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### **published in**

Teaching and Teacher Education  
2017

### **DOI (link to publisher)**

[10.1016/j.tate.2017.09.015](https://doi.org/10.1016/j.tate.2017.09.015)

### **document version**

Publisher's PDF, also known as Version of record

### **document license**

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### [Link to publication in VU Research Portal](#)

### **citation for published version (APA)**

Schipper, T., Goei, S. L., de Vries, S., & van Veen, K. (2017). Professional growth in adaptive teaching competence as a result of Lesson Study. *Teaching and Teacher Education*, 68, 289-303.  
<https://doi.org/10.1016/j.tate.2017.09.015>

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## Professional growth in adaptive teaching competence as a result of Lesson Study



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### HIGHLIGHTS

- Suggests the potential of Lesson Study to promote adaptive teaching competence.
- Approaches Lesson Study as a means to stimulate teacher professional growth.
- Stresses and clarifies the importance of appropriate school conditions in Lesson Study practice.
- Proposes a model for teacher professional growth in the context of Lesson Study.

### ARTICLE INFO

#### Article history:

Received 1 December 2016

Received in revised form

27 August 2017

Accepted 15 September 2017

Available online 5 October 2017

#### Keywords:

Lesson Study

Adaptive teaching competence

Professional development

Teacher professional growth

School conditions

### ABSTRACT

Since classrooms have become more diverse, professional development on adaptive teaching seems critically important, yet turns out to be complex. Lesson Study may address this issue due to its explicit focus on student learning. In total, 22 Lesson Study participants from different school contexts were interviewed. Clarke and Hollingsworth's Interconnected Model of Professional Growth was used as the analyzing framework to explore its adequacy for understanding teacher professional growth. The results reveal teacher professional growth in adaptive teaching competence and show how the intensive focus on student learning, collaborative professional experimentation and the facilitators' role may contribute to this.

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### 1. Introduction

The general aim of this study is to examine whether the professional development approach Lesson Study (LS) enhances teacher professional growth in terms of adaptive teaching. As classrooms in mainstream secondary education have become more diverse in terms of students' educational needs (VanTassel-Baska & Stambaugh, 2005), and inclusion of students with diverse educational needs in mainstream education is currently a guiding principle in educational policy (UNESCO, 2009), teachers are expected

to respond to a variety of students' educational needs (Corno, 2008). Such developments are consistent with results from a recent OECD publication in which responding to the learning needs of students is stressed as one of the broader expectations for teachers (Schleicher, 2016). The importance of implementing adaptive teaching strategies in classrooms is also recognized by teachers (Silva & Morgado, 2004).

Addressing the diverse educational needs of individual students, however, has proven to be a complex skill for many teachers in secondary education for many different reasons (Van de Grift, Helms-Lorenz, & Maulana, 2014), and remains a major challenge in different countries (Schleicher, 2016). Besides many practical and valid reasons (Janssen, Westbroek, & Doyle, 2015), it also seems to be a matter of a specific mindset to become aware of these differences and to see learner variation as an opportunity instead of an

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obstacle (Corno, 2008). In order to reach this adaptive mindset, professional development (PD) on adaptive teaching seems necessary.

Teacher PD has increasingly gained more attention (Opfer, 2016; Webster-Wright, 2009) and is perceived as essential in order to improve the quality of education (Van Driel, Meirink, Van Veen, & Zwart, 2012). Effective PD is claimed to be ongoing, active, collaborative, inquiry-based, authentic, integrated in practice, and explicitly focused on student learning (Borko, 2004; Borko, Jacobas, & Koellner, 2010; Desimone, 2009; Schleicher, 2016; Webster-Wright, 2009).

LS incorporates these elements: the collaborative approach is classroom- and inquiry-based and has a specific focus on the improvement of student learning (Dudley, 2013; Lewis & Perry, 2015; Lewis, Perry, & Murata, 2006). By thoroughly focusing on student learning, LS enables teachers to analyze students' different educational needs and it gives them information on how to address these needs (Dudley, 2013).

However, recent studies indicate that in order to understand why and how teachers learn in LS, in other words, to understand "teacher professional growth" (Clarke & Hollingsworth, 2002), the school context should also be examined (Opfer, 2016; Schleicher, 2016). Although it seems obvious that school conditions may affect the PD outcomes, this dimension is often neglected in studies on PD (Van Driel et al., 2012). Furthermore, the importance of a PD facilitator "who guides teachers as they construct new knowledge and practices" (Borko, 2004, p. 4) is repeatedly stressed, yet hardly examined (Borko et al., 2010).

In order to analyze patterns of professional growth in adaptive teaching competence as a result of LS, the present study uses the Interconnected Model of (Teacher) Professional Growth (IMTPG) (Clarke & Hollingsworth, 2002) and examines the applicability of this model in the context of LS. With this study we aim to increase the body of knowledge about professional growth in the context of LS and to distinguish elements that contribute to this.

### 1.1. Adaptive teaching competence

Adaptive teaching competence can be defined as "teachers' ability to adjust their planning and teaching to the individual learning processes of students" (Brühwiler & Blatchford, 2011, p. 98) and includes four dimensions: (1) subject knowledge which refers to in-depth content knowledge and knowledge about differentiation, (2) diagnosis of student learning that concerns knowledge of students' individual learning, needs and characteristics, (3) teaching methods as part of the repertoire of teaching approaches, and (4) classroom management in order to create conditions which facilitate student learning (Brühwiler & Blatchford, 2011). The approach teachers take in adaptive teaching can be explained in terms of differentiation which entails proactively designing and modifying curricula, teaching methods and learning activities to the diverse educational needs of individual students (Corno, 2008; Tomlinson et al., 2003). More specifically, differentiation is often referred to as 'differentiated instruction', which Tomlinson (2005) defines as "a philosophy of teaching purporting that students learn best when their teachers effectively address variance in students' readiness levels, interests, and learning profile preferences" (p. 263).

Where differentiated instruction was initially used in classrooms with gifted students and students with special needs, it has also become relevant for mainstream classrooms due to the increasing heterogeneous population in mainstream education (Smit & Humpert, 2012; VanTassel-Baska & Stambaugh, 2005).

Although differentiation is an opportunity for enrichment of classroom situations (Corno, 2008), the complexity of

differentiated instruction in secondary education (Van de Grift et al., 2014) might be caused by a lack of awareness, advanced content knowledge, and pedagogical and classroom management skills (VanTassel-Baska & Stambaugh, 2005). To address this issue, LS may offer suitable opportunities.

### 1.2. Lesson Study to promote adaptive teaching competence

LS originated in Japan more than 140 years ago and is claimed to be the world's fastest growing teacher learning approach (Dudley, 2015; Lewis et al., 2006). LS typically involves small groups of teachers who collaboratively conduct cycles of planning research lessons in detail, followed by one teacher who delivers the research lesson while the other team members observe the lesson with a focus on student learning. Subsequently, the LS team evaluates the research lesson and the observers share what they have witnessed in terms of student learning. The lesson may then be revised for teaching in other classes (Dudley, 2013). After two or three of these cycles, the LS team reflects on what they have learned and share their insights via short articles and presentations or by inviting colleagues to an 'open house' (Dudley, 2013).

To support the claim that LS embodies many key aspects of effective PD (Perry & Lewis, 2009), a growing body of research highlights four principle benefits of LS (Cajkler, Wood, Norton, Pedder, & Xu, 2014): "1) greater teacher collaboration; 2) sharper focus among teachers on students' learning; 3) development of teacher knowledge, practice and professionalism; and 4) improved quality of classroom teaching and learning outcomes" (p. 194). What distinguishes LS from other forms of PD is the explicit focus on student learning rather than focusing on the performance of an individual teacher (Cajkler et al., 2014). Due to this focus and the collaborative nature of LS, teachers are able to gain in-depth knowledge about their students' learning (Dudley, 2013). The deliberate and recursive processes of LS allow teachers to discover, confront and examine issues that arise in the research lesson (Dudley, 2015).

In the context of addressing different educational needs through LS, research in the United Kingdom (UK) has focused on students identified as having special educational needs and moderate learning difficulties (Ylonen & Norwich, 2012). Ylonen and Norwich (2015) found that as a result of LS, teachers' understanding of the learning needs of students with moderate learning difficulties increased and teachers could better engage these students in their lessons. This is consistent with the review of Xu and Pedder (2015), who report that as a result of participating in LS, teachers develop greater awareness of and deeper insights into learners' needs as well as a greater responsiveness to these needs.

