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Jong, L.A.H. de; Meirink, J.A.; Admiraal, W.F.

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## Teacher learning in the context of teacher collaboration: connecting teacher dialogue to teacher learning

Loes De Jong<sup>a,b</sup>, Jacobiene Meirink<sup>a</sup> and Wilfried Admiraal<sup>a</sup> 

<sup>a</sup>Leiden University Graduate School of Teaching, Leiden University, Leiden, The Netherlands; <sup>b</sup>Educational Sciences Department, Faculty of Behavioural, Management and Social Sciences, University of Twente, Enschede/the Netherlands

### ABSTRACT

A multiple case study has been carried out of four teacher groups who engaged in collective lesson design, observation, and reflection to support their professional learning. The teacher groups were examined on what and how they learned from their collaboration over time. For each meeting, teachers' learning logs and transcripts were analysed. The results show that the groups differed in the amount, consistency, and stability of self-reported learning outcomes throughout the meetings. Differences between groups also relate to the number and type of dialogic moves between the teachers within each group. A main conclusion includes that challenging each other in their dialogues supported teachers' learning. Additional explanations of learning outcomes relate to teachers' collective participation and facilitation in the group. **Keywords:** teacher professional learning; teacher collaboration; collaborative learning activities; teacher dialogue; secondary education

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Reviews on teacher professional learning (TPL) point to collaboration as critical element of effective professional development. According to Borko, Jacobs, and Koellener (Borko, Jacobs, and Koellner 2010), learning experiences are effective when teachers collaborate to examine their teaching practice. Opfer and Pedder (2011) and Van Driel et al. (2012) add that collective participation of teachers from the same school or team, in particular, can stimulate teacher change because it is embedded in teachers' daily work context. Numerous empirical studies confirm that teacher collaboration is a promising environment for TPL (e.g. Bakkenes, Vermunt, and Wubbels 2010; Levine and Marcus 2010). These studies do provide insight into collaborative TPL, but *how* learning evolves in teacher groups remains challenging to grasp because of the continuous character of TPL. TPL takes place in all kinds of situations: with and without colleagues, in and outside school, and in formally organised activities and work-based situations. Several longitudinal studies have been conducted that investigated TPL and collaboration at multiple moments in time (e.g. Levine and Marcus 2010; Vedder-Weiss, Segal, and Lefstein 2019). However, these longitudinal studies adopted one instrument to map teachers' perceptions of both the learning activities and associated teacher learning (e.g. Cajkler et al.

**CONTACT** Loes De Jong  [l.a.h.de.jong@iclon.leidenuniv.nl](mailto:l.a.h.de.jong@iclon.leidenuniv.nl)  Leiden University Graduate School of Teaching, Leiden University, P.O. Box 905, 2300, AX Leiden, The Netherlands

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2015; Christ, Arya, and Ming Chiu 2014) or TPL was not connected to specific learning activities but concerned an evaluation of the entire learning process (e.g. Levine and Marcus 2010). In sum, research that systematically tracks TPL and associated collaborative activities on different moments in time is scarce but needed, to inform both practitioners and researchers to set up effective teacher collaboration for learning. According to Lefstein et al. (2020), especially the conversations between teachers that take place in collaboration play a critical role in supporting their learning. Thus, a profound understanding of TPL requires insight into teacher dialogues. To better understand what and how teacher groups learn from their collaboration over time, we conducted an in-depth longitudinal study to investigate TPL and associated dialogic processes of four teacher groups.

### Teacher professional learning

Zwart et al. (2008) and Bakkenes, Vermunt, and Wubbels (2010) define TPL as ‘any ongoing work-related process that leads to a change of cognition and/or behaviour’ (Zwart et al. 2008, 983). Thus, TPL can be stimulated by purposefully deployed learning activities (e.g. participating in a workshop or being coached), and by activities that take place because of other purposes but which, nevertheless, lead to learning (e.g. having parent meetings or updating administration). Zwart et al. (2008) distinguish between two types of *learning outcomes* (LO). Cognition, the first type of LO, refers to the integrated whole of theoretical and practical insights, beliefs, and orientations. The second type of LO, behaviour, concerns activities that teachers (report to) undertake to support and stimulate student learning. Research on *learning activities* points to three effective characteristics. First, learning activities should be intense and sustained because teachers need time to develop new knowledge by absorbing, discussing, and practising (e.g. Desimone 2009; Opfer and Pedder 2011). To this end, one-time workshops are generally not effective. Second, effective teacher learning activities are embedded in teaching practice (e.g. Borko, Jacobs, and Koellner 2010; Opfer and Pedder 2011). Thus, learning activities should require teachers to engage with materials from practice, work actively, and ideally are school-based and integrated into teachers’ daily work. Thirdly, activities have more learning potential when they are collective in the sense that teachers participate with colleagues from the same school, department, or year level (Desimone 2009; Levine and Marcus 2010). Yet, research findings on this latter aspect are less straightforward than findings on the first two aspects of effective learning activities. Namely, how much collaboration supports TPL depends on the individual teachers and their school context as ‘too much collaboration and learning are stifling, too little collaboration and teacher isolation inhibit growth, just enough collaboration and teachers receive the stimulation and support from colleagues necessary for change’ (Opfer and Pedder 2011, 386).

### Teacher collaborative inquiry

It is generally assumed that teacher collaboration that includes aspects of inquiry is a promising route for TPL (e.g. e.g. Admiraal et al. 2016; Borko, Jacobs, and Koellner 2010; Deluca, Bolden, and Chan 2017). Namely, taking an inquiry stance can challenge

teachers' assumptions as they generate more nuanced or even very different understanding of teaching and learning (Slavit and Nelson 2010). From a learning stance, experimenting with new teaching practice is more promising for teachers than merely sharing experiences (e.g. Kvam 2018). A challenge that comes with experimenting, and other forms of school-based teacher collaboration, is the 'asynchronicity' in teachers' conversations when collaborating (Horn and Kane 2015). In other words, because the primary job of teachers -teaching- takes place in the privacy of teachers' classroom, teachers need to reconstruct relevant aspects of lessons when inquiring with colleagues. The advantage of this asynchronous learning situation is, however, that it enables teachers to slow down, critically reflect on their work, and thus inquire and learn. To support TPL even more, Little (2003) recommends collegial observation to increase specificity and completeness in learning because merely exchanging stories or even teaching materials does not reflect the complex nature of classroom interactions. Teachers can either directly observe their colleagues (e.g. in Lesson Study or Self-Study) or watch video recordings of lessons. Research on collegial observation has yielded positive results for TPL (e.g. Vermunt et al. 2019; Vedder-Weiss, Segal, and Lefstein 2019), but it appears to be difficult to organise in practice.

