragement as essential for solving the problems she faced, such as preparing the lessons. In particular, when she prepared a public lesson, the mentor was strongly *supportive*.

> He talked with me about my lesson plan design, the whole procedure of
>
> class teaching, each detail of the teaching, the design of blackboard writing
>
> and where I should be cautious when presenting, almost everything. (All

translations from Chinese into English were done by the first author)

She "felt very good" when she improved on the aspects the mentor emphasised.

The case of Jerry. The mentoring of Jerry by Mr Tang, who was responsible for both mathematics teaching and classroom management in the first year, can be characterised as *Type B*, *mentee-active* but *mentor-inactive*, but some aspects of *Type A,* with more activities by the mentor, could also be identified. Furthermore, Jerry described the mentoring as *supportive*. When Mr Zhou replaced Mr Tang, who was teaching a different grade in the second year, the mentoring of Jerry changed from *Type B* to *Type D,* where both the mentor and the mentee were inactive, and Jerry considered the mentoring activities as *non-supportive*. The main mentoring activity for Jerry in the first year comprised classroom observations (i.e., Jerry *observing* Mr Tang's teaching and Jerry's teaching being *observed)*. At the beginning, Jerry observed most of Mr Tang's lessons, and later in the year, he observed Mr Tang's lessons almost every day. In turn, Mr Tang observed Jerry's lessons once or twice per month. In the second year, mentoring mainly took place in the form of *observing* (i.e., at the beginning, Jerry observed when Mr Zhou introduced new topics, which he gave up on later in the second semester). Overall, the mentoring by Mr Zhou seemed to be less important to Jerry than that of Mr Tang.

Contents and topics in teaching. When observing the mentor's lessons, Jerry usually focused on the way Mr Tang presented mathematical topics, such as the mathematical examples he used, and the structure of the presentation. He tried to follow Mr Tang's way of teaching in his own classes. It becomes evident that Jerry intended to learn from him on how to teach "a clear structure of mathematical knowledge" and how to acquire "good skills in

classroom management".

He is good at managing students' discipline. His students do not dare to

talk. So they were forced to listen to (Mr Tang's) demonstration carefully.

These expectations point out that the mentoring between Jerry and Mr Tang can be

characterised as more *mentee-active*. However, aspects of the mentor being active can be

identified as well. For example, Jerry reported that Mr Tang usually asked him to give him

his lesson plan before he observed the lesson, and based on the lesson plan and the lessons

observed, both discussed problems with Jerry's teaching. Overall, the mentoring activity by

Mr Tang can be described as *mentor-active* as well, as Mr Tang was not only observing, but

also actively reviewing Jerry's lesson designs beforehand. In the second year, Jerry learned

from Mr Zhou which topics are important in the National College Entrance Examination in

China and how to teach based on them. Therefore, this mentoring can be described as *mentee-active*.

active.

Self-reflection and attitude. Jerry described mentoring as a compulsory activity arranged

by the administration and the school, providing opportunities for the mentee to observe

experienced teachers' teaching and to learn from it. "Otherwise, no teacher would be willing

to let you observe his or her teaching". Therefore, "it should be the mentee's own

responsibility to learn and to improve". This indicates that, according to Jerry, mentoring

activities should be *mentee-active.* Jerry valued the mentoring of Mr Tang in the first year as

supporting his learning of teaching, as he had known very little about teaching in the first

year, so he was keen to learn from Mr Tang through frequent observations of his teaching,

while the mentoring by Mr Zhou was apparently less productive. Jerry reported that he was

not so active in the second year, because he "had too much work to do", and because he "already knew how to teach" from the first mentor and both conducted exam-oriented "teaching with emphasise on mathematical contents required by the national curriculum". So he tried to conduct teaching independently. Overall, the mentoring of Jerry by Mr Zhou seemed to have been less *supportive* for Jerry than that of Mr Tang.

The case of Tommy. Mr Yang and Mr Hou were assigned as Tommy's mentors in teaching mathematics and classroom management in the first year. Mr Yang was assigned because he was a senior teacher, but as he was not teaching students of the same grade as Tommy and was too busy to support Tommy, Mr Hou was assigned. However, in the second academic year, Mr Hou did not teach the same grade as Tommy, so Ms Li replaced him.

The mentoring of Tommy by Mr Hou in the first year. The mentoring can be characterised as *Type B* (*mentee-active* and *mentor-inactive)*, except when they shared the same teaching work, for which it may be characterised as *Type A*. Overall, Tommy considered the mentoring as *supportive*.

