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Formative assessment in teacher talk during lesson studies

Teacher talk
during lesson
studies

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Abstract

Purpose – The purpose of this paper is to evaluate the extent of systematic examination of students' educational (support) needs by teachers participating in lesson study (LS) meetings within a framework of formative assessment (FA).

Design/methodology/approach – The study took place in the context of upper preparatory vocational education in the Netherlands. The learning trajectory of two LS teams was examined qualitatively, using the framework of FA to analyze teachers' explorative talk during LS-meetings. The sample included Dutch language teachers and mathematics teachers.

Findings – Findings revealed how the process of FA was intertwined with the LS process. Systematic examination of teaching practice was partly identified, however, FA was frequently inadequately applied. Teachers tended to rush into talk about pedagogics, instead of identification of goals and students' educational (support) needs. In total, 12 characteristics of teacher talk were related to the extent to which FA was applied.

Research limitations/implications – The findings of this study suggest that guidance and support during LS-meetings is desirable for systematic practices during LS-meetings and this guidance and support should adapt to specific weaknesses and strengths of a LS team.

Originality/value – This study builds on previous findings suggesting that a systematic approach is important for teachers during LS-meetings. The findings provide a starting point for realizing the potential of LS in preparatory vocational education, by revealing potential pitfalls of systematic practice during LS-meetings. Moreover, this study presents a framework of FA as a potential tool in facilitating a systematic practice of LS.

Keywords Lesson study, Educational support needs, Formative assessment, Teacher talk

Paper type Case study

1. Introduction

Previous studies on teacher talk during lesson study (LS) meetings indicate that without a systematic approach toward the investigation of student learning, it is unlikely that teacher talk will trigger teacher learning (Fernandez *et al.*, 2003; Mutch-Jones *et al.*, 2012; Pang and Lo, 2012). This study evaluates the extent to which teachers in LS-meetings systematically examine students' educational (support) needs in an inclusive secondary school in the Netherlands. The extent of systemic examination is determined with a framework of formative assessment (FA).

The introduction of inclusive education policies in many countries, including the Netherlands, raises the importance of teachers' capabilities to adjust teaching

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strategies to students' individual capabilities and educational (support) needs (Bruggink *et al.*, 2013; Kurniawati *et al.*, 2014; Waitoller and Artiles, 2013). Teachers are increasingly confronted with special educational needs (SEN) in the classroom, to which they are unable, or feel unable, to respond to adequately; as a result teachers can feel incompetent and doubt their self-efficacy (Goei and Kleijnen, 2009). The current study describes how the implementation of LS in an inclusive educational setting in an upper preparatory vocational school in the Netherlands facilitates the development of need-supportive strategies (Stroet *et al.*, 2015) via collaboratively developing differentiated instructions.

LS is a model of teacher learning, which is increasingly used to foster sustained teachers' professionalization through collaborative investigation of their teaching practice (Lim *et al.*, 2011). The model is used to increase teachers' pedagogical content knowledge, improve instructional abilities, and discourage professional isolation (Cheng and Lo, 2013; Dudley, 2013; Fernandez, 2002). Moreover, the aim of LS is to go beyond evaluation of teaching and promote examination of student learning (Cheng and Lo, 2013; Fernandez, 2002; Oshimaa *et al.*, 2006). Although large-scale effect-studies on LS are still lacking, a systematic review study on outcomes of LS supported the idea that the method has a positive impact on teacher learning and teaching practices (Cheung and Wong, 2014).

An effective component of LS is the exploratory talk of teachers during LS-meetings (Dudley, 2013; Pedder, 2014). This phenomenon was introduced by Mercer (1995) and describes the way in which tacit knowledge and reasoning is made explicit while reaching for shared agreement. Dudley (2013) showed that a substantial amount of teacher talk during LS-meetings could be classified as exploratory talk and his study showed that exploratory talk contributed to new insights on student learning. It is suggested that teachers' exploratory talk "provides a rich linguistic and cognitive ground for teacher learning points to occur" (Dudley, 2014, p. 42). This suggestion is in line with studies in the domain of teacher learning, in which professional dialogues about important issues, with a shared focus and responsibility, and with the opportunity to provide and receive formative feedback, have been found to trigger learning experiences (Lomos *et al.*, 2011; Webster-Wright, 2009).

