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A comparative study of the role of the external facilitator in lesson studies in Denmark and China

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Collaborative forms of mathematics teachers' professional development, such as lesson study, are integrated parts of the educational systems in many East Asian countries, while these forms are often new in Western countries. In this paper, we focus on a central role in lesson study, that of the facilitator. We compare how they talk with teachers and what they focus on in their talk in a lesson study context in Denmark and in China. We use a framework consisting of mentoring strategies and content categories; both developed empirically in a Chinese respectively a European context. Our analysis shows big differences in the facilitators' ways of engaging in talk with teachers. One big difference is the dynamic and relational patterns in the Danish case as compared to the lengthy talk of the Chinese facilitator. We analyze these patterns deeply and argue that their differences are not only related to the fact that lesson study is new in Denmark, but also to social and cultural differences.

Keywords: Comparative study, lesson study, the facilitator, mentoring strategy, content categories.

Introduction

In this paper, we compare the role of the external facilitator (the expert teacher, the knowledgeable other, etc.) in the varied forms of lesson study (LS) in Denmark and Shanghai, China. While LS is new in Denmark, it has long been a school-based teacher professional development activity in China which vary in forms for teachers with different teaching experiences (Huang et al., 2017). Given the challenge of importing a routine developed in one culture and one educational system into countries with different cultures and systems (Stigler & Hiebert, 2016), it is important to develop insights into the roles of central actors in LS, in particular the role of the facilitator. At the level of interaction between facilitators and mathematics teachers, we investigate the research question: To what extent are there similarities and differences between LS in Denmark and Shanghai in relation to *how* the facilitators talk to the teachers and *what* content aspects they talk about?

The role of external facilitators in lesson study

Research into the role of the external facilitator in LS is scarce, though studies emphasize the role as crucial (Takahashi, 2014). In countries, where LS is new, there is a lack of external facilitators able to support and qualify LS, and the role become often to scaffold the LS processes, not to enhance their quality (Hart et al., 2011). Studies from East Asia warn against oversimplifying the role, emphasizing the complexity of conducting LS (Takahashi, 2014; Ding et al., 2019). We will highlight aspects of the role that have been pointed out in different countries.

In a study in the US, Lewis (2016) examines how teacher educators new to LS learn to lead this work. The author followed two teacher educators for 18 months, who, among other things, were apprenticed

to experienced LS leaders before leading LS themselves. For our purpose, especially one challenge experienced by the teacher educators seems important: to define a form of leadership that is credible and valued and at the same time respectful of teachers' choices in directing the LS processes.

In a Japanese context, Takahashi (2014) investigates the nature of the final comment of the facilitator (i.e., the knowledgeable other). The three selected and popular facilitators (in the Tokyo area) focused on presenting new knowledge from research and the curriculum, showing the connection between theory and practice, and helping others learn how to reflect on teaching and learning.

Huang et al. (2017) contribute to a better understanding of Chinese LS as regards its social, cultural, and institutional aspects. They emphasize that the culture of respect to seniors makes it legitimate for teachers to learn from experienced facilitators and from watching exemplary lessons. They suggest that in a culture, where less respect is given to seniority and authority, modeling good lessons, and getting feedback from facilitators, which are crucial elements of CLS, may not work as effectively.

In another study in China, Gu and Gu (2016) examine the role of the facilitator (i.e., the Teacher Research Specialist) in post-lesson debriefings based on more than 100 h. of videos of 50 facilitators. They develop a two-dimensional framework for analyzing the mentoring activity: the first dimension encompasses the dynamic between the facilitator and the teachers, *the mentoring strategies* (see below), and the second dimension is the knowledge that mentors pay attention to (i.e., mathematical, pedagogical and practical knowledge). Regarding the mentoring strategies, Gu and Gu found that “the conversations between [the facilitator] and teachers were...monologues rather than dialogic in nature”, with the facilitators paying most attention to “what they know and what they anticipated, rather than...what teachers were concerned about in their teaching” (p. 451). Regarding the knowledge, the facilitators focused on practical knowledge, helping teachers to analyze concrete cases that embraced mathematical and pedagogical ideas.