Several factors hinder teachers from engaging in intensive forms of collaboration that include collective lesson experimentation and observation. Not only does it require complex organisational work in schools (Admiraal et al. 2016; Wolthuis et al. 2020), teachers should also feel safe to share details of their practice with colleagues (Vedder-Weiss, Segal, and Lefstein 2019). Because lesson experimentation and observation often reflect new ways of working and learning together, teacher groups can benefit from external support (Goodyear and Casey 2015; Horn and Kane 2015). Especially in contexts where collaborative cultures are characterised by little intensive forms of collaboration such as 'storytelling' or 'aid and assistance' (Little 1990), groups need to be supported in the process of collaboration because the implementation of innovative, collaborative processes is difficult to establish from within a group (De Jong, Meirink, and Admiraal 2019). At the same time, however, it should be noted that (external) support might stimulate groups' dependence on input from a facilitator and limit their capacity for intercollegiate collaborative talk about teaching (Horn and Kane 2015).

## Teacher dialogue as a tool for learning

The collaborative inquiry stance of teacher groups is not only served by the repertoire of learning activities that teachers undertake. In their review of teacher collaborative discourse, Lefstein et al. (2020) point to the importance of discourse in collaborative learning processes. The motivation behind their review is the popularity of (research on) professional learning communities that are assumed to support TPL. Lefstein et al. (2020) describe how agreement on the precise characteristics of professional learning communities is lacking, with 'reflective dialogue' emerging as the central ingredient. That is, how teachers communicate about their own lessons or from their observations. Teachers' descriptions and interpretations of events contribute to developing insights on teaching and student learning. The dialogues in teacher groups can vary greatly, with some groups' discussions being more effective to TPL than others (Dudley & Vrikki 2019). One widely supported finding on how teacher dialogue stimulates groups' inquiry

stance and TPL relates to the type of dialogic moves (DM) between teachers. More specifically, challenging or critically questioning colleagues is assumed to serve the inquiry stance of a teacher group (e.g. Achinstein 2002; Owen 2016). Warwick et al. (2016), for example, show that when teachers challenge each other, this has a direct effect on the course of the dialogue by moving towards collective or individual learning. Slavit and Nelson (2010) also point to the importance of posing each other critical questions and identified different levels of being critical and inquiry-oriented. Their study shows how teachers are primarily concerned with their teaching, but to a lesser extent with student learning. Yet, a focus on student learning (e.g. Cook and Faulkner 2010; Schipper et al. 2020; Vangrieken et al. 2017) is especially important in stimulating TPL, and thus requires attention (Slavit and Nelson 2010). Levine and Marcus (2010), however, stress that a focus on student learning alone is not enough, because without simultaneous attention to the process of teacher collaboration it ‘may not produce a strong feedback loop with data informing teachers’ work or deprivatised practice as a resource for critical reflection and learning’ (Levine and Marcus 2010, 396). Achinstein (2002) and Liu (2019) mention professional conflict, or a dialogue of difference, to deepen knowledge and create new ways of thinking. Brodie (2019) furthermore stresses the importance of safety that is required to inquire and challenge collectively.

### This study

In this study, we investigate TPL during a one-year school-based intervention on differentiated teaching. Teachers who differentiate, attend to student differences by adapting content (i.e. what student are learning), process (i.e. how students are learning), and product (i.e. how student learning is assessed) (Tomlinson 2014; Tomlinson and Jarvis 2009). During the intervention, teachers are externally facilitated in collectively designing, experimenting with, observing, and critically reflecting on differentiated teaching. Teacher groups are supported in participating in learning activities and engaging in professional dialogues that are assumed to further their TPL. To better understand *how* TPL develops in teacher collaboration we focus on the interaction level of teacher groups’ discourse (c.f. Dudley 2013) using the framework on teacher dialogue from of Warwick et al. (2016), which has been developed in the context of Lesson Study. According to Lefstein et al. (2020), empirical research on teacher discourse ‘has been sporadic and relatively diffuse’ (Lefstein et al. 2020). A general conclusion is that research that empirically established links between TPL and features of teacher discourse is rare. Lefstein et al. (2020) describe the strategies adopted by researchers to locate TPL, including 1) focusing on conditions that are presumable conducive to teacher learning (e.g. group norms and structures); 2) looking at meaning-making in conversations, or; 3) examining learning opportunities. A meaning-making approach to TPL is to discern what teachers talk and (presumably) learn about by focusing on teachers’ discourse topics. Another meaning-making approach to TPL is to focus on the discourse processes through which meanings are negotiated and co-constructed (Lefstein et al. 2020). The learning opportunities approach is developed by Horn et al. (2017) who classified learning opportunities in workgroup meetings based on the extent to which pedagogical concepts developed and how they mobilised teachers for future work. One of the limitations of their research is that the approach to learning ‘remains agnostic about

what is being learned. Future work can bring the qualities of what is being learned into sharper focus' (p. 52, Horn et al. 2017). To our knowledge, there is no research on teacher collaboration that systematically tracked teachers' learning process by investigating their LO and associated dialogues over time. Our main research question is: What and how do teacher groups learn from their collaboration over time? The following sub-questions are formulated:

- (1) What learning outcomes do teacher groups report?
- (2) With what type of dialogic moves are teacher groups' self-perceived learning outcomes associated?
- (3) How does teacher groups' learning develop throughout the meetings?

A multiple case study (Stake 2006) has been carried out of four teacher groups who engaged in collective lesson design, observation, and reflection to support their professional learning. The teacher groups were examined on what and how they learned from their collaboration over time, by combining self-reported and observed teacher data.

## Sample

Four teacher groups from three Dutch secondary schools participated in the study. The groups included three to six teachers per group, varying in teaching experience (see Table 1).

**Table 1.** Teachers' characteristics and number of collected data.

Teacher	School Subject	Teaching Experience (Years)	Working at School (Years)	Number of Meetings Present	Number of Logs	Implemented a lesson
<b>Group A</b>						
1	Chemistry	38	19	4	4	x
2	Physics	5	5	4	4	x
3*	English	3	3	3	3	x
<b>Group B</b>						
1	Economics	1	1	5	5	x
2	Dutch	2	2	4	4	x
3*	History	33	18	6	5	x
4	German	**	**	5	5	x
5	History	3	1	6	6	x
6	German	3	3	6	6	x
<b>Group C</b>						
1	Physical education	22	18	4	4	
2	Music	8	8	3	3	x
3	Drawing	18	2	4	4	
4	Economics	24	3	5	5	x
5	Drawing	16	14	3	3	
6	Geography	3	3	5	5	x
<b>Group D</b>						
1	German	39	14	5	5	
2	French	12	12	5	5	x
3*	Dutch	20	20	3	3	x
4	English	**	**	3	3	
5	English	**	**	5	5	
6*	Dutch	19	19	5	5	x

\* = teachers that communicated the planning with the first author; \*\* = information not provided by the teacher.