Although the aforementioned studies suggest that LS contributes to teacher learning, it is unclear whether teacher talk leads to exploratory talk and new insights on student's learning in any case. Several studies showed that the desired learning experiences about student learning are not guaranteed only through engagement in talk; a condition for learning experiences during LS-meetings is that examination of practice takes place in a systematic way, or in other words, "when teachers adopt research lenses toward their teaching practice" (Fernandez, 2002; Fernandez *et al.*, 2003; Mutch-Jones *et al.*, 2012; Pang and Lo, 2012). Systematic examination of teaching practice requires that teachers take the steps needed to reach the LS goal in an orderly and cumulative way; going back and forth between questions and teaching practice, while relying on evidence collected in research lessons. Yet, Fernandez *et al.* (2003) describe that teachers have difficulties in formulating meaningful and testable hypotheses, using appropriate means for exploring these hypotheses, relying on evidence to judge the success of research endeavors, and thinking how to generalize research findings to other contexts. Hence, unraveling the course of teacher talk during LS-meetings is needed to identify when and why teachers do, or do not, manage to enroll in systematic examination of student learning during LS-meetings.

1.1 Toward a conceptual framework of systematic practice

To date, the extent to which teachers adopt research lenses in LS-meetings is not clearly defined and no instrument is available that could be used for evaluation of systematic examination in teacher talk. In this study we used the framework of FA to identify the extent of systematic examination in teacher talk, as this framework represents the main structure and features of systematic examination of student learning and provides a starting point for designing differentiated instructions needed to respond to diverse educational needs in the classroom. FA is defined as “a systematic process to continuously gather evidence and provide feedback about learning while instruction is underway” (Heritage *et al.*, 2009, p. 1). Contrary to the purpose of summative assessment, FA is used to effectuate improvement and progression (Sadler, 1989). Given the focus on students’ differential educational support needs, FA is expected to be particularly suitable for the improvement of adaptive teaching practices.

Effectively, previous work has aligned FA with the way in which teachers should examine student learning during LS-meetings (Cheng and Lo, 2013). In essence, the philosophy of LS and the FA are similar in some of their main assumptions. For instance, the approaches of both LS and FA aim at inducing a “research focus” toward practice, which enables teachers to gain new insights into students’ learning process (Fernandez, 2002; Ginsberg, 2009; Heritage *et al.*, 2009; Oshimaa *et al.*, 2006). Furthermore, and similarly to LS, the aim of conducting FA is gathering evidence on the students’ learning process in a systematic and qualitative manner (William, 2010).

Complementary to the LS model, the literature on FA specifies the steps that are needed to effectively examine student learning and design suitable instructions. Therefore, a conceptual framework was derived from the literature on FA in order to examine the extent to which LS results in systematically examining student learning. This conceptual framework was based on the features of FA described by Black and William (2009), Ginsberg (2009), Heritage *et al.* (2009), Nicol and Macfarlane-Dick (2006), and Sadler (1989). The conceptual framework is not established to extend the LS model; it is rather defined to clarify a systematic reasoning and decision-making process during LS-meetings. The full conceptual framework developed for this study is summarized in Table I. Subsequently, the concepts and structures of this framework are explained.

1.1.1 Identifying students’ current learning status. The first step in FA is the clarification of the current situation, by analyzing and interpreting evidence on student learning potential and unsuspected strengths in the child’s cognition (Heritage *et al.*, 2009). Learning potential refers to the teacher’s ultimate concern, namely, whether the child is ready to learn the material in question (Ginsberg, 2009). Current knowledge (i.e. the cognitive processes that underlie the child’s overt performance) and motivation must be identified as well as potential learning obstacles (Ginsberg, 2009, p. 110). Analyses of students’ learning status are essential for the effectiveness of FA. As described by Heritage *et al.* (2009, p. 1), “inaccurate analyses or inappropriate inference about students’ learning status can lead to errors in what the next instructional steps will be, with the result that the teacher, and the learner fail to close the gap [between current and desired understanding].” The framework of FA represents a cyclical process and therefore this first step could be induced by the last step, when the evaluation of instructional interventions yields new questions about student learning.