Theoretical approach

Given our research questions, we need a theoretical approach that allows us to capture both how the facilitators talk with teachers, and what content aspects they focus on. Regarding the ‘how’ question, we are inspired by Gu and Gu’s (2016) four types of mentoring strategies, especially because they are developed in a Chinese LS-context. The strategies are: 1) *General comments*: what teachers in general should know and do, regardless of the specific LS. 2) *Comments on anticipated problems*: focused on problems, that teachers were expected to encounter, and advice on how to deal with them. 3) *Responses to teachers’ questions*: related to issues occurring in the observed lesson. 4) *Dialogues with teachers*: the facilitator and teachers discuss and share their views on these issues. Gu and Gu (2016) characterize the conversation between facilitator and teachers as *authoritative*, if the first two types dominate, and as *dialogic*, if the last two types dominate.

Regarding the ‘what’ question, we are inspired by the *Knowledge Quartet (KQ)* (Turner & Rowland, 2011). The KQ consists of four categories: *foundation*, *transformation*, *connection*, and *contingency*. *Foundation* refers to the teacher’s theoretical background and beliefs in terms of what they learned at school and teacher education etc. It includes knowledge of mathematics and of research on mathematics education, and beliefs about mathematics, its teaching and learning. The three other

categories are different as they refer to ways in which “content knowledge comes into play in the classroom” (p. 199) as *knowledge-in-action*. *Transformation* relates to the choices, teachers make, when transforming their own content knowledge into pedagogical forms targeted at students, while *Connection* refers to teachers’ choices and decisions about establishing coherence in students’ learning across lessons and class levels. The last *Contingency* category concerns the teacher’s response to unexpected classroom events. The KQ is suited for our purpose since it focuses on content that comes into play in classrooms (or in conversations as in this paper), and not explicitly on the knowledge possessed by the participants or the knowledge they ought to possess. This perspective on knowledge is different from the one in Gu and Gu (2016).

Methodological approach

We conduct our comparative study as a multiple case study based on two cases from existing research projects, one in Denmark (Skott & Møller, 2020) and the other in Shanghai (Ding et al., 2019). We introduce briefly the two projects, their contexts in each country, and our analytical strategy.

The Danish LS case

Introduced around 2010, LS is new in a Danish context. A LS project is typically initiated by persons outside a school as short-termed initiatives that are self-contained and aim to learn teachers to do LS on their own. The 1½ year long project, that was initiated by the first author’s research group in 2014 at a school in the Copenhagen area, fits this description (for details see Skott & Møller, 2020).

At the time of the project, there were radical educational changes at the political level in Denmark. Particularity, one change was important: the steering documents now encouraged teachers to plan in a certain way and to formulate measurable learning goals. This challenged teachers in general.

The project used a Japanese approach to LS (Murata, 2011), but with repeated teaching of the revised lesson plans. The selected case was from the project’s second year, and the group consisted of three experienced mathematics teachers and two facilitators (teacher educators) from the research group (Ea and Pia) of which only Ea had experience with LS. Ea and Pia facilitated all the LS processes (three two-hour planning sessions, three repeated teaching – one by each teacher – and three one-hour post-lesson debriefings) and participated in them on equal terms with the teachers. The teachers aimed to design a new teaching approach to the solution of linear equations in which their 6th grade students would be supported in developing a structural understanding of the equal sign.

For this paper, we selected the second planning session since it was representative of the facilitators’ ways of engaging in conversations with the teachers. During this session, the teachers presented their pre-prepared learning goals and tasks, which the participants further developed together. Transcripts of the video-recordings of this session comprise our primary data, but we also include lesson plans.

The Shanghai Lesson Design Study case (SH LDS)

The LDS is a variation of the forms of LS (called “Keli” in Chinese) in the school context in Shanghai. LS is one form of school-based development in which each teacher participates as part of their work (Huang et al., 2017). The LDS model has three LS cycles (L1, L2 and L3) (for more details see Ding et al., 2019). It was conducted at an international school in a suburb of Shanghai from 2012 to 2015.

The selected case was one of seven Keli topics focused on in the LDS. The LDS group consisted of seven Keli elementary teachers (Grades 1-5), two expert teachers invited by the school (one was the mathematics Teacher Research Specialist, Zhang, in this paper), one researcher (the second author), and five other mathematics teachers (Grades 1-8) from the school's teacher research group (TRG). The Keli teacher was a junior with two years of teaching experience. The case topic was to investigate the relationship between perimeter and area of rectangles in the Shanghai Grade 3 textbook.