The teachers from group A (school 1) taught pre-vocational students, and the teachers from groups B (school 2), C, and D (school 3) taught pre-vocational and higher general students.

## Procedure

### Recruitment

A total of 110 schools were contacted via email using the researchers' network and new, online available, school contacts. In the spring of 2018, the researchers visited nine schools to discuss the aims and procedure of the project. Eventually, six schools agreed to participate in the project, with a total of 11 groups. We selected the four groups that engaged in lesson experimentation. The remaining seven groups were not selected because they did not engage in lesson experimentation (5 groups) or changed in group composition midway through the process (2 groups). Initial communication about the planning took place between the first author and coordinating teacher(s) in each school.

### Meetings

Four to six school-based group meetings of about 2 hours were facilitated by the first and second author, roughly once per month. In the end, group A met four times, group B met six times, and groups C and D met five times. Following Opfer and Pedder's (Opfer and Pedder 2011) recommendation on TPL, the meetings were characterised as follows:

- (1) *Intense and sustained learning activities.* Teachers frequently met to participate in a learning cycle inspired by Lesson Study (Chokshi and Fernandez 2004), to engage in learning activities such as designing lessons, collegial observation, and providing feedback. The cycle consisted of three phases: orientating (one meeting), designing (one to two meetings), and reflecting (two to three meetings). In the first meeting, the teachers were provided with a manual of differentiated teaching, including hands-on tools and background information.
- (2) *Embedded in teaching practice.* In the orientation phase, the teachers explored the concept differentiated teaching, their current differentiation practices, and chose a focus (i.e. type of differentiation). In the design phase, the teachers designed a lesson in line with their focus. After the design phase, the teachers implemented and recorded their lesson. In the reflection phase, the teachers reflected on their implementation.
- (3) *Collaborative and collective.* The learning cycle was guided by a collective focus. Furthermore, the teachers collaborated by sharing teaching experiences, observing colleagues' teaching practice, and giving each other feedback. The following foci were chosen by the groups: Groups A and D decided in the first meeting to focus on addressing student readiness by adapting teacher explanation. Group B focused on addressing student readiness by providing different tasks. Group C decided to focus on addressing student readiness by challenging 'stronger' students and providing additional support for 'weaker' students.



## Facilitation

The facilitators took care of the organisation of the meetings and guided the conversations. In terms of organising, the facilitators took notes, monitored the time, distributed materials (e.g. manuals, lesson forms, agenda, minutes, video recordings), and reminded the teachers on agreements and upcoming meetings by mail. Regarding guiding the conversations, recommendations of Horn et al. (2017) were followed. The facilitators stimulated *dialogue* by asking teachers to share their thoughts and to respond to input from colleagues. Furthermore, the facilitators focused the conversation on *inquiry* instead of evaluation by discussing student learning instead of teachers' achievement and asking 'why' and 'how' questions (e.g. why is this teaching approach effective, how did the students respond, how does this approach differ from your current practices). Finally, the facilitators linked teachers' experiences with *future lessons* by asking what is needed to promote student learning in future lessons and what would be the first step. Throughout the meetings, the facilitator did not fulfil the role of an expert. Thus, the facilitator did not give feedback on the groups' teaching practice nor told the teachers what to do in their practices.

## Data sources

Observed DM between teachers in the meetings and self-reported LO that the groups attributed to the meetings were measured using logs and video recordings.

## Self-perceived learning outcomes

After each meeting, the teachers were asked to complete a hard-copy log on TPL. In sum, 92 logs were completed (see Table 1). The design of the logs was based on Zwart et al.'s (2008) definition of LO that distinguishes between the integrated whole of theoretical and practical insights, beliefs, and orientations (i.e. cognition) and the teaching activities that teachers (report to) undertake to support and stimulate student learning (i.e. behaviour). In the logs, the teachers were first provided with the definition of differentiated teaching, i.e. adapting teaching in terms of content (i.e. what students are learning), process (i.e. how students are learning), and product (i.e. how student learning is assessed) to student differences in readiness, interests and learning profile (Tomlinson 2014; Tomlinson and Jarvis 2009). Subsequently, the teachers responded to two questions on TPL, referring to cognition and behaviour. The question on cognition was 'what did you learn about differentiated teaching? For example, what did you come to know, what did you change your mind about, or what did you become aware of?' The question on behaviour was 'in what way do you plan to differentiate more in your teaching?'

## Observed dialogic moves

A total of 25 hours of video recordings (45 to 96 minutes per meeting) were used to study DM between teachers. Based on research from Warwick et al. (2016), five DM can be

**Table 2.** dialogic moves illustrated by two exemplary fragments from the first meeting of group A.

Fragments	DM
<b>Example 1</b>	
T3: I have, for example, a boy who can achieve on [level X] but who is assigned to [a lower level]. Unfortunately, I have to test him on [the lower level] for which the boy scores an A. It is not challenging. So I have to provide different materials for him every time, and that does not always work.	REA
F: Clear.	
T3: It's weird, isn't it? So you provide more difficult materials at [level X], but it does not motivate [the boy] because it does not lead to anything. And then he is tested again on [the lower level].	REQ, REA
T1: But then, why is he tested on [the lower level]?	REQ
T2: Yes, I am surprised too, yes.	SUP
T3: Because in the ninth grade, he was never awarded by anyone to let him do English on [higher levels]. And that disappoints me.	REA
<b>Example 2</b>	
T3: I always have 'the weak brothers and sisters club', that I then gather together. The rest [of the students] will start with the exercises and they will receive guidance. (...)	REA
T1: I think it's funny that you call it 'the weak brothers and sisters club'.	CHA
T3: I say that to myself and not to the students.	CHA
T1: I get that, but I don't think it has to be 'a weak brother and sister club'.	CHA
T2: Possibly, they may pick up [the lesson content] less quickly.	BUI
T1: So, for a specific part.	BUI
T3: Yes, but ...	
T1: You are actually saying or suggesting that they are weak in English across all its strands.	CHA
T3: They usually are.	BUI
T1: Okay, with you, but usually not with me. I also have such a 'club', [but] that is not the same in composition [for each part].	BUI, REA

REA = providing evidence or reasoning; REQ = requesting information, opinion or clarifications; SUP = expression of support or agreement; CHA = challenging colleagues' ideas; BUI = building on colleagues' ideas.

distinguished (see examples in Table 2) on the interaction level of teachers' discourse: Building, supporting, requesting, providing evidence and reasoning, and challenging. Building refers to teachers building on colleagues' ideas. When building, teachers make contributions that build on each other and work towards a shared understanding. Supporting concerns teachers' expression of support or agreement, such as 'I agree' or finishing one's sentence, without adding new information. When teachers request information, opinion or clarifications from colleagues, this is labelled as requesting. Providing evidence or reasoning (hereafter referred to as reasoning) is whenever teachers illustrate their argument. It concerns teachers' substantiation of statements, either by giving examples from practice (e.g. 'the tasks was not interpreted as different, but as additional, because the students told me that the other tasks seemed easier') or providing arguments related to teaching and learning (e.g. 'the lesson content is not challenging because students are working below their level'). Finally, challenging accounts for teachers challenging colleagues' ideas, such as 'I think your argument is incorrect'.