1.1.2 Defining teaching goals. The second step is formulating feasible and explicit goals; i.e., SMART goals. SMART refers to the principle of specific, measurable, acceptable, realistic, and time specific goals (Baar *et al.*, 2007). Goals should fit both the

Table I.
A two dimensional
conceptual
framework of
formative
assessment,
representing features
of systematic
examination of
student learning and
informed planning of
differentiated
instructions

Features of full examination →			
Features of	Steps	Sub-steps	Guiding tools
cumulative examination	(1) Identifying students’ current learning status	Identifying students’ learning potential	Drawing on reliable
		Identifying students’ current knowledge and	resources
		motivation	Specifying
	(2) Defining teaching goals	Identifying current obstacles with regard to:	propositions
		(a) Materials; (b) subject content; (c) teacher actions; (d)	
		students’ mind; (e) peer interaction; (f) behavior; (g)	
	(3) Designing instructions	misconceptions	
		Defining desired outcomes*	Defining goal
		Defining good performance*	operationalization’s
		Defining practicable performance*	Defining goals in a
	(4) Evaluating instructions and teaching goals	* On the level of:	SMART way
		(a) Task performance; (b) behavior; (c) knowledge; (d)	Formulating
		understanding	hypotheses on student
			learning
	(4) Evaluating instructions and teaching goals	Defining students’ educational needs with regard to:	Considering the
		(a) Instruction; (b) behavior; (c) affection; (d) peers	feasibility of instructions
		Providing the opportunity to close the gap between	Operationalizing of
		current and desired performance through:	pedagogics

learning potential and the current knowledge of students, defined in the first step. Moreover, goals should distinguish desired learning outcomes, success criteria, and feasibility in order to shape strategies and tactics (Nicol and Macfarlane-Dick, 2006). Goals that meet these criteria are crucial to a systematic process.

1.1.3 Designing instructions. The third step is bridging the gap between the students' current level and desired teaching goals, by identifying the educational needs of the students (Heritage *et al.*, 2009). Students' educational needs can be defined as the additional support that students in mainstream education need, addressing instructional, behavioral, emotional, and peer issues (Bruggink *et al.*, 2013). Since multiple educational needs have to be answered in a full class of students, applying differentiation is essential. In the LS process, differentiation could be applied by focusing on case-students who represent different levels in a class (Dudley, 2012). Again, explicit operationalization of instructions is required. A concrete formulation of instructions and implementation increases the probability of success (Baar *et al.*, 2007).

1.1.4 Evaluating the implementation of instructions. The fourth step is evaluation of instructions through reflection on experiences, sharing observations, examining students' feedback, and referring to defined goals. There are two types of evaluation that can be distinguished: evaluation of the process and evaluation of outcomes (Baar *et al.*, 2007). Evaluation of the process is focused on the way in which the instructions are performed. Evaluation of outcomes is focused on the way in which the instructions influenced students' learning process. Both could provide new information about students' learning status, which could induce a new cycle of systematic examination of students' educational needs.

1.2 Current study

In the remainder of this paper, a case study is reported of a LS trajectory with teachers working in an upper preparatory vocational school in the Netherlands. By scrutinizing teacher talk and looking for the elements of FA, we studied how LS did or did not contribute to a systematic investigation of student learning and possibilities for differentiation. The following research question was defined:

RQ1. Which characteristics in teacher talk during the LS-meetings could be identified that promote or obstruct full and cumulative FA?

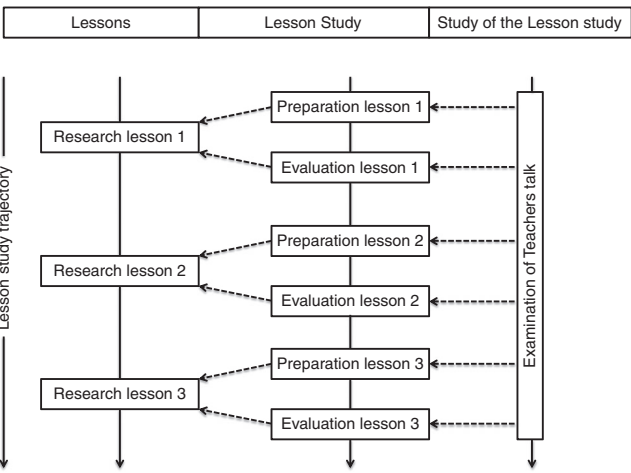
By addressing this question, insights are gained in how current LS practices and LS materials can be improved to enhance LS effectiveness. Moreover, the study of this research question, along with the framework of FA, yields insights for facilitators of LS trajectories that could be used to guide teachers toward purposeful exploratory talk during LS meetings

Note that we are not asking the usual question about the effectiveness of LS. Instead, we invoke the FA perspective and try to understand the teams' natural tendencies when examining their teaching practice. In Figure 1, the perspective of this study is graphically displayed; it shows how we used the framework of FA to study the LS. This figure shows that not the lessons being studied by the teachers, but teachers' LS-meetings are the focus of the current study.