Since LS has become "an umbrella term for a variety of adaptations or global responses" (White & Lim, 2008, p. 916), Goei, Norwich, and Dudley (in press) developed a Dutch LS variant in accordance with the UK model that uses 'case pupils' who represent different attainment groupings (Dudley, 2013). In the Dutch model, teachers conduct two LS cycles (as opposed to three cycles in the LS model used in the UK). Furthermore, the model has a strong focus on different educational (support) needs (Bruggink, Goei, & Koot, 2016) by applying the three-tiered logic (Kratochwill, Volpiansky, Clements, & Ball, 2007). This logic acts as a framework to organize classroom instruction based on clusters of students' educational (support) needs. The assumption is that all students receive universal instruction in the first tier. Students who do not benefit from the universal instruction are provided with group instruction in the second tier, and students who do not benefit from the universal and group instruction, receive more intensified individualized instruction in the third tier.

The LS facilitator also seems to play a pivotal role (Lewis, 2016;

Saito & Atencio, 2013). This is somebody “who guides teachers as they construct new knowledge and practices” (Borko, 2004, p. 4). In a recent paper, Lewis (2016) distinguishes different issues that arise when novice LS facilitators (yet experienced teachers) learn to lead LS such as teacher resistance, comfort and discomfort, teachers' content knowledge, teachers' goals, the available time, and sources of learning. This shows the complexity of the role of a LS facilitator. As a consequence, Saito and Atencio (2013) argue that while a LS facilitator may play an essential role in LS, “the relationship between teachers and these external stakeholders can sometimes be problematic in nature” (p. 92). Therefore, more understanding of how LS facilitators can support the work of LS teams seems necessary (Fernandez, 2005). Another frequently mentioned role in the LS process is that of a ‘knowledgeable other’. This is an experienced LS practitioner and content expert from outside the LS team who is able to link the LS activities to the broader curriculum and research findings related to the research lesson (Takahashi & McDougal, 2016).

Despite the increasing expansion and popularity of LS around the globe (Saito & Atencio, 2013), and its potential benefits (Cheung & Wong, 2014; Dudley, 2013; Lewis & Perry, 2015), more research is needed to demonstrate its precise impact on the learning processes of teachers (Dudley, 2013). This study is a further attempt to systematically examine LS and aims to contribute to knowledge about specific mechanisms within LS that enhance teacher professional growth in adaptive teaching.

### 1.3. Teacher professional growth

The IMTPG (Clarke & Hollingsworth, 2002) has the potential to demonstrate the complexity and multifaceted nature of teacher learning and PD activities (Van Driel et al., 2012), and has already proven its utility in previous research on teacher PD (e.g. Goldsmith, Doerr, & Lewis, 2014; Justi & Van Driel, 2006). However, in the context of LS, the model is hardly used or used to focus on specific content matter, predominantly in mathematics (Verhoef, Coenders, Pieters, Van Smaalen, & Tall, 2015; Widjaja, Vale, Groves, & Doig, 2015).

In the IMTPG teacher professional growth is represented as an inevitable and continuing form of teacher learning (Fig. 1). Clarke and Hollingsworth (2002) argue that professional growth occurs through ‘reflection’ and ‘enactment’ between four domains, where enactment is distinguished from “simply acting” (p. 951) by its planned nature based on knowledge, beliefs or experiences.

Since the model reflects a non-linear structure, multiple “growth pathways” between the domains are possible (Clarke & Hollingsworth, 2002, p. 950). The External Domain is defined as an “external source of information or stimulus” such as “professional publications and conversations with colleagues” (p. 953). In general teacher PD, this means that if teachers participate in PD activities (External Domain) and actively experiment with new classroom instruction and approaches (Domain of Practice), they may gain new knowledge and change their beliefs and attitudes through reflection and enactment processes (Personal Domain). Ideally, this results in structural changes in teacher behavior as well as student learning and should entail ongoing refinement of practice (Domain of Consequence). Clarke and Hollingsworth (2002) argue that “change in the Domain of Consequence is firmly tied to the teachers' existing value system and to the inferences the teacher draws from the practices of the classroom” (p. 953).

Where teacher PD has often taken the form of events that take place outside the classroom (Desforges, 2015), LS on the contrary is situated in the classroom and consists of professional experimentation, adaptation and refinement of practice (Cajkler et al., 2014; Lewis & Perry, 2015). Therefore, a transfer from an external

situation to a new setting is unnecessary as LS proceeds entirely in the teachers' classroom (Desforges, 2015). In that sense, LS activities and activities in the Domain of Practice seem interchangeable and might be difficult to distinguish due to integration of professional experimentation in the LS activities. We therefore examine the application of this widely used theoretical model and consider whether adaptations are recommendable in the context of LS.

### 1.4. Facilitating and constraining elements to promote professional growth

Although school conditions may affect the PD outcomes, this dimension is often neglected in studies on PD (Van Driel et al., 2012). Imants and Van Veen (2010) distinguish structural organizational conditions, such as available time and resources teachers can spend on PD, and cultural organizational conditions such as the learning environment, support from the school board, and a professional culture of collaboration. In the context of LS, Xu and Pedder (2015) argue that well-developed systems of leadership and organizational support are necessary in order to sustain LS practice in schools and classrooms. The most frequently mentioned constraints in LS activities that the authors report in their review were lack of time to engage in LS, lack of strong leadership support and extra stress for teachers to refine their practice. Furthermore, expecting teachers to work collaboratively may cause issues if teachers are used to an individualistic and competitive way of working.

In terms of the learning environment and how groups are formed in schools, the composition and focus of LS teams may facilitate or constrain the process as well. LS is predominantly used and examined in content specific teams focusing on mathematics (Huang & Shimizu, 2016), but is also used in other subject areas such as language education (Hurd & Licciardo-Musso, 2005) and sciences (Lee Bae, Hayes, Seitz, O'Connor, & DiStefano, 2016). Some studies even refer to LS teams with an interdisciplinary focus (Bjuland & Mosvold, 2015; Xu & Pedder, 2015), which can be defined as “communities where teachers from different disciplinary areas (ideally) collaborate to produce teaching that incorporates the disciplinary knowledge of the different teachers” (Havnes, 2009, p. 159). The diverse expertise of teachers in these teams is complementary and their social positions are therefore described as horizontal (Havnes, 2009). Grossman, Wineburg, and Woolworth (2001) argue that this “distribution of fundamentally different ways of knowing” may be an enrichment for group discussion but does not necessarily lead to “any higher-order syntheses” (p. 46). Moreover, working with colleagues across disciplines could even lead to frustration (Levine & Marcus, 2010). In this study, content specific teams as well as interdisciplinary teams were included.

## 2. Research questions

The following research questions are central in this study:

1. To what extent does LS enhance teacher professional growth in terms of adaptive teaching competence?
2. Which structural and cultural elements in the different school contexts hinder or promote teacher professional growth from the perspective of the teachers?
3. To what extent is the IMTPG applicable in analyzing teacher professional growth in the context of LS?

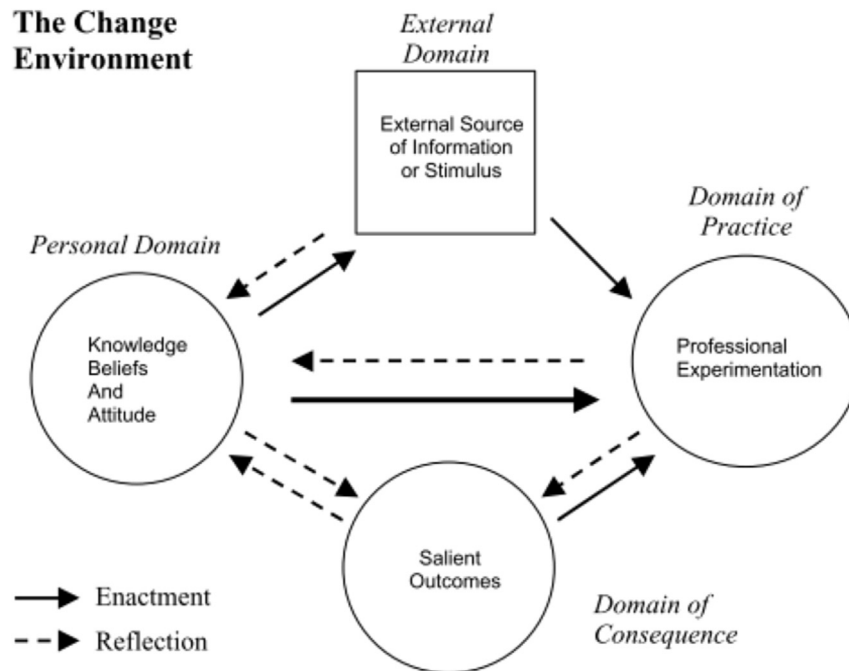


Fig. 1. The Interconnected Model of (Teacher) Professional Growth (Clarke & Hollingsworth, 2002, p. 951).