## Data analysis

To study teacher groups' LO and associated DM, eight steps of data analysis were performed. As a *first step*, teachers' hard-copy logs were digitised, and the video recordings of the meetings were transcribed.

To answer the first research question, we coded self-reported LO from the logs that the teachers filled in after each meeting, using two categories and three codes (*step 2*). Teachers' answers to the log questions on cognition and behaviour directed the two LO categories knowledge and planned implementation, respectively. The categories were theory-driven and were based on Zwart et al. (2008). The codes within each category were data-driven and emerged during the coding process. LO were coded using three codes: related-LO, unrelated-LO, and general-LO. The codes concerned knowledge or planned implementation, resulting in six subcategories. Examples of each subcategory are provided in Table 3. Related-LO and unrelated-LO are related and unrelated to the group focus, respectively. The group focus was decided by the groups in the first meeting. Moreover, related-LO and unrelated-LO concern a specific type of differentiation (i.e. content, process, or product) and/or specific student differences (readiness, interests, or learning profile). General-LO do not concern a specific type of differentiation nor specific student differences. Subsequently, for each group, we computed the percentage of related-LO, unrelated-LO, and general-LO (*step 3*). Therefore, we compared the number of teachers that reported LO with the number of teachers that were present per meeting.

To answer the second research question, we coded DM by locating teachers' self-reported LO in the meeting transcripts. Therefore, we first identified fragments in which the topics of the related-LO and unrelated-LO were discussed (*step 4*). Some LO were discussed multiple times in one meeting, and therefore associated with multiple fragments, with a maximum of three fragments per LO per meeting. In each group, a small number of LO were not identifiable in fragments of the transcripts, either because LO underpinned a whole meeting, or because LO were not discussed. General-LO were not included in the fourth step because these LO were unidentifiable in the transcripts due to their general nature and because they provided no or limited insight in teachers' learning process concerning the central theme of the meetings (i.e. differentiated teaching). As a *fifth step*, we coded the fragments using five codes: building, supporting, requesting, reasoning, and challenging (Warwick et al. 2016). For each fragment, we coded whether a particular DM was present. Subsequently, for each group, we computed the percentage of each DM per meeting (*step 6*).

To answer the third research question, we explored the development of LO and DM throughout the meetings. To this end, we summarised all data on LO and DM in time-ordered matrices (*step 7*). Next, we inspected the changes in LO and DM across phases (i.e. orientation, design, and reflection) per group (*step 8*).

**Table 3.** Examples of specific (related and unrelated) and general learning outcomes concerning knowledge and planned implementation of group A.

Learning Outcome	Knowledge	Planned Implementation
Specific		
Related	'Teacher explanation in three groups: How much and when'	'Prolonged explanation for students who need more explanation and repetition'
Unrelated	'Student motivation can vary per school subject'	'Provide challenging content for students who do not need more explanation'
General	'Types of differentiated teaching'	'Grouping of students'*

This group focused on addressing student readiness by adapting teacher explanation. \* = fictive LO, because group A did not report general LO concerning planned implementation.

To guarantee a valid interpretation of the results, the second author assessed the quality of the first author's coding of LO and DM (i.e. step 2 and 5) of one group. Therefore, the first author provided the second author with the coded logs and coded transcripts and a systematic report of the data analysis. The analysis was assessed on three generic criteria: visibility, comprehensibility, and acceptability (Akkerman et al. 2008). Based on the assessment of the second author, changes that mainly related to the comprehensibility were made. Namely, one adaption in labelling was made, and additional information on the analysis was provided in the method section and table notes. In addition, in terms of acceptability, one LO was recoded.

## Findings

This section starts with the findings that concern all groups, and next we report on group-specific findings. In each section, we first address LO (i.e. research question 1) and secondly associated DM (i.e. research question 2). We describe the average in LO and DM across meetings, and the development throughout the meetings (i.e. research question 3).

### All teacher groups

#### *Learning outcomes*

Most LO were reported by group A, followed by group B and groups C and D, respectively (see Table 4). In all groups, the first meeting stands out due to the relatively high amount of general-LO. These findings are in line with the setup of the intervention because, in the first meeting, the teachers explored differentiated teaching, resulting in LO relating to general aspects (e.g. knowledge on types of differentiation or student differences). At the end of the first meeting, the groups decided on a common focus (i.e. a specific type of differentiation and student difference), which we expected to direct the groups' learning process in the subsequent meetings. Overall, the amount of related-LO did not increase throughout the meetings in all groups. However, in all groups, the related-LO that are reported by the teachers became more detailed throughout the phases. For example, group A teachers reported in the orientation phase related-LO concerning grouping students and adapting teacher explanation to student readiness. In the design and reflection phase, related-LO concerned more details, namely, *how* to group students or provide explanation. These findings align with our expectations because the teaching practice that is discussed in the design and reflection phase reflects more specificity and completeness than in the orientation phase, which is due to the learning activities in which the teachers engaged. Namely, in the orientation phase, the teachers merely exchanged stories, whereas, in the design and reflection phase, the teachers designed, reflected and observed.

**Table 4.** Percentage of teachers per group that reported specific (related and unrelated) and general learning outcomes distinguished by all, knowledge and planned implementation.

Learning Outcome	Meeting 1	Meeting 2	Meeting 3	Meeting 4	Meeting 5	Meeting 6
<b>Group A</b>						
Nr. of teachers present	3	3	2	3	N/A	N/A
All Learning Outcomes						
All	100	100	100	100		
Knowledge						
Specific						
Related to focus	33	67	100	100		
Unrelated	33	0	0	0		
General	100	33	0	67		
Planned Implementation						
Specific						
Related to focus	100	100	100	67		
Unrelated	33	33	0	33		
General	0	0	0	0		
<b>Group B</b>						
Nr. of teachers present	6	6	5	5	5	5
All Learning Outcomes						
All	83	100	100	100	100	100
Knowledge						
Specific						
Related to focus	17	67	80	60	60	80
Unrelated	33	0	0	0	0	0
General	67	50	40	80	60	60
Planned Implementation						
Specific						
Related to focus	67	83	20	80	40	40
Unrelated	0	17	20	40	20	20
General	0	0	40	0	40	40
<b>Group C</b>						
Nr. of teachers	6	5	3	5	5	N/A
All Learning Outcomes						
All	83	100	100	80	80	
Knowledge						
Specific						
Related to focus	33	20	33	20	80	
Unrelated	0	0	0	40	0	
General	66	80	67	20	40	
Planned Implementation						
Specific						
Related to focus	33	40	66	40	80	
Unrelated	17	0	0	40	0	
General	0	40	0	0	0	
<b>Group D</b>						
Nr. of teachers	6	6	4	6	4	N/A
All Learning Outcomes						
All	100	100	75	50	100	
Knowledge						
Specific						
Related to focus	50	17	0	0	50	
Unrelated	0	0	50	17	0	
General	100	50	25	33	75	
Planned Implementation						
Specific						
Related to focus	33	33	75	33	75	
Unrelated	50	50	0	17	25	
General	0	0	0	17	0	

Type of learning outcomes concerning knowledge and planned implementation that were reported most in a meeting are reported in italics. N/A = not applicable because meeting did not take place.