2. Method

We conducted a framework analysis of teacher talk during the LS-meetings, since previous research showed that teacher talk provides substantive evidence about teachers' knowledge of students' learning status, how teachers' design instructions, how teachers use LS observations, and how the process unfolds (Dudley, 2013; Fernandez *et al.*, 2003; Parks, 2008). The application of perspectives from Maso and Smaling (1998) was used to embed the described conceptual framework of FA; through

Figure 1.
A graphic
representation of
multiple
synchronous layers
of examination
during the lesson
study process



open coding the course of conversations was identified and subsequently the data were analyzed with reference to the conceptual framework of FA (for more information on the coding procedure, see Boeije, 2009).

2.1 Sample

Two LS teams were included in the sample, from one preparatory vocational school in the northwestern part of the Netherlands. About 30 percent of the students had mild to moderate learning difficulties and comorbid disorders. In light of this student population, a school-wide LS implementation was organized aimed at differentiating instructions to students with diverse educational needs. The two LS teams in the sample of this study were a team of mathematics teachers consisting of four teachers (team ME) and a team of six Dutch language teachers (team DLE). These teams were selected based on their expressed need for LS, first, because their lessons were evaluated as poor by the Dutch inspectorate of education, and second, because they were confronted with increasing student diversity and an increasing number of SEN. Responding to this diversity more adequately in the classroom became a shared goal of team ME and team DLE in the LS trajectory. Therefore, the learning trajectory of these two teams was regarded most interesting in respect to the research question of this study.

2.2 The LS trajectory

The LS implementation entailed three LS cycles consisting of seven team meetings, see Table II. The LS approach was introduced at the start of the school year, with the whole teaching staff present. A facilitator coached each subject team; there were five external facilitators from university and three school administrators from the school itself. Interventions of the facilitator emerged on the spot; no specific tools, such as the FA framework, were used to guide the teams. The facilitators were present during all LS-meetings. An expert in the field of subject matter and pedagogy was involved during the lesson planning meetings of team ME.

In the design phase of each LS cycle, three case students (Dudley, 2012, 2013) were designated for the different tiers following the three-tier logic (e.g. Kratochwill

Planned meetings	Team mathematics	Team Dutch language education	Teacher talk during lesson studies
1. Choosing a subject and classifying students	✓	✓	<div>319</div> <div>Table II.</div> <div>Overview of lesson study meetings and included data</div>
2. Designing of the first research lesson	✓	✓	
<i>Research lesson 1</i>		<i>Excluded</i>	
3. Evaluation and revision of the first research lesson	✓	✓	
<i>Research lesson 2</i>		<i>Excluded</i>	
4. Evaluation of the revised research lesson	✓	✓	
5. Designing of the third research lesson	<i>m</i>	✓	
<i>Research lesson 2</i>		<i>Excluded</i>	
6. Evaluation of the third research lesson	<i>m</i>	<i>m</i>	
Notes: ✓, video data included; <i>m</i> , missing			

et al., 2007). Examining learning behavior within these different groups, with a focus on the case-student, was expected to yield insights on effective differentiation of instructions (Dudley, 2012, 2013).

2.3 Data collection

The data collection took place over a period of one school year (September 2013–July 2014). The data consisted of nine video recorded meetings, which is shown in Table II. Four meetings were not recorded due to technical and facility issues. Recordings of the first, the second, and third meetings were included for both teams. In the first meeting, the teams chose a subject and classified the students into three groups with comparable instructional needs. In the second meeting, the teams designed the first research lesson. In the third meeting, the teachers collaboratively evaluated the first research lesson. Team DLE was also filmed during the evaluation meeting of the second research lesson and the preparation meeting of the third research lesson. Team ME was furthermore filmed during the evaluation meeting of the second research lesson.

2.4 Analysis

The analysis included three phases and throughout each phase a logbook and memos ensured process management. In the first phase the data were explored. A thick description of the video recordings was written. These descriptions contained the narratives of each meeting. Moreover, episodes of teacher talk were identified and labeled (Strauss and Corbin, 1998), which was done by breaking video fragments into thematic episodes. Thematic episodes are defined as series of turns about the same topic (Tannen, 1984). The original video recordings were labeled, for which the software program InqScribe was used (from Inquirium CCL, Chicago; USA, 2012). The labeled episodes were represented in matrices, in order to visualize the course of the meetings. By labeling thematic episodes, a thematic and chronologic oversight emerged. This oversight enabled examination of the extent to which the four steps of FA were addressed in a full and cumulative way.