### 3. Methodology

#### 3.1. Participants and context of the study

Twenty-two teachers from eight secondary schools in the western and northern part of the Netherlands participated in this study. As part of a three year project, seven of these schools which were funded by the Dutch Ministry of Education (LERO-V-027), aimed at improving the collaboration between schools and university teacher training programs by applying LS. In these schools, one or two LS teams participated (Table 1). The remaining school (school #5) implemented LS school-wide which resulted in nine participating LS teams. As a consequence, half of the sample consists of teachers from this school. After several years of disappointing school results, this school was motivated to use LS as a means to stimulate adaptive teaching and create a cultural change within the school. All schools were committed to conduct LS and worked closely with the research team. The seventeen included teams used LS as a means to address adaptive teaching competence.

The interdisciplinary teams (schools 1 to 4) conducted at least three LS cycles per year for which they received 166 h of facilitated time, and were supported by a, mostly untrained, facilitator from their school (internal facilitator). The content specific teams (schools 5 to 8), which constitute the majority of teams, followed at least two LS cycles using the Dutch LS variant developed by Goei et al. (in press). Teachers in these schools were supported by a university team responsible for planning, research, trained external facilitators, and subject matter specialists. The latter role differs from a 'knowledgeable other' (Takahashi & McDougal, 2016), since the subject matter specialists in this study did not necessarily have extensive LS experience. Teachers in schools 5 to 8 had considerably less facilitated hours to spend on LS (27 h a year).

Initially, twenty-five teachers from the seventeen participating LS teams were randomly selected using an online random generator ([www.random.org](http://www.random.org)) and were consequently invited by e-mail. To comply with the ethical guidelines, teachers were informed about the objectives and data collection procedure of this research

via e-mail, and that the interview data would be treated confidentially. Participation in this research was voluntary and teachers were only included in the sample if they had participated in LS for at least one academic year consisting of at least two LS cycles. Eventually, thirteen male and nine female teachers agreed to participate. Three male teachers decided not to participate in this research given their involvement in assessing final exams. These teachers are affiliated to schools 4, 5, and 7. The sample descriptions are presented in Table 2.

#### 3.2. Data collection and analysis

##### 3.2.1. Data collection

Semi-structured interviews were used to gain deep insights into the learning experiences and professional growth of the teachers related to their LS activities. The interview structure consisted of fifteen questions divided into three main categories: experiences with LS as PD approach, learning experiences through LS, and questions about the school context (facilitating and hindering elements). These categories were clustered into the different IMTPG domains. The final interview protocol is included in Appendix A.

Given the semi-structured nature of the interviews, the answers of the participants and the role of the interviewer in posing the right follow-up questions may, to some extent, determine the content of the interview data. Thus, "The interviewer and respondent are referred to jointly as interview participants, highlighting their collective contribution to the enterprise" (Holstein & Gubrium, 2003, p. 19). Therefore, prior to conducting the interviews, the researchers discussed the interview questions in detail and indicated what type of follow-up questions could be posed and when they were suitable to be asked.

Questions in the External Domain were focused on actual LS processes and the role of the LS facilitator. The intention of posing these questions was to assess whether LS was conducted as intended and whether the facilitator helped to structure the process. Follow-up questions were posed in case teachers' responses deviated from the intended LS procedure and focus, amount of

**Table 1**  
Composition of school sample.

School	Amount of LS teams	Amount of teachers		Focus of LS team	Duration	Time allocation	Facilitator
		Male	Female				
1	2	1	1	Interdisciplinary	1 year	166 h	Internal
2	1	1	1	Interdisciplinary	2 years	322 h	Internal
3	1	1	–	Interdisciplinary	1 year	166 h	Internal
4	1	–	1	Interdisciplinary	1 year	166 h	Internal
5	9	7	4	Content specific	2 years	54 h	External
6	1	1	1	Content specific	1 year	27 h	External
7	1	1	–	Content specific	1 year	27 h	External
8	1	1	1	Content specific	1 year	27 h	External

Note: Teachers in schools 2 and 5 spent two years on LS as opposed to one year in the other schools.

team meetings, and group composition. Furthermore, follow-up questions were posed if teachers elaborated on how the LS facilitator stimulated or hindered the learning process. The researchers were interested in concrete examples regarding the extent to which the facilitator contributed to this.

In terms of professional experimentation in the Domain of Practice, questions focused on actual experiences during each step of the LS cycle. In this domain, the researchers were particularly interested in actual teacher experimentation. Therefore, follow-up questions were posed in case teachers referred to concrete examples.

Questions in the Personal Domain were related to teachers' learning reflections on actual LS experiences. In particular, scale questions were included to help teachers identify specific, practical steps which improved their situation (McKeel, 2012). Follow-up questions were posed in case teachers referred to knowledge, beliefs and attitudes they developed during LS and what had contributed to this.

The researchers specifically drew attention to adaptive teaching competence in the Domain of Consequence by asking questions about whether LS enabled teachers to structurally behave differently and to better address students' needs. Additionally, questions involved whether teachers believe that students benefit from their teachers' participation in LS and whether participation led to more feelings of collaborative responsibility.

The interviews were carried out by the first author and a fellow researcher at the end of the academic year (May/June 2015). They lasted on average 45 min each and were audio recorded. Subsequently, the interviews were transcribed and sent to the participants for a member check. Only small textual revisions were

suggested by three of the participants. One interview faced a technical recording issue causing the researcher to summarize the interview on audio directly after the interview took place. The participant was informed about this issue and was asked to supplement the transcription. The teacher agreed and this resulted in data we believe to be roughly and sufficiently equivalent to the other transcriptions. All transcriptions were read by the first author and a fellow researcher to gain an initial view of the teachers' perspectives.

### 3.2.2. Data analysis: development of the coding scheme

After multiple sessions of analyzing the transcripts and discussing the content, the researchers constructed a final coding scheme (Table 3), based on the work of Justi and Van Driel (2006). This scheme distinguishes the different IMTPG domains, supplemented with a domain that specifically focuses on the school context. The data were analyzed using qualitative analysis software QDAMiner.

Each domain was divided in specific labels. The External Domain was divided into LS focus, LS procedure, collaboration in LS team and LS facilitator. These labels partly contain elements relating to the factual information of how LS was conducted such as the specific LS objectives of the various LS teams, the amount of meetings per LS cycle, and whether teachers participated in content specific or interdisciplinary teams. On the other hand, several questions focus on the role of the LS facilitator and how teachers collaborated in the LS teams. Although this is not a specific question, one enactment pattern from the Personal Domain to the External Domain is located in the latter Domain. This pattern refers to comments about knowledge, beliefs and attitudes in terms of adaptive teaching competence that teachers already had before entering LS (Personal Domain), and how this influenced the LS process (External Domain).

The Domain of Practice consists of enactment patterns from the Personal Domain (in case teachers refer to certain knowledge, beliefs and attitudes that influenced their professional experimentation), and is furthermore divided into professional experimentation as part of LS (experimenting within LS) and experimenting in teachers' own daily practice with what they learned in LS (experimenting outside LS). All comments that refer to specific examples of how teachers experimented with new instruction strategies or lesson material belong to this domain.

The Personal Domain contains the possible reflection patterns that the IMTPG distinguishes (i.e. reflection from the External Domain and from Domain of Practice). This refers to reflecting on how LS as PD activity (External Domain) or concrete examples of professional experimentation (Domain of Practice), led to new knowledge, beliefs and attitudes.

Lastly, the Domain of Consequence was divided into reflection patterns from the Personal Domain and the Domain of Practice. Comments that were labelled in this domain refer to structural

**Table 2**  
Sample descriptions.

Descriptive	Data
Male/Female	13 male (59.1%)/9 female (40.9%)
Age (in years)	$M = 43.1$ , $SD = 12.9$ (range: 24–62)
Teaching experience (in years)	$M = 12.5$ , $SD = 10.9$ (range: 0.5–36)
Teacher qualification <sup>a</sup>	M.Ed.: $n = 14$ (63.6%) B.Ed.: $n = 8$ (36.4%)
Main teaching subject	Sciences: $n = 6$ (27%) Languages: $n = 5$ (23%) Social sciences: $n = 4$ (18%) Pre-vocational related subjects: $n = 4$ (18%) Other: $n = 3$ (14%)

Note: The subcategory 'sciences' refers to mathematics, physics, chemistry and biology. 'Languages' refers to Dutch, English, Spanish. 'Social sciences' refers to economics and history. 'Pre-vocational related subjects' refers to technical and health subjects. 'Other' refers to physical education and identity courses.