Contents and topics in teaching. Tommy said that there were not many opportunities to discuss with other teachers apart from the mentor, so he relied on Mr Hou a lot in the first year of teaching. He taught the same topic one day after Mr Hou, so he could learn how Mr Hou taught it first. Tommy mentioned that he was used to teaching mathematical topics according to how he had learned the topics as a student. By observing Mr Hou's teaching, he could learn the proper structure to present mathematical topics. Tommy explained:

> Mr Hou has a comprehensive understanding of the mathematical topics. He
>
> knows every aspect of a mathematical topic, such as the meaning of the

concepts, the applications of the topic, etc. These aspects construct the

whole lesson structure and help to promote students' thinking.

Moreover, he also learned from Mr Hou about students' possible misconceptions of

mathematical topics. In particular, he emphasised that "the (mathematical) examples used by

Mr Hou were good, as each of them pointed out a mistake the students usually made (in

doing related exercises)", so "I would like to use his examples in my class". Mr Hou also

followed the compulsory instructions of the mentoring programme and observed the mentee's

lessons. From the observed perspective, Tommy mentioned that Mr Hou never praised him,

but often pointed out that he had problems in his teaching. Mr Hou also questioned the

structure of Tommy's lessons by asking questions: "Why did you teach in this way?" "Why

did you use this sequence?" and "What were your intentions when teaching in this way?"

These descriptions show that the mentoring of Tommy by Mr Hou in the first year can be

mainly described as *Type B*, but sometimes Mr Hou was also active as a mentor tending

towards mentoring *Type A*, especially when Tommy and Mr Hou taught the same group of

mathematically interested students with mathematical topics going beyond the curriculum.

Self-reflection and attitude. As mentioned above, Tommy relied strongly on Mr Hou in

the first year of his teaching. From a general perspective, Tommy compared his own and Mr

Hou's teaching and described Mr. Hou's strengths as "well-structured" teaching, "promoting

students to understand by themselves". In contrast, he described his own teaching as

"unimpressive", "too talkative", saying that the students "appeared to be bored". Tommy

attributed the reason for these differences to his missing teaching experience:

I think it is a disadvantage that I did not graduate from a normal university.

That's why I cannot behave like other teachers. What I can follow is only

my own experience of learning the specific mathematical contents.

Therefore, Tommy tried to follow Mr Hou's teaching techniques. He thought he had a similar teaching style to Mr Hou. In the second teaching year, when Mr Hou was not his mentor anymore, Tommy still went to observe Mr Hou's teaching to see "how he dealt with the mathematical topics". Describing Tommy's affective attitude towards mentoring, it can be confirmed that he experienced the mentoring by Mr Hou as *supportive*; he stated that "without observing his teaching, I don't know how to teach (specific mathematical topics), such as the demonstration structure, and in which sequence the mathematical topics in one lesson should be demonstrated".

The mentoring of Tommy by Mr Yang in the first year and by Ms Li in the second year. These two examples of mentoring can be characterised as *Type D*, with both the mentor and mentee being inactive. Furthermore, no clear evidence can be identified concerning the *supportiveness* of the mentoring activities. Mr Yang was a senior teacher teaching grade 12 students to help them prepare for the national examination. No *observation* took place, but Tommy felt very happy when he got Mr Yang's teaching plans for mathematics teaching throughout the whole high school, so he could "spend less time in preparing (lessons)". Overall, the mentoring between Tommy and Mr Yang can be described mainly as *Type D* with some aspects of *Type B*, when Tommy learned from Mr Yang's teaching materials. In the second year, when Mr Hou was replaced by Ms Li, Tommy reported that "we were very busy with our own teaching work, so I did not have much time to observe Ms Li's classroom teaching, and neither could Ms Li come to observe mine". As required, Mr Yang or Ms Li

came to observe Tommy's classroom teaching, but only very infrequently.

Discussion: Chances for and Challenges of Mentoring Early Career Teachers

This multiple case study investigated mentoring for early career mathematics teachers in Shanghai from the mentee's perspective. From the detailed descriptions given above of the cases of the three teachers, it can be concluded that various types of mentoring can be empirically distinguished by considering the mentee's perspective and by describing four different types of mentoring, with either both the mentor and mentee being inactive or active or with one being active and the other being inactive. Furthermore, the framework includes the dimension of whether the mentees appreciated the mentoring as supportive or non-supportive. Based on the three cases of early career teachers mentored by seven mentors, seven one-to-one mentoring activities emerged, which allowed four general types of mentoring to be generated empirically. These general types provide a framework for examining the chances for professional development offered to and difficulties connected with these types of mentoring for early career teachers in Shanghai, which answers the second research question of the study.