### Dialogic moves

In all groups, the DM that are associated with related-LO and unrelated-LO mostly reflect *building*, followed by *supporting* and *reasoning*. *Requesting* occurred less often, and all groups engaged in *challenging* least often. Thus, the composition of types of DM was similar across groups. However, the number of DM made in each group differs. In other words, the percentage of DM made in the meetings varies per group (see Table 5). This latter aspect of DM provides us with insight into the extent to which teachers engaged in dialogue with each other. Namely, low percentages of DM reflect discourse in which teachers' LO are discussed by one teacher and/or the facilitator, with no or little input from other teachers. Regarding the development of DM, an intensification in types of DM is visible in the reflection phase of all groups. This intensification is in line with our expectations because we assumed that collegial observation would foster an inquiry stance in the group, and therewith their dialogue, as collegial observation enabled teachers to see how students respond to teaching and to reflect on the lessons' effectiveness. Yet, how DM intensified differs per group and is therefore discussed below.

### Group a

#### Learning outcomes

LO reflect high levels of consistency, compared to the other groups. Namely, all teachers reported LO throughout the meetings. Furthermore, group A reported mostly on related-LO, concerning both knowledge and planned implementation. Thus, most LO concerned their group focus of adapting teacher explanation to students' ability level (see Table 4). The development of TPL of group A seems most stable of all groups (i.e. little differences in types of LO between the meetings). In the first meeting, this group reported most unrelated-LO and least related-LO concerning knowledge, which is due to the explorative character of the first meeting as mentioned above. In meeting 3 and 4, LO became more detailed. For example, the teachers reported LO on how to provide explanation and how to group students.

#### Dialogic moves

The dialogic moves (DM) that are associated with related-LO and unrelated-LO are characterised by high levels of building, reasoning and challenging, compared to the other groups (see Table 5). The second example in Table 2 illustrates group A, which comes from the first meeting in which teacher 3 shared her current practices of differentiated teaching. This fragment is illustrative for group A because in several instances, challenging by teacher 1 leads to a dialogue between teachers with different perspectives. The analysis furthermore indicates that DM of group A changed throughout the phases. Whereas the DM reflect relatively high levels requesting, reasoning, and challenging in the orientation phase, these levels decreased in the design phase and increased again in the reflection phase (see Table 5).

**Table 5.** Teacher groups' specific (related and unrelated) learning outcomes and associated dialogic moves.

Learning Outcome per Meeting	Dialogic Move by Teachers				
	BUI	SUP	REQ	REA	CHA
<b>Group A</b>					
1 Challenging content 1/3 (T3, PI)	x	x	x	x	
Student motivation (T2, K); Challenging content 2/3 (T3, PI)	x	x		x	x
Prolonged explanation 1/2 (T3, PI); Student attention (T1, PI)	x		x	x	
Student level (T3, K)	x	x		x	x
Teacher or student choice (T2, PI)	x	x	x	x	
Challenging content 3/3 (T3, PI)	x	x	x	x	x
Prolonged explanation 2/2 (T3, PI)	x	x	x	x	
2 Grouping on level 1/2 (T2, K)	x	x	x	x	
Grouping on level 2/2 (T2, K)	x	x	x	x	
Pace and level (T3, K)	x	x		x	
Additional content and working independently (T3, PI)	x			x	
3 Clear explanation 1/2 (T1, PI)	x				
Grouping per school subject 1/2 (T1, K)	x	x		x	x
IGDI model (T2, K); Explanation in groups (T2, K); Pace of explanation (T2, PI)	x	x			
Explanation using PPT or A4 (T1, K)	x				
Clear explanation 2/2 (T1, PI)	x				
Grouping per school subject 2/2 (T1, K)	x	x	x	x	x
4 Student labelling (T1, K)					
Grouping (T3, K)	x	x		x	x
Deepen and widen lesson (T3, PI)	x	x		x	
Assessment (T3, PI)	x			x	
Student placement 1/3 (T2, K)	x	x	x	x	x
Explanation 1/2 (T2, K); Student placement 2/3 (T2, K)	x	x	x	x	x
Grouping (T2, PI)	x	x	x	x	
Explanation 2/2 (T2, K); Student placement 3/3 (T2, K)	x	x	x	x	x
<b>Total number</b>	<b>24</b>	<b>18</b>	<b>12</b>	<b>20</b>	<b>9</b>
<b>%</b>	<b>96</b>	<b>72</b>	<b>48</b>	<b>80</b>	<b>36</b>
<b>Group B</b>					
1 Assessment without grading (T1, K); Product differentiation 1/2 (T4, K)	x	x	x	x	x
Content (T2, PI); Tasks (T4, PI); Content (T5, PI); Challenging tasks (T6, PI)	x	x	x	x	
Product differentiation 2/2 (T4, K)	x	x		x	
2 Different tasks 1/2 (T2, K); Different tasks 2/2 (T3, K)					
Different tasks 1/2 (T2, K); Different tasks 2/2 (T3, K)					
Groups (T3, PI); Pace in content (T3, PI)					
Group work (T6, K)	x		x		
Zone of proximal development (T1, K); Zone of proximal development (T3, K)					
Divergent differentiation (T1, PI)					
Different books (T6, K)	x	x	x	x	
3 Guidance (T6, PI)					
Grouping on grades 1/2 (T5, K); Grouping on grades (T6, K)	x	x	x	x	
Grouping on grades 2/2 (T5, K); Grouping on grades (T6, K)	x	x		x	x
Tasks (T4, K)	x				
Bloom's taxonomy (T3, K)	x				
4 Interests 1/3 (T3, PI); Interests 1/3 (T4, PI)					
Explanation in groups 1/2 (T6, PI)					
Different levels 1/3 (T5, K); Independent work 1/2 (T6, K)	x	x	x	x	
Choice options 1/3 (T3, PI)					
Choice options 2/3 (T3, PI)					
Different levels 2/3 (T5, K)					
Differentiated teaching is activating (T3, K)	x	x	x	x	x
Choice options 3/3 (T3, PI)	x	x		x	
Explanation in groups 2/2 (T6, PI)	x	x			
Different levels 3/3 (T5, K)	x	x	x	x	
Independent work 2/2 (T6, K)	x	x	x	x	
Interests 2/3 (T3, PI); Interests 2/3 (T4, PI)			x	x	
Interests 3/3 (T3, PI); Interests 3/3 (T4, PI)	x	x		x	
5 Consider weaker and stronger students 1/2 (T6, PI)	x	x		x	x
Differentiation in content 1/2 (T4, K)	x	x			

*(Continued)*

Table 5. (Continued).