<sup>a</sup> In the Dutch education system, a MEd degree generally allows teachers to teach all different cognitive levels in secondary education, whereas a BEd degree allows teachers to teach the pre-vocational education levels and grade one to three of senior general education and pre-university education levels.

changes in teacher behavior as a result of LS which should be visible in the classroom or school context as well as differences in student learning. Since several remarks refer to professional growth on the team level, an extra label was added. No comments were labelled as reflection from the Domain of Consequence to the Personal Domain, nor comments labelled as enactment from the Domain of Consequence to the Domain of Practice. The general aim of the interviews was to examine whether LS influenced professional growth and how this becomes visible in practice. We did not include questions that address how this new structural teacher behavior or student learning (Domain of Consequence), in turn, influenced their knowledge, beliefs and attitudes (Personal Domain) and their professional experimentation (Domain of Practice). Therefore, these patterns are not included in the coding scheme.

Lastly, the Domain of the School Context was divided into cultural and structural conditions, which could be facilitating, hindering or neutral. Neutral labels refer to comments in which school organizational elements were discussed without actually indicating whether this was facilitating or constraining the process.

After allocating all the concerning comments to the different IMTPG domains, the final step was to further analyze these labelled cases – i.e. coded utterances – in terms of characteristics of adaptive teaching competence. All labelled cases that contained such elements were highlighted and subsequently clustered according to the four dimensions distinguished by Brühwiler and Blatchford (2011). The dimension subject knowledge was slightly

adapted by including specific knowledge about differentiation theories.

#### 4. Findings

##### 4.1. General patterns of reflection, enactment and adaptive teaching competence

Prior to answering the research questions, this section addresses the general patterns in order to get a clear overview of the data. Using the coding scheme, as laid out in the data analysis section above, we focus on teachers' reflection and enactment patterns between the different IMTPG domains and draw specific attention to the way in which teachers addressed adaptive teaching competence in the interviews. By illustrating and visualizing the distribution of the labelled cases per domain and the relationships between the domains, it allows for an overall characterization of the interviews. Furthermore, we categorized the labelled cases that contain elements of adaptive teaching competence to gain insight into the type of remarks that were made in this context.

In total, coding the transcripts yielded 2201 labelled cases distinguishing nineteen thematic units (Table 3). For each domain, the proportion of the labelled cases as well as the relationship between the domains are presented in Fig. 2. The majority of the labelled cases can be found in, or in the direction of, the Personal Domain (45%), followed by the External Domain (29%) and the Domain of Consequence (13.1%). This indicates an emphasis on utterances

**Table 3**  
Coding scheme.

Domain	#	Label	Illustration	Cases	% of cases
External Domain (ED)	1	LS focus	"Our goal was to improve differentiation by using ICT" (T15)	50	2.3
	2	LS procedure	"We met every Wednesday afternoon" (T14)	318	14.4
	3	From PDo to ED	"Before, I thought that's nice and then I tested it and it was so disappointing when something didn't work" (T05)	48	2.2
	4	Collaboration in LS team	"In the beginning we had little time to actually develop something. It was a lot of negotiating instead of doing" (T03)	97	4.4
	5	Facilitator	"Without a facilitator, it would have been a very difficult story" (T08)	126	5.7
Domain of Practice (DP)	6	From PDo to DP	"And I thought, this is going to work, because, well, I [normally] organize my lessons quite efficiently" (T06)	3	0.1
	7	Experimenting within LS	"We came up with different game elements for example in order to stimulate students" (T12)	104	4.7
	8	Experimenting outside LS	"A very specific example is a writing assignment I explained. This coincidentally happened this morning" (T04)	7	0.3
Personal Domain (PDo)	9	From ED to PDo	"Differentiating gave me clear insights [...] Which students do I have and which student can be offered something extra?" (T08)	714	32.4
	10	From DP to PDo	"You always think you see everything of these students. Well, that's just absolutely not the case" (T09)	278	12.6
Domain of Consequence (DC)	11	From PDo to DC	"Because now I really think what can I do besides the textbook. How can I transfer the content to the students?" (T10)	106	4.8
	12	From DP to DC	"And now I really think about which group I have in front of me. What suits this group? How am I going to do it?" (T21)	55	2.5
	13	From DP to DC on team level	"And the proof is that I believe we're ahead of the rest of the school. Making sure that your subject connects to the actual profession and their choices, that eventually they are better motivated, work harder and the results increase" (T13)	128	5.8
School context (DSC)	14	Facilitating cultural	"The school board really wants that their teachers continue to professionalize in design labs or with Lesson Study" (T01)	23	1.0
	15	Facilitating structural	"It has been very useful that we finally got the time to prepare lessons together and to focus on the behavior of students" (T11)	26	1.2
	16	Hindering cultural	"We were actually put to work too fast. It's a shame to find out the conditions too late. It demanded a lot of flexibility from the group" (T17)	24	1.1
	17	Hindering structural	"That it takes a lot of time. Just everything together. I noticed that neither myself nor others appreciated that" (T22)	62	2.8
	18	Neutral cultural	"What you always need as a teacher is concrete ideas from others" (T04)	14	0.6
	19	Neutral structural	"You need time for this. The teacher shouldn't get the feeling that this comes on top of the rest. It should be facilitated" (T01)	18	0.8
<b>Total:</b>				<b>2,201</b>	<b>100</b>

Note: Due to rounding to one decimal in this table, the sum of the percentages of cases is 99.7%.

about what teachers gained in terms of knowledge, beliefs and attitudes. The low proportion of labelled cases located in the Domain of Practice (5.1%) is striking, which indicates only little emphasis on actual examples of experimentation within LS or teachers' daily practice. However, utterances that refer to experimentation were sometimes found in the External Domain when teachers answered general questions about the LS focus, procedure, facilitator or collaboration within their LS team, and relate their answer to a specific example of experimentation. Moreover, 12.6% of the utterances relate to reflective patterns from the Domain of Practice to the Personal Domain. For example, when teachers express, in more general terms, their appreciation for LS in terms of how it enables them to actively experiment with new content, materials or instruction and what they learned from this.

Further analysis of the relationships between domains reveals a dominance of reflective change sequences (58.1%), which is no surprise given the reflective nature of the majority of the interview questions (Appendix A). Most of these reflective patterns are found from the External Domain to the Personal Domain, i.e. remarks about elements of LS, such as the LS procedure or facilitator, that influenced their knowledge, beliefs and attitudes (32.4%). Besides the 12.6% of cases in which teachers explain how professional experimentation led to changes in the Personal Domain, 13.1% of the cases concern utterances in which teachers reflected on how their knowledge, beliefs and attitudes (4.8%) and professional experimentation (8.3%) resulted in structural salient outcomes (Domain of Consequence). The total sum of the patterns equals 60.4% since the remaining part of the labelled cases (32.1%) relate to activities within a certain IMTPG domain or the Domain of the School Context (7.5%).

Enactment patterns were less often found in the interview data (2.3%). Only in a few cases, teachers refer to situations in which (new) knowledge, beliefs and attitudes actually influenced their LS process (2.2%) or led to thoughtful experimentation in their daily practice (0.1%). Again, this may be caused by the reflective nature of the interview questions or that teachers tend to talk in terms of what they learned or appreciated about LS, and less in terms of what type of actions they undertook as a result of what they learned in LS. Moreover, there are no enactment patterns from the External Domain to the Domain of Practice. This may be associated with the earlier notion that LS is classroom-based and incorporates elements of professional experimentation (Lewis & Perry, 2015), and that, as a consequence, labelled cases that refer to actual experimentation are found in the Domain of Practice as well as the External Domain.