General Types of Mentoring in Shanghai

Within our three-perspective model of mentoring (Figure 1), specifically assessing the mentor's and mentee's *input* and the *supportiveness* of mentoring, the data allowed us to categorise the seven groups of mentoring into four areas of the three-dimensional model. Since the strength of each perspective was not examined in this study, we visualise our cases using four areas, labelled by four points (Figure 2).
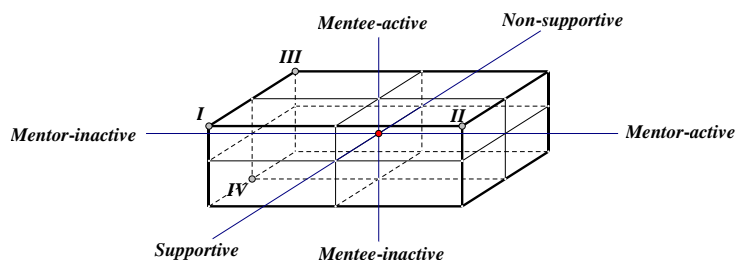
Figure 2: Assessing mentoring from the three perspectives

The first general type of mentoring can be described as ***unnecessary*** for the mentees. These cases (visualised by IV in Figure 3) share, as commonalities, an inactive mentor and mentee, and the fact that the mentee has no clear attitude towards the mentoring, with regard to whether it is supportive or non-supportive. The following mentoring activities exemplify this case: the mentoring of Doris by Ms Tian in the first year, the mentoring of Tommy by Mr Yang in both years, the mentoring of Tommy by Ms Li in the second year and the mentoring of Jerry by Mr Zhou in the second year. Reasons for such kinds of "unnecessary" mentoring could be as follows: the mentee preferred to conduct teaching on her own (the case of Doris), the mentor did not teach the same group of students as the mentee (the case of Tommy), the mentor was perceived by the mentee as not having the same teaching style as the mentee (the case of Tommy) or the mentee found it useless to observe the lessons of the mentor as the mentee was already acquainted with teaching (the case of Jerry).

The second general type of mentoring can be described as ***supportive***, with the mentee being active and the mentor mainly being inactive, but being supportive when necessary (visualised by I in Figure 3). The mentoring of Doris by Mr Zhang over the two years could be mainly characterised by this type. Doris taught independently, but when she had problems teaching, she discussed them actively with the mentor, who provided suggestions.
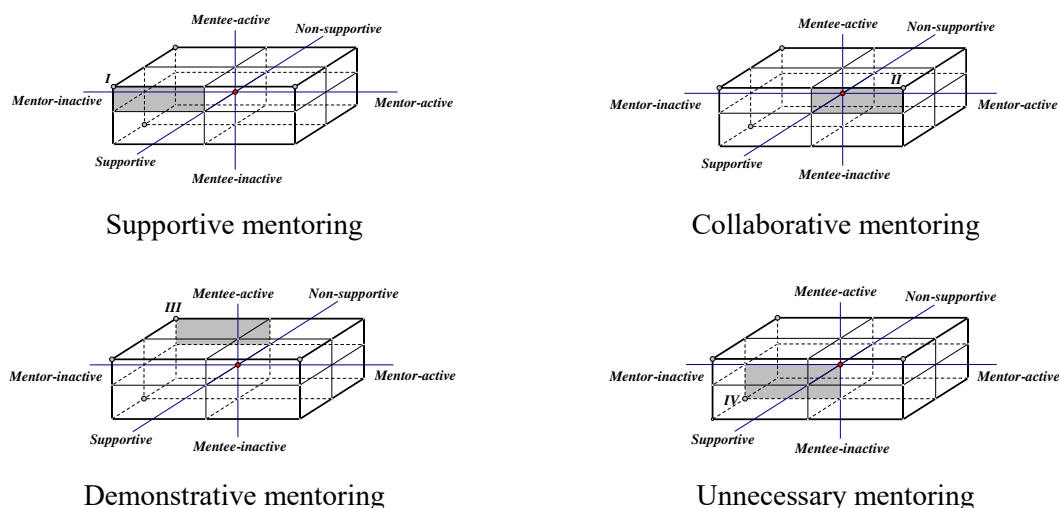
Figure 3: The four types of mentoring

The third type of mentoring, a ***collaborative*** style, can be identified by both the mentee and mentor being active, and by the mentoring being experienced as supportive by the mentee (visualised by II in Figure 3). The case of Doris can exemplify this type as well: when Doris integrated history into her teaching, the mentor became active and the mentoring developed a more collaborative character, going beyond the mentor supporting the mentee. This indicates that there can be two types of mentoring within one mentor-mentee dyad, depending on the context, for example, the content of the teaching. Another case of *collaborative* mentoring is when Tommy was mentored by Mr Hou in the first year, when they shared the same additional teaching with mathematically interested students.