Learning Outcome per Meeting	Dialogic Move by Teachers				
	BUI	SUP	REQ	REA	CHA
Consider weaker and stronger students 2/2 (T6, PI)					
Vary in tasks (T3, PI)	x				
Differentiation in content 2/2 (T4, K); Explanation and student expectations 1/3 (T5, K)			x		
Explanation and student expectations 2/3 (T5, K)	x	x		x	
Explanation and student expectations 3/3 (T5, K)	x	x	x	x	
6 Learning styles 1/2 (T2, PI)	x			x	
Levels 1/2 (T2, PI); Learning styles 2/2 (T2, PI); Tasks (T3, PI)	x	x	x	x	
Grouping (T3, K)		x		x	
Levels 2/2 (T2, PI)					
<b>Total number</b>	23	19	13	19	4
<b>%</b>	59	49	33	49	10
<b>Group C</b>					
1 Pace (T5, PI)	x			x	
Level (T2, PI)	x	x		x	
Stronger students (T1, PI); Convergent and divergent differentiation (T4, K); Convergent and divergent differentiation (T5, K)	x	x	x	x	
2 Content 1/2 (T6, K)	x	x	x	x	
Content 2/2 (T6, K)	x	x		x	
Task with explanatory form (T5, PI)*	x	x			
3 Placement in classroom (T6, K); Student choice (T6, PI)					
4 Explanation in groups (T5, PI)	x	x	x	x	x
Student motivation (T6, PI)	x	x		x	
Formative assessment (T2, K); Formative assessment (T2, PI)	x				
Grading (T2, K); Grading and collaboration (T5, K)	x	x	x	x	x
Choice option (T3, PI)	x	x	x		
5 Not punishing 'stronger' students (T1, PI)	x	x	x	x	x
Tasks 1/2 (T1, K); Tasks 1/2 (T6, PI)	x	x	x	x	
Assignments (T3, K)	x	x	x		
Explanation at the start (T2, K)					
Choices (T2, PI); Student choices (T3, PI)	x	x		x	
Tasks 2/2 (T1, K); Tasks 2/2 (T6, PI)	x	x		x	
<b>Total number</b>	16	14	8	12	3
<b>%</b>	89	78	44	67	17
<b>Group D</b>					
1 Cognition and explanation (T3, K); Cognition and explanation (T6, PI)	x	x		x	x
Motivational tasks (T2, PI)					
Explanation (T3, PI)	x	x			
2 Grouping on diagnostic control (T4, K); Grouping on grades 1/3 (T2, PI)	x	x	x	x	
Grammar (T4, PI)	x			x	
Grouping on grades 2/3 (T2, PI); Grouping on diagnostic control (T4, K); Formative assessment (T6, PI)	x	x	x		
Grouping on grades 3/3 (T2, PI); Grouping on diagnostic control (T4, K)	x	x	x	x	x
3 Teacher support 1/3 (T3, PI)	x			x	
Teacher support 2/3 (T3, PI)	x	x	x	x	
Different tasks 1/2 (T3, K)	x	x		x	
Different tasks 2/2 (T3, K)	x	x	x	x	x
Relevant assignments (T6, K)	x	x		x	
Teacher support 3/3 (T3, PI)	x	x			
4 Explanatory forms 1/3 (T3, PI); Explanatory forms 1/3 (T6, PI)	x	x	x	x	
Feasibility of tasks (T6, PI)	x	x	x	x	
Group boys and girls (T6, K); Group boys and girls (T6, PI)	x	x	x	x	
Explanatory forms 2/3 (T3, PI); Explanatory forms 2/3 (T6, PI)	x				x
Explanatory forms 3/3 (T3, PI); Explanatory forms 3/3 (T6, PI)					
5 Explanatory forms (because it contains clear explanation) (T3, K)		x		x	x
The average group (T1, PI)	x	x		x	x
Different forms of explanation (T6, K)	x	x			
Not emphasise students' level (T3, PI)	x			x	
<b>Total number</b>	21	18	9	17	8
<b>%</b>	79	67	33	63	25



DM associated with general-LO are not included in the study. Percentages of DM below (i.e.  $\leq 10\%$ ) the groups' median are reported in italics. Percentages of dialogic moves above (i.e.  $\geq 10\%$ ) the groups' median are in bold. Some LO are associated with multiple fragments in one meetings, and therefore reported multiple times in this table, indicated by '.../...':

\* = transcript regarding LO is incomplete because teachers' conversation is unintelligible; T = teacher; K = LO concerning knowledge; PI = LO concerning planned implementation; BUI = building on colleagues' ideas; SUP = expression of support or agreement; REQ = requesting information, opinion or clarifications; REA = providing evidence or reasoning; CHA = challenging colleagues' idea.

## Group b

### Learning outcomes

LO reflect, in comparison with group A, less consistency. Overall, teacher 1 and 2 reported little LO throughout the meetings. Furthermore, group B reported relatively often on general-LO and unrelated-LO. Thus, these LO did not concern their group focus adapting tasks to student readiness (see Table 4). In comparison with group A, the development of LO of group B is less stable (i.e. more differences in types of LO between meetings). Similarly to group A, this group reported more unrelated-LO and less related-LO concerning knowledge in the first meeting. Detailed LO were reported by two teachers in meeting 3 and 4. Detailed LO are, for example, the provision of headphones to students in order to stimulate independent work when other students receive explanation.

### Dialogic moves

DM that are associated with related-LO and unrelated-LO are characterised by low levels of building, supporting, reasoning, and challenging, compared to the other groups (see Table 5). Thus, the fragments in which LO are discussed barely reflect actual dialogue between teachers, because the topics of LO are addressed by one teacher and/or the facilitator, with no or little interference from other teachers. Especially at the start of the meetings 2, 3, and 4, LO are associated with DM that reflect little interaction, because teachers share their current ideas and intentions in response to the facilitator's opening questions (e.g. 'where do you currently stand regarding our goal'). DM that involved more teachers typically include building, supporting, and in some instances reasoning (see Table 5). Such an illustrative fragment comes from meeting 4 in which the facilitator asked teacher 3 to reflect on his lesson, after sharing it on video:

F:To make the link with differentiated teaching: What has been the working principle behind that lesson? Why were the students motivated, despite having the same materials?