All teachers explicitly refer to adaptive teaching competence in 205 of the total number of 2.201 labelled cases (9.3%), ranging from two to twenty labelled cases per teacher. Given that only questions 8b and 8e of the interview protocol specifically address adaptive teaching (Appendix A), this number is relatively high. Categorizing these cases using the four dimensions of Brühwiler and Blatchford (2011) enables us to better comprehend the different elements of adaptive teaching we found in the data. This results in the following distribution: 96 labelled cases (46.8%) are categorized as 'diagnosis of student learning', which refers to changes in how teachers perceive and identify students' different educational needs. The category 'teaching methods' contains 46 cases (22.4%) and refers to actual experimentation with and structural application of new instructional strategies, teaching methods and material. Teachers refer to approaches such as group and individual instruction, addressing different cognitive levels and developing material that is more tailored to the students. The category 'classroom management' (17.6%) contains elements of how teachers created conditions which facilitated student learning. The last category, 'subject knowledge' (3.9%), addresses how teachers learned about new

differentiation approaches such as reading literature or attending conferences, but also in-depth discussions with colleagues about differentiation and content knowledge. The remaining nineteen cases (9.3%) do not fall into one of these categories and refer to objectives (nine cases), LS procedure (eight cases), and the LS facilitator (two cases). This demonstrates a dominant attention to focusing on student learning and corroborates that this is a distinct characteristic of LS (Dudley, 2013).

The general patterns allow us to deduct several key elements that emerge from the data, which may help us to answer the research questions. Firstly, LS seems to have a positive effect on teachers' knowledge, attitudes and behavior in terms of adaptive teaching competence. In particular, this may be stimulated by the explicit focus on student learning that is part of LS as well as the ample possibilities to collaboratively experiment with new teaching materials, methods and instructions. In addition to this, the LS facilitator seems to play an important role in guiding teachers through the different stages of LS. Secondly, the school context proves to be of importance when it comes to promoting the LS process and, in turn, professional growth. Thirdly, the interview data allow us to determine whether the IMTPG is applicable in analyzing teacher professional growth. In the following sections we answer the research questions by addressing these key findings.

#### 4.2. Professional growth in adaptive teaching competence

This section examines to what extent LS enhances teacher professional growth in terms of adaptive teaching competence. This first research question will be answered by focusing specifically on structural changes in teachers' knowledge, beliefs and attitudes (Personal Domain), as well as teachers' behavior (Domain of Consequence).

To start with, all teachers, except for one, expressed how participating in LS contributed to changes in their beliefs and attitudes when it comes to adaptive teaching. Teachers mainly refer to these changes in terms of 'eye openers', 'more awareness of students' different educational needs', 'looking differently at students' and 'realizing the importance of differentiated instruction'. This is illustrated by the following teacher who answers the question whether or not participating in LS made him a better teacher:

"Yes, I believe so. Mainly because of writing down the expectations of students in the different categories and to put this in practice and observe the results. That really helped me and I believe that you become a better teacher by doing so. That you become even better at analyzing your students and arrange your lessons accordingly" (T12).

However, although teachers claim that as a result of LS their awareness of students' different educational needs as well as their ability to identify these needs increased, almost half of the teachers stress that it still remains (very) difficult to actually adapt their teaching to these individual needs. This is illustrated by the following teacher:

"But to apply your teaching behavior [to these needs] is still very difficult. And that is also the case for the entire team, everybody is struggling with this. Yes, it is hard to differentiate" (T01).

Focusing on gained knowledge about adaptive teaching as a result of LS, it appears that six teachers made utterances that were categorized as 'subject knowledge' using the categorization of Brühwiler and Blatchford (2011). Utterances that were labelled as



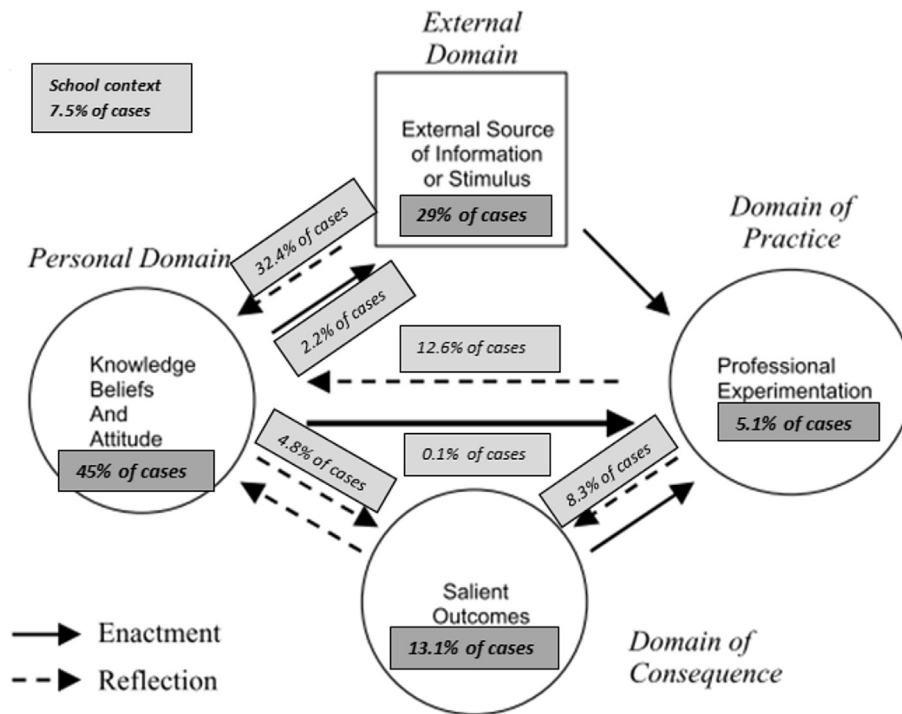


Fig. 2. The IMTPG (Clarke & Hollingsworth, 2002), supplemented with the proportion of labelled cases.

such refer to teachers' appreciation for reading literature about different ways of learning within a certain subject. This is expressed by the following teacher:

"I would like to continue to gain in-depth knowledge about ways of learning within mathematics. How do you ensure that they learn what you want them to learn and to make enough variations in your lessons" (T21).

Another teacher argues that she would have appreciated it if more attention would have been given to theory, though she doubts whether this should have been done in a prescribed way:

"Well, perhaps a bit more theory for example? That's what we had to look for ourselves now. [...] But on the other hand, I think that if someone would have explained and delivered everything, this wouldn't have worked either" (T01).

Despite the relatively little attention that content knowledge receives in the earlier mentioned categorization, the most dominant category, 'diagnosis of student learning', contains utterances that refer to teachers' knowledge of students' learning, characteristics and educational needs. In this context, teachers often refer to really getting to know their students' educational needs, which is illustrated by the following teacher:

"Well, actually, you learn that all students just learn in very different ways and that all students start their work differently and get very different results" (T03).

Based on the data, we also assume that not all knowledge gained by the teachers is explicit. It often seems largely tacit (Eraut, 2000) as can be seen in the following illustration where a teacher answers the question what she does differently in terms of her teaching behavior. She is convinced that she behaves differently, but when

faced with putting this into words, she seems to have difficulties doing so:

"You just walk around, you look and observe and you see students who are done with their work quickly and then you say: Go and check your answers and tell me your result. [...] You just learn to look in a certain way. I don't know how to explain it" (T13).

Moving from changes in teacher knowledge, beliefs and attitudes to changes in teacher behavior, we found that thirteen teachers argue that they really work in a different way in their 'business as usual lessons'. They address students' educational needs more explicitly and are able to give clear examples of what they do differently as a result of LS. One teacher (T08), for example, explains that she has started to use group education plans in which she integrates information from the individualized education programs that are used in her school. Another teacher sums up the following changes in his behavior:

"What do I do differently? Expressing the lesson objective for example. I'm more aware that every student learns in a different way. Actually, I think my instruction has also changed in that I give my instruction in different ways" (T03).

In the following sections, we address the main contributors to teachers' professional growth that emerge from the data: diagnosis of student learning, professional collaborative experimentation and the role of the LS facilitator.

### 4.3. Key contributors to professional growth

#### 4.3.1. Intensive focus on student learning

A distinctive element of LS is the intensive focus on student learning. The data in this study confirm this unambiguously.

Teachers argue that LS enables this intensive focus in every stage of the LS process: from determining goals, predicting student reactions and outcomes in the lesson preparation phase, to observing the actual student behavior in the research lesson, and evaluating their predictions and outcomes accordingly in the post lesson discussion.

In terms of determining goals, nine teachers explicitly refer to differentiation as their main LS team focus. The next remark illustrates the focus of a particular team:

“Well, for us it's more that we want to look at students more thoroughly. So, more customized to the students' needs. Also, less frontal teaching so that they [students] are more involved, yes. So, really that we can get more out of students than what is currently the case” (T06).