In the second phase of analysis the data were compared. While comparing the labeled data with the conceptual framework of FA, all four steps of FA were recognized throughout the meetings of both LS teams. This is reflected in the distribution of episodes over the four steps, as summarized in Table III.

Preliminary ideas and hypotheses about the way in which teachers performed FA were tested across different meetings, according to the principle of analytical induction (Boeije, 2009). Preliminary ideas were verified through comparison across different meetings and teams. In the final phase of analysis the data were reassembled and the findings were integrated into a consistent and meaningful whole (Boeije, 2009).

The final results were rated from two perspectives, in order to ensure the validity and reliability of this study. In the first place, a member check took place by presenting the findings to the facilitators of the LS teams. The facilitators were asked to closely examine the results and to compare our findings with their experiences of the whole LS trajectory. Their feedback confirmed our main findings; yet, some points provided reason adjust. Second, an independent expert in the field of qualitative data analysis conducted an audit trail on the research process, in order to evaluate the visibility, comprehensibility, and acceptability of the results. The audit procedure was executed according to the procedure described by Akkerman *et al.* (2008). In short, the audit indicates that the findings are grounded in the data in a reliable and valid way.

3. Findings

The reflection of FA in the LS-meetings is addressed for each step of the conceptual framework. Within each step, several characteristics are identified that promoted or obstructed full and/or cumulative FA. In order to illustrate the findings more clearly several excerpts from the LS-meetings are provided. First, the LS trajectory is shortly outlined for both teams, which provides contextual information on the findings presented in this section.

3.1 Resume of the LS trajectory of team DLE

The topic of the research lessons was “identifying relations in texts”; such as, for example, enumerations and cause-and-effects. The first learning goal of team DLE was to apply differentiation to instructions in the classroom more accurately. Second, team DLE aimed to identify educational needs more accurately. The teachers of team DLE classified students based on their potential and their current knowledge of relationships in texts. Early on in the LS trajectory, the teachers distinguished the difference between students’ behavior and subject knowledge. Students’ work (notes, assignments, etc.) was used to classify students in the three tiers. Moreover, teachers’ discussed the relation between students’ abilities and their current results at Dutch language tests.

Along the LS trajectory, the first learning goal was mostly discussed. At the end of the LS trajectory team DLE was unsatisfied about the differentiation strategies that

Table III.
Overview of episodes
related to the steps
of formative
assessment

Step in the conceptual framework	Number of related thematic episodes		Total	%
	Team mathematics	Team Dutch language education		
1. Identifying students’ current learning status	21	22	43	13.5
2. Defining teaching goals	10	49	59	18.6
3. Designing instructions	57	96	153	48.1
4. Evaluating the instructions and teaching goals	46	17	63	19.8
Total	134	184	318	100

Notes: A total of 318 out of 508 thematic episodes, over the nine investigated lesson study (LS) meetings, were labeled as FA. Other episodes addressed the LS process, the LS assignments, or other topics concerning teaching practice

were applied in the research lessons. These strategies, namely, led to divergent differentiation where students with different abilities were provided with different learning goals, which disadvantaged students with lower abilities when at the end of the school year students needed to pass the same test. Therefore, team DLE concluded at the end of the LS trajectory that equal learning goals for all students (passing the test) were crucial and therefore convergent differentiation strategies are needed.

3.2 Resume of the LS trajectory of team ME

The topic of the research lessons was “solving linear equations with the balance method.” The balance method helps students to solve equations by performing the same arithmetic operations on both sides of equations (from the = sign). Besides applying differentiation to instructions in the classroom more accurately, the learning goal of team ME was to design instructions and assignments that to connect to the experiences of the students. Team ME classified the students according to their “level,” which was not further specified. The teachers classified the students in terms of behavior and work attitude, with labels like “average,” “quiet,” “busily,” and “weak.” Moreover, students were classified, roughly, based on grades.

Along the course of the LS trajectory the second learning goal was disputed. Hicham and Hans advocated for a traditional algebraic approach, whereas Mieke and Patrick wished to use LS to experiment with experience-based teaching strategies. During the whole LS trajectory, team ME remained divided this topic.