In this paper, we focus on Zhang's talk in the first post-lesson debriefing of the selected Keli case. There were roughly two parts of his talk. The first part lasted 40 min. and focused on the problems in L1 and how to redesign the lesson in L2. The second part lasted 35 min. and focused on how to reimplement the redesigned lesson. The meeting lasted 75 min. Transcripts of video-recorded TRG-meetings are our primary data materials, but we also draw on lesson plans and a teacher interview.

Strategy of analysis

To examine both the 'how' and the 'what' questions, we analyzed the facilitators' utterances line-by-line and coded them in a two-folded way: mentoring strategies and KQ-categories. However, in the Danish case, Gu and Gu's four types proved to be insufficient to capture all the strategies used by the facilitators. We thus added three more types based on our preliminary data analysis: 1) *Encouraging comments*, such as emotional recognition of teachers' ideas and suggestions (e.g., "I think you did the right thing by choosing goals"). 2) *Challenging comments*, such as disagreeing with teachers' proposals and understandings (e.g., "I think [your learning goals] are too comprehensive to be reached in a single lesson"). 3) *Building on or reformulating teachers' ideas*, that are expressed in the conversation (e.g., "but as you said [this] could have been taught in the previous lesson, so in this lesson we could start from ...").

Regarding the KQ-categories we were inspired by the codes provided by Turner and Rowland (2011). We did not code short utterances that only had a clarifying purpose and was unrelated to the KQ.

Results of the analysis

The Danish case

Few of the facilitators' utterances in the second planning session fell within the first two of Gu and Gu's (2016) mentoring strategies, while slightly less than half fell within their last two types, and slightly more than half fell within in the three added types. According to Gu and Gu, the facilitators, thus, seemed to talk with the teachers in a dialogic way. However, we nuance this characteristic later.

The main part of the facilitators' utterances fell within the KQ categories. Of these, the majority fell within the connection and transformation categories, while the rest was of a foundational nature. There was almost none in the contingency category, which is not surprising, as the focus was on planning. The contributions outside the KQ, was primarily encouraging comments, such as "What you suggest sounds reasonable" (Ea). This indicates that the facilitators primarily focused their contributions on knowledge-in-action, which we will elaborate below.

We will give three examples of different combinations of mentoring strategies and categories. The first is an example of: response to teachers' question (third type) and foundation. The example is

interesting, since this is the only combination where the facilitators brought foundation in the form of mathematics education research into play. Initially, a teacher asked, “what does research say, should it [the context of the task they were designing] be something that the students can relate to, or could it be purely mathematical?”. Ea answered that “research does not say anything about that is has to be a context from students’ everyday life, but Realistic Mathematics Education emphasizes that it should be a context that the students can imagine and experience as meaningful”. Here, the facilitator transformed her foundational knowledge of the specific research result into forms that made sense for the teacher in relation to the specific issue and that helped all the teachers to broaden their perspective on the issue. Note that it was a teacher asking for this kind of knowledge.

The second is an example of the combination: building on teachers’ ideas (added type) and foundation. The participants discussed learning goals in relation to the task they were designing, when a teacher claimed that an equation “can be interpreted in many ways as” something to do with concrete materials and “something about x ”. Pia replied, “That is exactly why it makes sense to break down goals ... you need to focus only on parts of them in specific lessons”. Breaking down goals is a term introduced by the new steering documents, which the teachers have difficulties assigning meaning to in practical situations. As such, the term can be said to be part of the foundation as it needs to be learned formally for instance by studying the documents. The facilitator built on the teacher’s idea of many layers of goals to provide practical meaning to the term by meta-communicating its purpose and how it can affect their planning. We argue again that the facilitator transformed her foundational knowledge into forms that were meaningful for the teachers in the specific situations.