T3:Yes, but [...] I gave one group different assignments than the other group. And they did not overlap, those are other assignments. So, there is differentiation on level, there is differentiation on choice.

T6:But that means, [...] if you want to discuss that, those assignments, then you have to do that with half of the group, and the other half [of the group does] something else then. (*Building*)

T3:Yes [...] in general that goes well. [...]. (*Supporting and building*)

F:How did the students respond?

T3:Yes, just positive, they were positive in the sense of ‘Nice, we are going to do an assignment’. [...] [Student X] was often like ‘I don’t need to do everything’. [...] At a certain point, [student X] could choose himself, and then he was like ‘Really?!’. So just a sigh of release that he does not have to do [everything]. And someone else who then said, ‘But it’s fun!’. That. Especially the possibility that they did not have to do everything. [...].

T6:But it is what you said. It is this autonomy that they can determine and/or manage something themselves, I think that gives a good feeling. (*Supporting and reasoning*)

The analysis furthermore indicates that in the reflection phase, DM include more supporting and reasoning in which the coordinating teacher (teacher 3) takes the lead, compared to the orientation and design phase (see [Table 5](#)).

## Group c

### Learning outcomes

LO reflect, similarly to group B, less consistency than group A. Namely, teachers 3 and 4 reported little LO throughout the meetings. Furthermore, group C reported many unrelated-LO. Thus, the LO did not relate to the group focus of supporting ‘weaker’ students and challenging ‘stronger’ students (see [Table 4](#)). Compared to group A and B, group C’s development of LO is least stable (i.e. most differences in types of LO between the meetings). This group reported many related-LO in the final meeting. Detailed LO were reported by all teachers in meeting 2, 4, and 5. An example of detailed LO concerns the provision of explanatory forms to students.

### Dialogic moves

DM that are associated with related-LO and unrelated-LO are characterised by average levels of challenging, compared to the other groups. A typical fragment of group C involves building, supporting, reasoning, and in about half of the instances requesting (see [Table 5](#)). A fragment that reflects this comes from meeting 5 in which teacher 4 asked for feedback from his colleagues on his lesson, after sharing it on video:

T4:Do you have any questions or comments? [...]. (*Requesting*)

T2:Yes, I recognise it very much, that you try to explain three assignments. That was my very first beginning [with differentiated teaching] when I immediately [thought] ‘Does everyone do that’? And I was happy to see [in your video] that differentiated teaching just takes a little while. [...]. (*Supporting, building*)

T1:Yes, I sometimes do parts of one [assignment] that is new and another one that is already known. So [T5], you could do something like that. The next time I do it as whole-class, and after that, I can use it for differentiated teaching. In that way, the explanation at the beginning [of the lesson] does not have to take as long. (*Supporting, building*)

T5:Yes, that is right, mainly making those questions that were completely new [to the students]. (*Supporting, reasoning*)

Furthermore, the analysis indicates that similarly to group B, DM of group C seem to intensify in the reflection phase, in terms of challenging.

## Group d

### Learning outcomes

LO reflect, similarly to groups B and C, less consistency than group A. Namely, only teacher 3 and 6 frequently reported many LO and teacher 5 did not report any LO. Furthermore, group D reported many unrelated-LO. Thus, the LO did not relate to the group focus of adapting teacher explanation to student readiness (see Table 4). The development of TPL of group D is, together with group C, least stable of all groups (i.e. most differences in types of LO between the meetings). Furthermore, similarly to group C, this group reported many related-LO in the final meeting. Four teachers reported detailed LO, such as how to group using student grades.

### Dialogic moves

DM are, similarly to group C, characterised by average levels of challenging. A typical fragment of group D involves building, supporting, reasoning, and in roughly one-third of the instances requesting and one-fourth of the instances challenging (see Table 5). A fragment that reflects this comes from meeting 5 in which the teachers reflected on the lesson conducted by teacher 2:

T1:We concluded that you must prepare for three lessons, and you combine it [the three lessons] into one lesson. [...] You were like ‘Now I need a break, if the next class would start now’. (*Building, reasoning*)

T2:Yes, you cannot do this a few times a day. It does take a lot of time and energy, such a lesson. (*Supporting*)

[...] T6:It could also have been fewer groups. That more children do the same [task]. (*Challenging*)

T1:You had three things, but two groups always did the same thing. They were not always different. But you do notice that it is almost three lessons, and if you organise it differently, you can also spread that over three lessons. Then you have a somewhat smaller organisational problem. (*Challenging, building*)

T3:What I noticed [with teacher 6’s lesson], which I think is very cool with differentiated teaching, is that it worked out. [Because of] the explanatory forms of each group. Then [the teacher] does not have to talk as much. (*Building, supporting, reasoning*)

T2:Yes, but basically, [the students] had such a form with all explanation once again. (*Supporting, challenging*)

T3:But if they have [explanatory forms], they could use it again and then ‘good luck and if you have any questions, I’m here’. (*Challenging*)

[...] T1:If you do it more often you could, indeed, almost leave out [the teacher’s] explanation at the start of the lesson. (*Sharing, building*)

Furthermore, the analysis indicates that, similarly to group B and C, DM of group D intensify in the reflection phase, in terms of challenging (see [Table 5](#)).

## Conclusion

This study aimed to gain insight into what and how teacher groups learn from their collaboration over time. We analysed teacher groups' LO and associated DM. Based on the results, we can conclude that (self-perceived) professional learning was supported in all groups. Yet, differences in LO are noticeable between the groups. LO of the groups differ in terms of amount (i.e. the number of teachers that reported LO), consistency (i.e. relatedness to the group focus), and stability (i.e. differences in amount and consistency between meetings). Overall, the smaller the number the amount of LO reported in a group, the less consistent and stable LO are. Regarding DM, the composition of DM is similar for all groups. With ranging from more to less frequent building, supporting, reasoning, requesting, and challenging. Differences between the groups relate to the number and type of DM between teachers. The number of DM made between teachers differs, with three 'interactive' groups (i.e. groups A, C, and D) with relatively many DM, and group B with less DM. In line with previous studies such as Owen (2016) and Slavit and Nelson (2010), our study shows that teachers who challenge ideas of their colleagues support their learning. Namely, when teachers challenged each other, this directly affected the course of dialogue and teachers moved towards learning. However, our study also confirms previous findings of Warwick et al. (2016) that challenging does not frequently occur. Yet, challenging increased in the reflection phase in all interactive groups. Only in the group that reported most LO, challenging stimulated a dialogue between teachers in which they shared varying perspectives on teaching and student learning, which is important to deepen knowledge and create new ways of thinking (Achinstein 2002; Brodie 2019). In another interactive group (that reported relatively little LO) challenging did not lead to such a dialogue. Namely, the teachers mainly responded to colleagues' challenging by disagreeing without further discussion, or the teachers did not respond at all. Interestingly, one group did not interact intensively or challenge each other frequently compared the other groups but did report relatively many LO.