Other teams involve ICT in their LS focus in order to better address the different educational needs of students. In one school (School 3), classroom differentiation is regarded as essential since this school mixes all the cognitive levels in the first two grades which is not common in Dutch secondary education.

In planning the lesson, teachers notice that they start to look closer at what their students are capable of by analyzing their students' learning and determining what their students need in order to reach the lesson objectives. This is highly appreciated by the majority of teachers as illustrated by the following teacher:

“Nice that it was really focused on individuals instead of the classroom. And that analysis was very important, to really look at each student. What does that student learn? I found it to have added value” (T03).

What really triggers this intensive focus on student learning is the use of ‘case students’ who represent different attainment groupings. This was, especially in schools 5 to 8, an essential part of their LS processes using the three-tiered logic. The following teacher explains this way of working with close observation and how this stimulates more awareness of students' different educational needs:

“We obviously clustered the students and then you realize that the result is completely different than I expected. We selected some students as A-students [first tier], but they didn't turn out to be easy at all. The same for the C-student [third tier]. And different observers see different things. These are examples in which you are forced to look better at each individual student” (T16).

In schools 1 to 4, where teachers did not work with the three-tiered logic, teachers used other models or ways to focus on student learning. In school 1, for example, teachers aimed to address different cognitive levels by using verbal, written and visual ways of delivering their instruction, whereas in school 3 they focused on addressing the different learning preferences of their students.

#### 4.3.2. Collaborative professional experimentation

The second contributor to professional growth that emerges from the data is active collaborative experimentation with new instructional strategies, teaching methods and material. This enables teachers to see immediate effects of what they collaboratively prepared in their research lessons as well as in their own lessons.

Teachers who did not integrate adaptive teaching explicitly in their LS team focus, refer in more general terms to their LS objectives such as ‘collaboratively improving the quality of the lessons’,

‘experimenting with new teaching methods’ and ‘collaboratively preparing, conducting and evaluating lessons’. They perceive LS as a collaborative process and the majority of teachers, seventeen in total, stress that they are predominantly positive about how they worked together and the support they experienced from colleagues in their LS team.

“We really worked as a group. Everyone, and that was really the group culture, was taken seriously” (T03).

What is really appreciated is the perceived freedom to experiment and to work collaboratively on new solutions. Twelve teachers explicitly describe how they experimented with adaptive teaching in their LS team. This is something that, mainly due to time pressure, teachers do not often seem to do in their own teaching practice. One teacher, for example, clearly explains how his LS team developed and tested assignments that were suitable for different learning preferences in their research lessons:

“We, for example, came up with this: We are going to construct tasks to present to [students with] different learning preferences. We first assessed the tasks and then linked them to the learning preferences. We consequently tested and presented them to the students” (T15).

Another teacher explains the importance of experimenting with different teaching material and instruction strategies, referring to the three-tiered logic, and values this way of immediately exploring if something works in practice or not:

“Yes, it was very nice to see the final result. I selected [name student] in the red thing [third tier] because he never finished his work, always dropped out and walked away. And this boy basically made a fool of me in the research lesson because he really worked very hard” (T13).

Since professional experimentation is part of LS, teachers describe various examples of how they tested different material, methods and instruction strategies within LS. However, only in a few cases, teachers carry out experiments outside LS in their own daily practice. The following teacher gives a clear example of this:

“The way we discuss test results with students. This is what I also tried out in my own lessons a few times” (T18).

Presumably, this process demands time in terms of getting used to a new way of lesson planning and partly letting go of fixed routines and habits as well as actual time to plan, test and refine new lesson material and strategies. Another reason might be that in order to experiment, teachers need a collaborative environment to exchange ideas and find inspiration. Such an environment might not be common practice for most teachers.

#### 4.3.3. The role of the LS facilitator

The third key contributor to professional growth is allocated to the LS facilitator. Based on the data, this role can be roughly distinguished in managing the LS process and stimulating teachers to use theory and new insights. The first refers to planning, communicating with the team members, arranging the resources and monitoring the time within each meeting. The second refers to introducing the team members to LS, stimulating the LS team to focus on content and to exchange ideas, and providing the team with theories, ideas and theoretical models.

The results show that, in particular teams with an external LS

facilitator, the sixteen teachers from schools 5 to 8, highly valued this role. Teachers appreciate that the LS facilitator kept “a bit of control”, because “otherwise you find yourself constantly in discussions and nothing is put on paper” (T12). The following teacher illustrates both tasks:

“They [facilitators] kept an eye on the planning, the span of time and they sent us the objectives that we formulated about differentiation and the rest, so that we did not lose sight of them. And to make a link with the theory. They had a lot of ideas about that. [...] And the facilitators have a lot of ideas about pedagogical content knowledge in general. Just knowledge sharing” (T03).

The six teachers from schools 1 to 4 were supported by an internal LS facilitator. In most cases this was a colleague and therefore often well-known by the team members. Their role was perceived more as chairman or chairwoman of the group. The two teachers from school 2 and the only teacher from school 4 argue that, especially in the beginning of the first LS cycle, the role of the facilitator in these schools and how the process was guided and structured, were not clear. For these three teachers, the start of the process felt fairly chaotic and they express the need they felt for someone who was familiar with LS and who could lead the discussions and structure the process. In school 1, however, the two teachers were very pleased with how their internal LS facilitator organized and structured the process. The only teacher who fulfilled the role of internal LS facilitator, was the teacher from school 3. This teacher was reasonably satisfied with how the process worked out.

#### 4.4. School context

##### 4.4.1. Facilitating and hindering elements

The second research question addresses which structural and cultural elements in the different school contexts hinder or promote teacher professional growth. In order to examine this, we focus on the labelled utterances in the Domain of the School Context. This Domain contains 167 labelled cases of which 106 refer to structural school contextual elements and 61 to cultural school contextual elements. What draws attention is the relatively high representation of hindering structural elements, mentioned by eighteen teachers. These cases refer to the struggles teachers experience with the amount of facilitated time, issues that concern scheduling the research lessons, and time pressure in relation to other teaching and extra-curricular activities. However, sixteen teachers argue that the amount of facilitated time for LS was sufficient. All the teachers from schools 1 to 4 express that they highly appreciated their allocated time to work on LS whereas teachers in schools 5 to 8 argue that their allocated time sometimes resulted in feelings of being under pressure to realize the objectives within the given time frames.

In terms of facilitating cultural elements, eighteen teachers mention the support of their colleagues, learning from each other, the improved collaboration in their team, and increased feelings of shared responsibility to improve the quality of lessons. One teacher even advises LS to be part of team building activities. Furthermore, fourteen teachers mention the support of their management.

Although most of the comments that refer to the role of the LS facilitator ended up in the External Domain, teams that were subject to changing facilitators stress that this had a negative influence and these comments were therefore labelled as hindering structural school elements.

Neutral labels, whether referring to structural or cultural school

elements, address general statements of teachers in terms of the LS process such as advice for new teams that consider to start with LS. They relate to practical issues such as time and organization, but also stress the importance of support from the school management.

##### 4.4.2. Differences between schools

Given the substantial differences between schools 1 to 4 and schools 5 to 8 in terms of facilitated time, the external versus internal LS facilitators, the team composition, and the disproportionate distribution of the sample across the different schools (Table 1), this section briefly reports whether differences in professional growth emerge between the two sets of schools.

Analysis of the data reveals that there is a clear difference between the two sets of schools in terms of the amount of teachers who report professional growth in terms of adaptive teaching competence. In total, sixteen of the twenty-two teachers report professional growth in terms of adaptive teaching competence. As shown in Table 4, three of these sixteen teachers are affiliated to schools 1 to 4, whereas the remaining thirteen teachers are affiliated to schools 5 to 8. This corresponds to 50% of the teachers from schools 1 to 4 as opposed to 81.3% of the teachers from schools 5 to 8. The relatively overrepresented school in this sample, school 5, is presented separately and contains eight of the eleven teachers (72.7%) who report professional growth, whereas all the remaining five teachers from schools 6 to 8 report growth in this context (100%).

Examining their responses in detail, teachers from schools 1 to 4 describe their growth in terms of more awareness and mostly give specific examples of how they address the educational needs of students as a result of LS. Teachers from schools 5 to 8 often associate adaptive teaching and differentiation with the three-tiered logic as part of their LS practice. However, it is not fully clear how this professional growth unfolds in practice and what exactly in LS or the school context caused or contributed to these differences such as the amount of facilitated hours, the team focus (content specific or interdisciplinary), the role of the LS facilitator, the collaboration within the team, and other school contextual elements.