The third is an example of the most frequent combination: dialogues with teachers (the fourth type) and connection. The participants discussed how to introduce the task to students. Pia suggested to use scenarios that they had formulated because “it is a difficult process for students to make up a scenario that can be solved without including weird numbers. Then you can also formulate different scenarios to meet the needs of different students”. This example is one of many where the facilitators intended to make the teachers themselves understand and realize what would be the most appropriate decision in a particular situation, instead of telling them what to do. The facilitators formulated their advice as suggestions, which they provided reasons for. In this case, the reason was the anticipated epistemological difficulty for students (i.e., the connection category).

In summary, the facilitators contributed to establish a conversation with the teachers, that was much more dialogic than authoritative in nature. It was characterized by being dynamics in terms of short contributions (less than two min.) from all participants, open and negotiable. The negotiations were on the terms of the teachers (as the aim was to produce a lesson plan that suited their needs) and based on their contributions (i.e., building on their ideas, questions, and concerns). The facilitators did not make decisions (not even when asked) but attempted to support the teachers in making these by encouraging and supporting pedagogical reflections. The content of the facilitators’ contributions was mostly related to knowledge-in-action (transformation and connection), but also to the foundation category. However, then the facilitators contributed something of a foundational nature, they tended to transform it into forms that were meaningful for the teachers in specific situations and not to present it as knowledge per se. Hence, contributions of this kind tended also to be knowledge-in-action.

Instead of describing this type of conversation as dialogic, we suggest to characterizing it as *relational*, as it was crucial for the facilitators to establish a good relationship with the teachers (cf. the nature of the added types). This seemed to be a prerequisite for producing a joint lesson plan.

The SH LDS case

During the 75 min. long post-lesson debriefing, Zhang talked most of the time and the teachers listened. The conversation can, thus, according to Gu and Gu (2016), be characterized as authoritative. However, after a close analysis of the content of Zhang's talk, we consider the conversation as dialogic, which we will illustrate by two examples. First, Zhang initiated the debriefing by saying to the teacher, "In LS, you need to pay more attention to other's critical and creative ideas about your lesson...merely praising your lesson will not help you to improve your teaching". This comment can be perceived as contributing to an authoritative conversation. However, given the limited time of the school-based LDS and the business of teachers, the general cultural atmosphere in China is to be humble and to first learn from the facilitator's input to the LDS by listening carefully. Second, in the end of the first part Zhang said to the teacher, "So now you understand what problems you had in L1, and why we must modify the lesson plan. The key learning goal of this lesson is to enable pupils to participate into and thus gain learning experience of the whole process of plausible reasoning in mathematics". Hereafter all the participating teachers smiled to Zhang. They thus used a professional sign in China to show their respect and high appreciation of his input and practical wisdom. This indicates that Zhang's talk was not driven by his power or position above teachers, and that the questions he posed helped them to reflect on alternative ways to deal with their problems of using the reformed textbooks. Hence, when we consider Zhang's talk as a whole, we will characterize it as contributing to a predominantly dialogic conversation.

Regarding the 'what' question, in the first part of Zhang's long talk we could identify the foundation category, but with strong links to the transformation and connection categories. For instance, "In the west the focus is on the ground theories of the cognitive/psychological processes. We focus on craft art on the application of the theories. That is, how we deliberately use these learning theories to improve our lesson plan and classroom teaching and learning". The same picture emerged in the second part but combined with an emphasis on contingency of how to design and implement tasks to support students' different needs in class as regards their anticipated reasoning through inquiry-based activities. Thus, it was difficult to categorize Zhang's utterances into the individual KQ categories.

We will give an example of the most frequent combination of mentoring strategies and KQ categories. The example combines the two types: responses to teachers' (not formulated) questions and (implicit) dialogues with teachers, with the foundation category that links to transformation and connection. In the first part of his talk, Zhang posed a sequence of questions, "Why chose this topic in the textbook? ... From the van Hiele theory of levels of geometrical thinking ...". Zhang further posed questions for teachers to reflect on the updated educational assessment of deep learning, such as "whether the construction of the lesson matches our fundamentally shared educational value by the majority in the field". Though, Zhang's talk may be considered as "monologic rather than dialogic in nature" (Gu & Gu, 2016, p. 451), we interpret his sequence of questions "why ... (because)" and "whether ... or" as a mean to support teachers to reflect on the use of updated theories and educational assessment in LS.