The fourth type of mentoring can be described as ***demonstrative*** mentoring: the mentee is active in observing the mentor's classroom teaching and follows the mentor's way of teaching; however, the mentor is not active (visualised by III in Figure 3). This appears to be useful for the mentee at the very beginning of mentoring and is therefore recognised as supportive. Jerry being mentored by Mr Tang in the first year can exemplify this type.

The Nature of Demonstrative, Supportive and Collaborative Mentoring

As summarised above, three of the four mentoring activities are considered to be useful for the mentee, namely demonstrative, supportive and collaborative mentoring. Demonstrative and supportive mentoring, presented in this study, are mentee-active but mentor-inactive, but collaborative mentoring requires both the mentor and mentee to be active.

Demonstrative mentoring allows early career teachers without pedagogical experiences, like Jerry and Tommy, to learn directly from experienced teachers' ways of teaching. The mentee can adapt to teaching quickly, which is especially relevant within a centralised curriculum like the Chinese one and can be seen as an advantage. However, this kind of mentoring deprives the mentee of his or her own exploration of teaching. This can lead to the abandonment of mentoring – as in the case of Jerry – when the mentee can teach independently and has the impression that no support is needed anymore. The mentoring may therefore not be sustainable. This kind of mentoring has some similarities to the probation phase in New South Wales in Australia, in which mentoring by supervision is offered (Kemmis et al., 2014).

Supportive mentoring looks like the support mentoring in Sweden (Kemmis et al., 2014). This kind of mentoring allows the mentor to assist (rather than supervise) the mentee in learning to teach. It requires the mentee to already have some pedagogical qualifications at the beginning, as well as the mentor's ability to assist the mentee. It probably requires good timing as well. For instance, when Doris was busy with her own teaching at the very beginning, she was not willing to seek support from Ms Tian.

Collaborative mentoring resembles the mentoring model in Finland (Kemmis et al., 2014), but in the form of one-to-one mentoring. It requires a joint understanding between the mentor and the mentee, based on similar teaching ideas or teaching style, so that the mentor and the mentee can work together. The mentee can be encouraged to learn from the mentor, and develop his or her own specific teaching practice based on intensive conversations with the mentor. This helps to increase the sustainability of the mentoring and contribute to a productive teacher community.

Conclusions

Returning to our model of the three perspectives of mentoring, it appears that the mentor's activeness is highly relevant for the mentee's perception of whether the mentoring is supportive or not. When the mentor is active, either by his or her own initiative (e.g., Doris mentored by Mr Zhang) or as required (e.g., Jerry mentored by Mr Tang), the mentoring is usually considered supportive in the mentee's opinion. The mentor's input can therefore be seen as a decisive factor for the sustainability of mentoring. However, the majority of the seven groups of mentoring identified in this study were characterised by active mentees but inactive mentors. There may be several reasons for this: For example, this compulsory mentoring programme has been newly developed and may not be widely established, although there is guidance by the government to support active mentoring. Furthermore, it may be due to the cultural characteristics of mentoring activities in China that emphasise the necessity of the input of the mentee. As an old saying goes, "the mentor can open the door" (opening his or her class for you to observe), "but you must enter by yourself" (but you learn of your own accord).

To summarise, the model suggested in this study has shown to be effective in analysing the mentoring of early career mathematics teachers in Shanghai, and probably elsewhere as well, from the mentees' perspective. The analyses point out that there are different opportunities and challenges for the mentee in the three different types of useful mentoring – demonstrative, supportive and collaborative – taking into account the input of the mentor and the mentee, as well as the mentee's perception of the supportiveness of mentoring. It especially indicates the importance of the mentor's active input that is lacking in mentoring in China despite the country's long mentoring tradition.

This study enriches the corpus of research on mentoring by bringing an East Asian perspective. However, due to the limited number of cases included, there may be other possible types of mentoring that were missed by this study. For a comprehensive understanding of mentoring, more cases of mentees with different backgrounds are desirable. Moreover, the limited cases only show examples demonstrating the input of the mentor and the mentee as well as the mentee's perception of the supportiveness of the mentor in the mentoring, but they cannot indicate the degree of the input and the perceived supportiveness.

Overall, our investigation is based on literature of mentoring in general for teachers of all subjects. Therefore, our findings, especially the model for mentoring (Figure 1), can be applied to mentoring for teachers in general. However, as the four types of mentoring were generalised from cases of mentoring mathematics teachers, these types are specific for mathematics teachers. In light of the study of Mtetwa and Thompson (2000) on mentors behaving like mathematicians, further studies are needed in order to examine whether our results can be generalised to teachers of other subjects. In sum, further research on mentoring

with a more sophisticated design, which overcomes the limitations of this study, is therefore

needed to build an even more extended model for a comprehensive understanding of this

complicated area of mentoring.

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