3.2.1 Step 1: identifying students' learning status. Three characteristics promoted or obstructed the identification of students' learning status:

- (1) The extent of clarity about the classification criteria (i.e. the domain of knowledge and understanding that would lead the classification of case students) promoted talk about students' learning status. Well-defined classification criteria functioned as reference frame for students' current knowledge, whereupon the learning potential and obstacles were discussed. However, unclear criteria obstructed teachers from providing evidence or reasoning that explained students' learning status and led to talk about general characteristics, such as students' working attitude, motivation, personal traits, and behavior. Interaction 1, from the first LS-meeting of team ME, provides an illustration of the generic propositions about student learning during the classification of the first students:

Interaction 1:

Hans: “This boy is very quiet I think. He gave the impression of being introvert. He is a bit scared. Sometimes he asked something and then he blushes. However he asks things. Not much, but sometimes he asks things. He is a quiet student and he does his job. I don't think he needs extra challenge.”

Mieke: “Does this also apply in mathematic lessons?”

Hicham: “Well, he actually doesn't ask questions. Sometime, but he does his job.”

Patrick: “So, you have to keep an eye on him.”

Hicham: “Yes.”

This interaction characterizes the way in which students were classified in the first meeting; these propositions were recurrently uttered for almost every student.

Therefore, little information on students' learning potential and current knowledge on linear equations was shared in the meeting. In contrast, the teachers of team DLE applied criteria regarding students' potential, knowledge, and understanding (e.g. reflected in six episodes in the first meeting). Team DLE used students' previous answers to assignments regarding relations in texts to determine students' current knowledge. This resulted in more detailed diagnoses of students' learning status:

- (2) Acknowledgment of the complexity of students' learning process promoted talk about students' learning status. Complexity in student learning was identified when multiple factors and their interrelatedness were taken into consideration when identifying students' learning status. For instance, during the first meeting of DLE, most time was spent on analyzing and explaining students' learning status on different dimensions (e.g. potential, knowledge, motivation, or obstacles). At the start of the meeting, the teachers already distinguished the difference between students' capabilities and task performance. Accordingly, factors were identified that could obstruct students from turning their capabilities into results. Interaction 2 from meeting 1 of team DLE illustrates the latter:

Interaction 2:

Hanneke: "She always comes along, but she is weaker than you'll expect. While she performs verbally strong, she has a lack of intelligence."

Anouk: "Yes, it bothers her sometimes. Because of her verbal capacity, some questions amaze me. [...] I just don't understand what she is saying. Sometimes she answers in a totally different way."

The differences in student learning potential and students' knowledge, identified in team DLE, eventually provided concrete starting points for differentiation of instructions:

- (3) Resources of information about student learning promoted talk about students' learning status. The use of multiple resources while identifying students' learning status led to explorative talk that went beyond sharing observations. For example, by including both students' performance in exercise books, grades, and observations, teachers were more often able to bring arguments about students' learning status in the discussion. In contrast, when teachers limited themselves to singular resources, such as grades, fewer episodes on students' learning status were found. This is exemplified in Interaction 3, from the first meeting of team ME:

Interaction 3:

Mieke: "These are the good ones."

Patrick: "They are already working on the next chapter, you know, and therefore they are quite bored in class."

Hans: Oh, right, those ones.

For example, by including the working speed of students, based on their progression in the workbook that was normally used, team ME identified the excellent students in the class that was chosen for the first research lesson.

3.2.2 *Step 2: defining goals.* Four characteristics promoted or obstructed the definition of goals:

- (1) Concrete subject matter promoted talk about goals. While both teams addressed desired performance and desired outcomes in relation to the subject matter in the first meeting, success criteria were often defined with unspecific terms, such as “difficult” or “simple.” However, when teachers talked about the way in which students would approach a specific assignment during the preparation of the research lessons, the teachers revised these unspecific terms. Thus, concrete subject matter was needed to operationalize terms like difficult or simple. For example, team DLE decided to collaboratively examine a text that was chosen for the research lesson, which led to elaborate talk about the research lesson goals. In the meetings of team ME, the mathematics expert promoted this process by showing qualitatively different linear equations to the teachers.
- (2) Talk about instructions obstructed talk about goals. In essence, it was found that the tendency to lapse into talk about interventions perturbed the process of FA. In other words, the process of defining goals was slowed down by suggestions that were not related to lesson goals. In fact, it seemed that during the first meeting of ME, talking about interventions and educational support prevented the teachers from formulating any goals.
- (3) Talk about differentiation obstructed talk about goals. Namely, the struggles with differentiation were related to the definition of goals. Goals were often defined based on students’ educational needs and learning obstacles. From a FA perspective, however, goals need to be defined based on potential and desired learning, whereas instructions – rather than goals – should meet the educational needs and help overcome learning obstacles. Since educational needs and learning obstacles were leading when defining learning goals, the teams did not talk about how to push students’ boundaries and capitalize on students’ potential learning capacities.