Furthermore, the proportional difference between teachers from school 5 versus teachers from schools 6 to 8, who report professional growth, draws attention. Given the small numbers, this proportional difference could be caused by coincidence but there may also be other reasons for this difference such as the school-wide implementation of LS in school 5.

#### 4.5. Applicability of the IMTPG as analyzing framework in the context of LS

The third research question examines the IMTPG as a framework of analysis. The results draw attention to the relatively small proportion (5.1%) of labelled cases in the Domain of Practice (experimentation within and outside LS). Obviously, this could be caused by the type of questions in the interview protocol (Appendix A), but the data show that teachers often referred to examples of experimentation. Further analysis reveals that experimentation is also found in other domains, with a dominance in the External Domain. Remarks about professional experimentation were often labelled as LS procedure (Label #2) or were directly linked to professional growth in the Domain of Consequence (Label #11 to #13).

Generally, specific examples of professional experimentation were found in the Domain of Practice whereas more procedural and practical remarks about how LS teams conducted the different stages of the LS cycles were mainly found in the External Domain (Label #2). However, remarks about the LS procedure and

experimentation were often intertwined and were labelled in the External Domain or the Domain of Practice depending on their main focus. It turns out to be rather complex to distinguish professional experimentation from statements labelled as LS procedure.

To give an illustration of this complexity, the first interview question focused on how LS was conducted. In response, some teachers immediately elaborated on specific examples of what they actually did in their meetings, as the following teacher describes:

“First, we classified students in green, yellow and red. [...] So that's what we took into consideration while making the lesson plan. What does he need? And that's what we fully described next” (T06).

Given the fact that this teacher was describing the LS procedure his LS team followed, this explanation was assigned label #2 (LS procedure), whereas in other cases similar responses could be coded in the Domain of Practice.

To summarize, the IMTPG seems to be a successful framework to categorize data of teacher change. However, in the context of LS two issues arise: firstly, since LS integrates professional experimentation, two domains seem to be highly intertwined (the External Domain and the Domain of Practice) and therefore difficult to distinguish. Secondly, and perhaps as a consequence, there is no labelled case that refers to an enactment pattern from the External Domain to the Domain of Practice.

## 5. Conclusion and discussion

The general aim of this study was to examine whether LS enhances teacher professional growth in terms of adaptive teaching competence using the IMTPG as an analytical framework. This study shows how the intensive focus on student learning, collaborative professional experimentation and the facilitators' role may develop teachers' adaptive teaching competence. It becomes clear that the teachers in this study appreciate the in-depth and systematic approach of LS. They argue that participating in LS contributes to their professional growth and that it stimulates them to become more aware of students' different educational needs. In addition, the majority of the teachers argue that they learned a considerable amount about students' characteristics and how students learn as well as ways of differentiating their subject matter to suit students' learning preferences. Analyzing the data for changes in actual teacher behavior yield clear examples of what teachers do differently in their daily practice in terms of lesson preparation, classroom strategies and lesson material.

The data enabled us to distinguish three key contributors to the experienced professional growth. First, the intensive focus on student learning is highly valued by the teachers. This focus supports teachers to thoroughly predict, observe and evaluate how and what students learn in order to better address students' educational needs. Furthermore, the three-tiered logic (Kratochwill et al., 2007), that was used in schools 5 to 8, serves as a convenient

organizer to frame instructions and interventions for different clusters of educational (support) needs. The logic may support teachers to assess and address students' educational needs. Regardless of whether this logic is used or not, teachers argue that the intensive focus on student learning leads to actual differences in teacher behavior. However, in some cases this remains experimental and incidental, and therefore cannot be defined as teacher professional growth as this would only apply in case of structural changes in beliefs, knowledge, attitudes and behavior. These teachers stress that they needed more time to see structural effects on their teaching behavior.

The second key contributor to professional growth concerns the experienced time and freedom to collaboratively experiment with new instructional strategies and classroom material and methods. Teachers highlight the strength of seeing immediate effects in the delivered research lessons or their own daily practice. This enables them to adopt new ways of teaching to better address students' educational needs.

Thirdly, we can conclude that a LS facilitator seems to play a pivotal role by managing the LS process and stimulating the teachers to use theory and new insights in terms of pedagogical content knowledge.

The second research question highlights the importance of the school context in carrying out LS. Cultural conditions that may influence professional growth relate to the support of the school management and the positive effects of working in LS teams in terms of collaboration, shared feelings of responsibility and learning from each other. Structural conditions mainly point at the allocated time. The majority of the teachers argue that the facilitated time they received to participate in LS was sufficient in order to experience professional growth. Further research is needed to assess how much time teachers should at least invest in LS to reach structural changes in teachers' daily practice in terms of addressing students' educational needs. Obviously, the way these hours are spent determine to a large amount the eventual effects. After all, previous research shows the difficulty of indicating an exact 'tipping point' of a certain amount of hours to be spent on PD in order to be effective (Van Driel et al., 2012).

After comparing the results between the two sets of schools, no clear differences emerge in terms of how professional growth unfolds in teachers' daily classroom practice. This raises the question whether the use of a trained external LS facilitator in schools 5 to 8 compensates for the additional allocated time that teachers in schools 1 to 4 received. We suggest that further research is needed to determine how and to what extent external and internal LS facilitators contribute to teacher professional growth in the context of LS, as it seems that there were major differences between the role of internal and external LS facilitators. Despite these differences, we can conclude that a LS facilitator seems to play a pivotal role by managing the LS process and stimulating the teachers to use theory and new insights in terms of pedagogical content knowledge.

Similarly, we have no clear indication whether working in content specific teams (in schools 5 to 8) or interdisciplinary teams (schools 1 to 4) would result in more professional growth in terms of addressing students' educational needs. Although working in interdisciplinary teams has its strengths (Havnes, 2009; Levine & Marcus, 2010), such as broadening and deepening school norms of reflection (McLaughlin & Talbert, 2006), it seems that working in a content specific team, possibly supported by the three-tiered logic, could lead to more in-depth discussions and higher-order syntheses about the content (Grossman et al., 2001). Taking the subject discipline as the starting point in a team dialogue, teachers might develop knowledge about how to better support students' learning of key concepts (McLaughlin & Talbert, 2006).

**Table 4**  
Reported professional growth.

School(s)	Amount of teachers	Reported professional growth	Percentage
Schools 1-4	6	3	50%
Schools 5-8	16	13	81.3%
School 5	11	8	72.7%
Schools 6-8	5	5	100%

Note: school 5 and schools 6-8 are presented separately (italics) given the relatively overrepresented amount of teachers from school 5.

The third research question focused on the IMTPG as framework of analysis in this study. In recent years, as [Clarke and Hollingsworth \(2002\)](#) predicted, PD programs have developed into more integrated, classroom-based and applicable activities ([Little, 2012](#); [Van Driel et al., 2012](#); [Borko, 2004](#)). The more sophisticated structure of the IMTPG might have contributed to this by capturing the complexity of teacher professional growth. LS integrates the effective PD characteristics and seems to have given teacher PD a further impulse ([Perry & Lewis, 2009](#)). In this study we therefore examined the applicability of the IMTPG. The results draw attention to the interchangeability of activities in the External Domain and activities that are related to professional experimentation in the Domain of Practice, and show the complexity of distinguishing these elements in a framework of analysis.

Given the results in this study, we suggest that LS should not be perceived as an external PD activity. After all, [Clarke and Hollingsworth \(2002\)](#) argue that the External Domain “is distinguished from the other domains by its location outside the teacher’s personal world” (p. 951), whereas external learning activities rarely reflect teachers’ thoughts about what they need to learn or how to learn it ([McLaughlin & Talbert, 2006](#)). In LS this is clearly perceived differently. Therefore, we propose to slightly adapt the IMTPG in the context of LS. Instead of extending the model (e.g. [Coenders & Terlouw, 2015](#)), our adapted version integrates the External Domain and the Domain of Practice into a Lesson Study Domain ([Fig. 3](#)). In this integrated domain, the LS procedure, professional experimentation and the role of the LS facilitator are highlighted. The LS facilitator is explicitly presented in this adapted model due to the essential role the facilitator may have in stimulating further teacher professional growth through LS ([Lewis, 2016](#); [Norwich & Ylonen, 2013](#)). In addition, the reflection and enactment patterns are presented in reciprocal directions between all domains since these patterns often overlap or intertwine.