## Discussion

The findings of this study provide detailed insights into teachers' collaborative learning. By identifying fragments of conversations in which the topics of teachers' (self-perceived) LO were discussed, we tried to grasp teachers' collaborative learning moments. Important to note is that we do not imply that the links between teachers' LO and associated DM are causal. As stressed by Lefstein et al. (2020), collaborative' practices, norms, and structures are complex, interlocking and situated and one element (e.g. DM) cannot be separated from its interactions with other elements to fully understand TPL. What works in one context might not work in another context. An important question that remains however is: How can it be explained that the learning processes in terms of LO and associated DM differ between groups? For this, we explore two (interrelated) contextual explanations based on our observations in the groups.

Our first explanation of differences in how and what teacher groups learn concerns *teachers' collective participation in collaborative learning activities*. Our results indicate that without continuity in collaboration, with teachers being absent or not engaging in experimentation, critical dialogues about teaching and student learning seem to have less impact on TPL. From previous research, it is known that inconsistent participation of teachers limits the feedback loop (Levine and Marcus 2010) in teacher groups which results in limited and fragmented (self-reported) LO. Thus, despite that groups C and D are interactive, and teachers challenge each other, a lack of continuity and collectiveness in group collaboration limits the continuity and collectiveness in TPL.

Our second explanation concerns the *facilitation and internal support in the group*. The three interactive groups are characterised by little dependence on the external facilitator in terms of guiding the conversations (Horn and Kane 2015). From the three interactive groups, group A was least dependent on the facilitator's guidance because internal support (i.e. support from a teacher member) was provided by one teacher that actively facilitated the conversations in the group by frequently challenging his colleagues. In the least interactive group (i.e. group B), the facilitator had an active role in initiating conversations by asking open questions and engaging teachers in colleagues' discussions because the teachers were not eager to talk. Yet, the least interactive group reported, together with group A, most LO. As described above, this can be attributed to the collective participation of this group. Our study shows that internal support is an important affordance for collective participation. Namely, in the least interactive group, internal support was provided by the coordinating teacher who managed the meetings. This teacher planned the meetings, reminded colleagues on agreements, and supported colleagues in recording their lesson, which stimulated teachers' collective participation. In the three interactive groups, however, the facilitator was confronted with various organisational challenges because teachers did not keep the agreements or were absent due to other school obligations, which illustrates the complex organisational work that teacher collaboration requires (Admiraal et al. 2016; Wolthuis et al. 2020). In sum, we conclude that lesson experimentation and collegial observation requires new ways of collaborating which benefits from, or even requires, external facilitation (Goodyear and Casey 2015). Moreover, our study shows that the presence of internal support by participating teachers strengthens collective learning.

### Limitations and recommendations for future research

In this study, we measured LO by teacher logs which reflect teachers' view on their own TPL. To fully grasp TPL, it is worthwhile to include additional measurements, such as classroom observations. We focused on TPL in the context of meeting-bound activities. In an effort to solve the issue of 'asynchronicity' in teachers' conversations (Horn and Kane 2015), teachers were stimulated to share video recordings of their lesson. However, the learning process took place while teaching remained less visible. Therefore, it can be useful to observe teachers while teaching or to interview teachers directly after teaching about their learning in relation to the group focus.

Another recommendation is to question teachers on their self-reported LO that related to the group focus, but which were not identifiable in the group conversations. In this study, the researchers identified fragments of teachers' conversations, using

teachers' self-reported LO. Actively involving teachers in identifying both LO and learning moments in (and outside) meetings, can contribute to a further understanding of how and when teachers learn.

Regarding DM, we recommend further investigations of the content of the dialogues. To stimulate TPL, a focus on student learning in teachers' conversations seems especially important (e.g. Cook and Faulkner 2010). This aspect in DM was not considered in this study. We focused on the type of DM (e.g. requesting information or building on a colleague) and distinguished between related and unrelated content regarding the group focus. Insight into the content of the DM, for example in terms of a focus on teaching or student learning, can further nuance our findings on LO and associated DM. Our final recommendation concerns the exploration of teacher learning and dialogue from a sociocultural stance. The analysis framework on DM was arrived upon by Warwick et al. (2016) through methods associated with sociocultural discourse analysis (Mercer 2007). Sociocultural discourse analysis attempts to capture the meaning of discourse for teachers by placing emphasis on their social and cultural context. The present study illustrates how teacher learning occurs in dialogue and how this varies across groups. Future research could benefit from further exploration of teachers' context, such as affective group characteristics. Differences between groups were noticeable in terms of frequency of interaction. Possibly, groups are less interactive due to a lack of safety or self-efficacy in the group (e.g. Brodie 2019; Vedder-Weiss, Segal, and Lefstein 2019). Furthermore, teacher learning and dialogue could be studied against a sociohistorical backdrop on classroom practice. To better understand what and how teacher groups learn, it would, for example, be worthwhile to address teachers' current practices of differentiated teaching and the educational vision in schools in relation to differentiated teaching. Possibly, groups report many learning outcomes because in their context, differentiated teaching (or any other topic of professionalisation) is considered innovative or aligns with (their perceptions of) their school's change capacity. Other groups might report less learning outcomes because differentiated teaching is not considered as innovative or does not align with (their perceptions of) their school's change capacity.

## Practical implications

The findings of this study regarding teacher groups' TPL in terms of what they learn and how this is stimulated in teachers' conversations can be informative for both school staff and facilitators. The first practical implication concerns stimulating the collectiveness in groups. To this end, the commitment of teachers and prioritisation by school leaders in terms of providing time and space to meet must always be paramount. The second implication is related to the importance of facilitation by external facilitators and internal (informal) teacher leaders. External facilitators can provide more or less facilitation regarding guiding conversations and organisation, depending on the group composition. Furthermore, professional development programmes could pay attention to the support of teachers' leadership competencies, while considering differences between teachers. Beginning teachers might need more or different knowledge and skills to enact leadership roles than their more experienced colleagues (Meirink et al. 2020).

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## Notes on contributors

*Loes De Jong* is working as apostdoctoral researcher at Leiden University Graduate School of Teaching. Her research focuses on teacher collaboration, professional learning communities, and teacher professional learning in secondary education (ORCID iD:0000–0003–2112–4072).

*Jacobiene Meirink* works as a researcher at Leiden University Graduate School of Teaching. Her research focuses on teacher professional development, and more specifically how collaborative forms of PD contribute to teacher learning.

*Wilfried Admiraal* (Leiden University) is full professor Teaching and Teacher Education and director of the Leiden School of Education. His research interest combines the areas of teaching, technology, and social psychology in secondary and higher education (ORCID iD:0000–0002–1627–3420).

## ORCID

Wilfried Admiraal  <http://orcid.org/0000-0002-1627-3420>

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