Eventually, both teams became aware of the fact that they did not apply differentiation to instructions, but instead to learning goals. Team ME redefined the differentiated goals into uniform lesson goals for the second research lesson, guided by instructions of the facilitator. By the same token, team DLE became aware of this misunderstanding after five LS-meetings and two research lessons, by questioning the LS process. Interaction 4 illustrates the latter:

Interaction 4:

Anouk: “We actually defined different goals for each case student. However, it doesn’t make sense, since every student has to pass the same test and exams.”

Arie: “Indeed.”

Anouk: “So, I think that we should actually define the same goals for every student; we just have to customize the pathway to the goal for every student.”

Arie: “Exactly, that is applying differentiation, that is what we want to learn, and that is what we didn’t learn till now.”

Anouk: “And we still do not apply differentiation.”

This talk was an important turning point in the LS process of team DLE. Although the teachers felt unsatisfied about the outcomes of the first and the second LS rounds,

during the third LS round adequate instructional differentiation was accomplished. In fact, during the fifth meeting the teachers indicated that “taking time to find out how to differentiate” yielded an important learning experience.

3.2.3 Step 3: designing instructions. The third step, designing instructions, was the most visible step in the teachers’ discussions, as also shown in Table III. Three characteristics promoted or obstructed this step:

- (1) Talk about students’ learning process and students’ thinking processes promoted talk about the fit between instructions and educational (support) needs of their students. Explicitly taking student learning and thinking processes into consideration was related to more statements about individual differences between students and, thus, fuller FA. Accordingly, when teachers examined student learning and thinking processes, they came up with more custom-made instructions and assignments. Furthermore, instructional differentiation was prepared in more detail when students’ educational needs were clearly defined.
- (2) Talk about instructions was obstructed by “gaps” in definitions of students’ learning status. The extensive discussion on instructions often revealed missing information about students’ learning status. Consequently, teaching gaps were identified, goals were redefined (both research lesson goals and LS goals), and expectations about students’ learning status defined. In other words, “missing” procedural steps or substantial gaps in students’ learning status and research lesson goals were discussed and completed during the third step. This led to full and cumulative FA; it helped teachers to create shared understanding about the function of instructions, which led to more thorough discussions about the instructions. However, it appears that one meeting was too short for both designing a full research lesson and filling the gaps of the previous meetings (particularly in meeting two and meeting five of team DLE).
- (3) Talk about behavior obstructed talk about instructions. While designing instructions, all teachers showed a tendency to talk mainly about disruptive behavior and barely about learning behavior. This was obstructing the progression of FA, since talk about disruptive behavior often resulted in claims based on generalizations of student behavior in class, rather than hypotheses about subject specific learning behavior. Patrick, from team ME reflected on this tendency in the third meeting, see Interaction 5:

Interaction 5:

Expert: “Well, I mean: When negative numbers are introduced, the students get confused. Expectations like this are missing.”

Patrick: “Maybe that is due to the fact that we are more talking about behavior, because of the type of students in this school.”

Expert: “Yes, yes, yes.”

Patrick: “So we are less talking about the subject matter. It happens a lot. I am already happy when the students are doing something. However, that is about students’ acting.”

As mentioned in the interaction, the focus behavior was seen as a result of SEN, which led to much disruptive behavior in the classroom. However, when teachers talked

mainly about disruptive behavior, less effort was made in order to improve instructions and more familiar instructional methods were chosen for the research lesson.

3.2.4 Step 4: evaluating instructions. Four characteristics promoted or obstructed evaluation of instructions:

- (1) Talk about initial expectations promoted evaluation the instructions. Interaction 6, from the first evaluation meeting of team DLE, illustrates how teachers confirm their preliminary ideas about students learning, through evaluation of the research lesson:

Interaction 6:

Arie: "Why do you assume that these students are smarter?"