Although this study reports meaningful results and raises important questions, there are several limitations. Firstly, this study relies solely on retrospective self-reports evoked by the starting questions of the interview protocol, which may have caused a dominance of reflective patterns (58.1% of all labelled cases). In accordance with the notion of tacit knowledge ([Eraut, 2000](#)), we found that teachers might not always be explicitly aware of their professional growth nor is it always visible to others. Triangulation

methods and the use of observation instruments or test scores may capture professional growth even better.

Secondly, the interviews were conducted after completion of two LS cycles. This study does not take teachers’ starting position into account, nor an assessment during the process. Pre-test and post-test designs may address this in future research.

Thirdly, although very meaningful to compare two sets of schools with different variations of LS in terms of allocated time, external versus internal LS facilitators, the use of the three-tiered logic, and content specific versus interdisciplinary teams, it remains unclear how these variables independently contributed to teacher professional growth. In addition to this, the sample was not equally distributed over the included schools and school 5 even contains half of the sample. It is therefore difficult to compare these schools. We suggest further research, preferably controlled trial experiments over longer periods of time, to control these different variables.

Lastly, the proposed adapted conceptual framework should be interpreted with caution. Integrating the External Domain in a LS domain should not necessarily mean that there is no opportunity for the “decomposition of practice” ([Grossman et al., 2009](#)), which, in the context of PD for novice teachers and students, enables “both to ‘see’ and enact elements of practice more effectively” (p. 2069). [Grossman et al. \(2009\)](#) argue that external practice, rehearsal or enacting the practice with support is recommendable before full participation in authentic settings takes place. LS, however, offers these opportunities which [Cajkler, Wood, Norton, and Pedder \(2013\)](#) outline in their school placement LS process.

### 6. Concluding remarks

Relatively little of the current research in the context of LS focuses on professional growth in adaptive teaching competence. With this study we hope to increase this body of knowledge. One particularly challenging element in this work is the use of the IMTPG for analyzing teacher professional growth. As a result, we propose a slightly adapted version of this model in the specific context of LS. We hope this contributes to discussing and researching ways of capturing the complexity of teachers’ professional development and how this may lead to professional growth. Furthermore, we emphasize that professional growth cannot be examined without taking the school context, in which professional

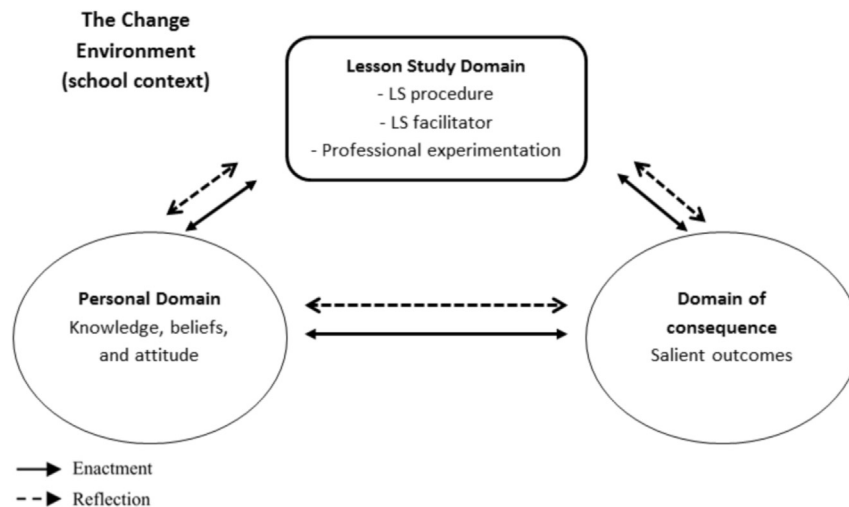


Fig. 3. Adapted version of the Interconnected Model of (Teacher) Professional Growth.

learning takes place, into account.

## Funding

This work was supported by The Netherlands Organisation for Scientific Research (grant number: 023.005.105).

## Acknowledgements

The authors would like to thank fellow researcher Anita Emans for her contribution in constructing the interview questions, data collection and analyzing the first set of interviews. Additionally, the authors would like to thank the reviewers for their thorough feedback on previous versions of the manuscript.

## Appendix A. Interview protocol<sup>1</sup>

### External domain

1. Can you explain how Lesson Study was conducted in your school?
  - a. Can you specify what the main objective was to implement LS in your school?
  - b. Can you specify how LS was conducted in your school?
    - I. How many LS cycles were carried out?
    - II. How many meetings were planned in each cycle?
    - III. Did you refine and re-teach the research lesson?
    - IV. How many team members were part of your LS team?
    - V. Did you work in a content specific or multidisciplinary team?
    - VI. Did you have a LS facilitator and a content expert?
  2. What do you think of the role of the LS facilitator during the whole trajectory?
    - a. Did it help you to better structure the process?
    - b. What did you like about the role of the LS facilitator in your team?
    - c. What did you miss in his/her role?
  3. How did you experience working in a LS team?
    - a. Did you feel supported by your team members?
    - b. Could you provide sufficient input in the meetings?
    - c. What did working with LS bring to the LS team?

### Domain of practice

4. How did you experience the different steps of which a LS cycle consists?
  - a. How did you experience planning the research lesson collaboratively?
    - I. What is your opinion about the format/template used for planning the research lesson?
    - II. What has planning the research lesson collaboratively brought you?
  - b. How did you experience conducting the research lesson collaboratively?
    - I. In terms of teaching the research lesson?
    - II. In terms of observing the research lesson?
    - III. What has conducting the research lesson collaboratively brought you?
  - c. How did you experience evaluating the research lesson collaboratively?

- I. What has evaluating the research lesson collaboratively brought you?
- II. How do you normally – i.e. outside the LS activities – evaluate your lessons?
- d. [if applicable] How did you experience re-designing the research lesson collaboratively?
  - I. Can you specify what type of adaptations were made after the research lesson?
  - II. Was this process of value or is it sufficient to conduct a cycle without redesigning and re-teaching the research lesson?
  - III. What has re-designing the research lesson collaboratively brought you?
- e. [if applicable] How did you experience re-teaching the research lesson collaboratively?
  - I. What has re-teaching the research lesson collaboratively brought you?
- f. Which of the previously mentioned phases of the LS cycle did you appreciate most?

### Personal domain

5. What are the most important insights and learning experiences you have gained through participating in LS?
6. I would like to ask you several 'scale questions' in which you have to indicate what grade you would assign yourself on a scale from 1 to 10. 1 refers to 'extremely poor' and 10 to 'excellent'.
  - a. What grade would you assign yourself with regards to planning your lessons in general at this moment?
    - I. Why this grade?
    - II. Did this grade increase as a result of LS and how did this occur?
  - b. What grade would you assign yourself with regards to teaching your lessons in general at this moment?
    - I. Why this grade?
    - II. Did this grade increase as a result of LS and how did this occur?
  - c. What grade would you assign yourself with regards to evaluating your lessons in general at this moment?
    - I. Why this grade?
    - II. Did this grade increase as a result of LS and how did this occur?
7. How did LS influence your classroom behavior? Do you feel more confident?

### Domain of consequence

8. What do you currently do differently in your 'business as usual lessons' as a result of LS?
  - a. Has LS made you a better teacher? Can you explain why/why not and how you notice this?
  - b. Can you identify differences between students differently/better? How and what caused this?
  - c. Did anything change in the way you deliver your instruction to your students? How and can you give specific examples?
  - d. Do you use different teaching methods? What kind of teaching methods and why exactly these?
  - e. Do you check more often whether the lessons you deliver reach different students? How do you do this?
9. How did students experience that their teachers were working with LS? Do they indicate that the lessons improve in quality as a results of LS?

<sup>1</sup> The order in which the interview questions were posed could deviate from this protocol.

10. Do teachers feel more responsible for the educational quality as a result of LS? Can you specify how you notice this?
  - a. Are LS experiences shared with colleagues who are not involved in LS? How does this occur?

#### School context

11. Has LS been a suitable professional development approach for your school?
  - a. Can you specify promoting elements? What made these elements promoting?
  - b. Can you specify hindering elements? What made these elements hindering?
12. Were you sufficiently supported to work with LS? More specifically, can you elaborate on the following school conditions and how they supported or hindered you?
  - a. In terms of facilitated time?
  - b. In terms of support from the school management team?
  - c. In terms of collaborating with colleagues?
13. Were there any things that you missed or needed more during the whole LS process?

#### Final questions

14. Do you want to continue working with LS? Which elements would certainly have to be addressed?
15. Are there any issues that we have not discussed but which you would like to address?

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