In the utterances, Zhang expressed foundational knowledge such as awareness of educational purpose, the van Hiele theory, and theories of deep learning of mathematics. However, this foundation knowledge is specifically targeted the transformation and connection categories that are related to teacher's struggle in understanding the concepts of mathematics inquiry and inquiry-based teaching addressed in the reformed curriculum and textbooks. That is, Zhang links foundational knowledge to the transformation and connection categories by relating to the teacher's actions in L1 and her struggle with understanding the key problems embedded in the reformed textbook. Note that the teacher's problems were only evident in an interview with her after L1. It was not uttered during the debriefing.

In summary, Zhang's talk was considerably long and dominated the post-lesson debriefing. However, our analysis illustrates that he addressed the teachers' shared problems with the reformed textbooks and supported their learning of craft skills according to updated theories and educational assessment.

Concluding discussion

We identified major differences by comparing how the facilitators talked with the teachers and what content aspects they talked about in the Danish LS and the SH LDS. In the Danish case, the facilitators contributed to a type of conversation that we called *a relational dialogue*. Contributing encouraging comments, challenging comments, and building on teachers' ideas (the three added types of mentoring strategies), it was crucial for the facilitators to establish good relationships with the teachers to work together in the new LS context. Moreover, the facilitators' way of talking with teachers (incl. also the strategies related to a dialogic conversation) aimed to encourage and support teachers in their reflections on appropriate decisions regarding specific issues related to their classroom teaching. Our analysis shows that the facilitators supported the teachers' reflections, among other things, by providing reasoned suggestions in close response to the teachers' expressed needs. This is contrary to how the facilitators in Gu and Gu's study (2016) talked with teachers.

In contrast, the Chinese facilitator did not need to build up relationships with the teachers due to the school-based LS systems (Huang et al., 2017). Thus, Zhang could directly use the limited school-based meeting time to guide the teachers to deliberately learn craft skills. The use of Gu and Gu's (2016) mentoring strategies shows that Zhang contributed to an authoritative conversation. However, our analysis shows that it is more dialogic in nature. We see roughly two dialogical layers. One layer is self-evident as different teachers' utterances were recorded and thus noticeable in the analysis. The second layer concerns the teachers' gesture (e.g., smiling) and appreciation of Zhang's contribution. We interpret this as an expertise of the facilitator, being able to notice (implicitly) the teacher's struggle and provide a way to reflect pedagogically through a sequence of why and whether questions.

Regarding the 'what', our analysis shows that the facilitators focused their talk on the content, but with emphasis on different aspects. In the Danish case, the foundation category played a lesser role than connection and transformation, but the analysis shows, that regardless of which category the facilitators related to, their contribution took the form of knowledge-in-action. That is, they tended to transform their knowledge into forms that were meaningful for the teachers in relation to specific classroom situations and not to present it as knowledge per se. This seems to some extent to be different in the Chinese case, where the foundation category was prominent in Zhang's talk. However, Zhang was expected to provide foundational knowledge and gained respect by doing it, while the

Danish facilitators only contributed such knowledge, when requested to do so. This difference might be explained in terms of the differences between the two countries. In Denmark, teachers generally have a high degree of self-determination, a so-called *methodological autonomy* (Skott & Møller, 2020). This means that the single teacher tends to acquire the legitimacy to decide on teaching matters themselves, not only on those related to methods. For a facilitator, it is thus often demanding to balance between orienting teachers' work in certain directions and at the same time being valued and credited, as in Lewis' study (2016). While in China, there is a cultural belief: 'there must be a teacher from whom one can learn when one works together with other persons', which conveys a collective belief that learning is a process that involves acting, speaking, listening, observing and thinking in a group where some may be more knowledgeable than yourself. Combined with the cultural values of seniority and authority (Huang et al., 2017), the facilitator is thus from the outset positioned as a competent actor to be listened to. Although, the participating teachers differed in terms of experience – the Chinese teacher was a junior – this did not seem to influence our results significantly.

One important contribution of this initial comparative study is that although LS is new in Denmark and requires a new actor role, this novelty alone is insufficient to explain the differences in 'how' and 'what' the facilitators talk with teachers. The study indicates that cultural, social, and power related issues at both the interactional and a broader level influence the role of the facilitator. We shall examine such issues and suitable analytical frameworks further in our future comparative work.

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