Hanneke: "It appears, those boys don't make mistakes and they ask questions that are more intelligent." [...]

Anouk: "After all, our assumptions were right."

Arie: "Well in that case, they should have had more challenging assignments."

Hanneke: "Yes, indeed."

When teachers referred to their preliminary ideas about students' reactions to instructions, teachers talked more about how and why instructional strategies did, or did not, contribute to the lesson goals:

- (2) Talk about initial disagreements and decision moments in earlier meetings promoted evaluation of instructions. In other words, looking back on assumptions about student learning in the light of new insights obtained in the research lesson helped teachers to solve earlier conflicts or answer questions of earlier meetings. This is illustrated in the first evaluation meeting of team DLE. During the preparation of this research lesson, teachers disagreed on the way in which enumerations (one type of relation in a text) should be introduced to the students. During the evaluation, observations, and student interviews were used to underpin arguments. Likewise, looking back on initial ideas promoted the evaluation of instructions. It was found that the facilitators and the expert were often the ones that pointed at these initial ideas during the evaluation of instructions.
- (3) Talk about deviations from the lesson plan led to talk on the justification of implemented instructions, which obstructed evaluation of instructions. Talk about deviations from the lesson plan resulted often in procedural evaluation, but seldom did it induce talk about the evaluation of instructions. Moreover, it was found that evaluation of the research lesson often led to speculation of the efficacy of instructions that were not executed. This obstructed the evaluation of teaching goals and learning experiences.

4. Discussion and conclusions

The aim of this study was to evaluate how LS did or did not contribute to a systematic investigation of student learning and possibilities for differentiation. For this purpose we proposed and used a conceptual framework based on the principles of FA. The results point at 12 characteristics of teacher talk that either promoted or obstructed the extent to which FA showed fully and cumulatively in teacher talk during LS meetings.

On the one hand, we found that systematic examination was predominantly promoted by operationalization of student learning, the use of qualitative resources, relating to student thinking and understanding, and looking back on preliminary ideas and disagreements. On the other hand, we found that a focus on students' behavior obstructed deep understanding of the complexity of students' learning process.

The results suggest that the LS teams did not manage to look beyond the behavioral manifestations of SEN in the classroom. Moreover, teachers struggled to find satisfying ways of applying differentiation, despite the three-tier tool that was provided. These problems mainly resulted from a lack of cumulative FA; students' learning status and lesson goals were often not clearly formulated when teachers started talking about differentiated instructions. In line with Fernandez *et al.* (2003), Horn and Kane (2015), and Pang and Lo (2012), the results of this study underscore that indeed teacher collaboration in itself, as a driver for improvement in practice might be insufficient, since teachers show struggles regarding systematic investigation of student learning.

The results of this study suggest that guidance and support is desirable and that these should connect to specific weaknesses and strengths of the LS teams. The function of the facilitator and the expert, thus, seems to become of even greater importance and should be examined and supported. The conceptual framework of FA, addressed earlier, could provide a starting point for guidance and support of LS teams. Interventions by the facilitator and the expert should provide the teachers with clear and accessible suggestions to improve systematic examinations of students' learning processes. Therefore, we recommend future research to address how different types of interventions "on the spot" guide teacher talk toward a more systematic process.

There are some limitations to this study that need to be taken into account. First, the meetings of the third LS cycle were underrepresented in the included data. Second, the identified struggles that are resulting from lacking systematic examination could also be a result of teething problems, as the teachers needed to get used to the LS model. It might take more time and practice before teachers are completely familiar with the investigation of their practice through LS. Future research on the extent to which student learning is systematically investigated should therefore also include teacher talk in more experienced LS teams. Moreover, this study focused only on teacher talk during planning and evaluation meetings. It might be interesting for future research to connect teacher talk to other aspects of LS trajectory, such as teaching strategies that are applied research lessons and student learning behavior during the research lessons.

In recapitulation, this study extends previous research in two ways. First, it shows that FA could be used to describe the extent to which systematic examination during the LS-meetings varies across meeting and across teams. Second, this study describes unique characteristics of teacher talk that explain this variation across LS-meetings and across LS teams. Thus, in contrast with the idea that LS leads to teacher learning in any case (Clarke *et al.*, 2012; Webster-Wright, 2009), the results of this study suggest that guidance and support that adapts to the specific strengths and weaknesses of the team is at least one important condition for realizing the full potential of the impact of LS on teacher learning.

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