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**Studying micro-processes of change in
teacher thinking and acting in the context of a
video-based teacher professional development program**

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List of abbreviations

ATP	Advanced Traditional Program
DVC	Dialogic Video Cycle
KMK	Kultusministerkonferenz
MP	Measurement point
OECD	Organization for Economic Co-operation and Development
PISA	Programme for International Student Assessment
PSC	Problem-Solving Cycle
TALIS	Teaching and Learning International Survey
TPD	Teacher professional development

Abstract

Despite the growing importance of teacher professional development (TPD), there is limited research on the effectiveness of such programs. To date, the degree to which a TPD program affects teacher learning has commonly been investigated by analyzing changes in teacher practices as well as student achievement. However, as these studies fail to specify the micro-processes underlying teacher change in the classroom, the purpose of this dissertation was to look beyond these issues to a more comprehensive view of TPD effects. In order to open the “black box” of TPD by analyzing micro-processes along multiple dimensions, the dissertation adopted Desimone’s (2009) proposed conceptual framework for studying TPD effects and investigated selected variables in the three areas (1) progress of implementing TPD core features; (2) changes in teachers’ thinking through video-based reflection; and (3) changes in teachers’ actions. The Dialogic Video Cycle (DVC) was used as a TPD case that allowed investigation of the proposed research issues. The DVC was systematically compared to a control group, the Advanced Traditional Program (ATP). The main difference between the programs related to how situated learning opportunities were provided. While concrete lesson plans and video excerpts of teachers’ own practices were implemented in the DVC, the ATP was designed as a more traditional TPD program, with fewer opportunities for situated learning. Ten math and science teachers (DVC: $n = 6$; ATP: $n = 4$) from higher and lower secondary schools participated voluntarily in the TPD programs during the school year of 2011/2012. The following research questions were investigated: (1) *To what extent do DVC teachers change their teaching practices toward better goal clarity in classroom dialogue in comparison to ATP teachers?*; (2) *To what extent is there a change in DVC teachers’ thinking that redefines their dialogic teaching practice in terms of suggested teaching alternatives?*; (3) *How do core features of TPD, such as content focus, develop over the one-year time span of the DVC?* Based on high-inference video analyses of teaching practices before and after DVC intervention ($N = 20$ lessons) and of DVC meetings ($N = 6$ meetings), the findings of the micro-analyses suggest that teachers benefited from participating in the DVC’s situated learning environment and changed their actions at a higher level compared to teachers in the ATP (Essay 1). Further, the results strengthen our understanding of how teachers changed their thinking in the video-based discussions in the DVC workshops, in the way that they reflected on teaching alternatives, which may, in turn, have initiated teachers’ actual change in action (Essay 2). Another relevant finding is that core features of TPD developed over time, making it difficult to examine their implementation as a one-time snapshot (Essay 1 and Essay 2). The dissertation serves as a first look at TPD micro-processes and teacher learning from different perspectives and offers recommendations for future research

and TPD practice, including suggestions for combining and balancing TPD core features more effectively.

1. Introduction

The importance of teacher professional development (TPD) was underestimated for many years (Lipowsky, 2010; Vigerske, 2017). Previous studies and related policy in particular have focused on teachers' learning during their initial education at university and in schools (Eichenberger, Lüders, Mayr, & Müller, 2010). Social developments such as internationalization, the technological revolution, and the boundless tide of information mean that teachers constantly face new challenges (Darling-Hammond, 2006; KMK, 2004; OECD, 2015). In the twenty-first century, teaching and learning have changed as classrooms become more heterogeneous and diverse in terms of students' prerequisites and social backgrounds (OECD, 2005). New media and digital devices provide novel opportunities to visualize content, solve tasks, and promote students individually. In these circumstances, the teacher's role has developed from omniscient informant to facilitator of learning processes, helping students to integrate new knowledge into existing cognitive structures. Although teachers' initial education remains a relevant element of their training, it is no longer possible to respond to these rapid social developments merely by initiating new approaches and programs in this first phase and waiting for a new generation of teachers to emerge (OECD, 2013). Against this background of rapid and dynamic social change, TPD must provide rich opportunities for learning throughout the teacher's career, supporting acquisition of the complex knowledge and skills that teachers need in the twenty-first century (OECD, 2017; Vermunt & Endedijk, 2011; Vigerske, 2017). TPD must therefore refresh the competencies acquired during teachers' initial education and extend their professional knowledge and skills to further tasks and functions (Timperley, Wilson, Barrar, & Fung, 2007; Vigerske, 2017). In Bavaria alone, 15.6 million euro was spent on national TPD programs to attain these goals in the academic year 2016/17 (involving 340,010 offered program days and about 30,000 participating teachers) (Bayerisches Staatsministerium für Unterricht und Kultus, 2017). According to previous research, 67% of science teachers surveyed in Germany had participated in a TPD program during the previous six months, but only 33% were very satisfied with the program format (Deutsche Telekom Stiftung, 2017). Yet while TPD gains in importance, there is limited research on the effectiveness of these programs, especially in Germany (Lipowsky, 2014; Lipowsky & Rzejak, 2012). To date, the degree to which a TPD program has an impact on teacher learning has commonly been investigated by analyzing improvements in teaching quality and, ideally, in student performance. For example, Timperley et al. (2007) summarized a number of single studies of the effect of TPD on students' achievement and reported a mean effect size of $d = .66$. In Hattie's (2009) meta-analysis of "Visible Learning," which summarizes findings from more than 50,000 studies, the impact of TPD on students' performance returned an effect size of

$d = .62$. Studies of this kind are based on the assumption that TPD was effective in some way if teachers changed their teaching practice after participating in the intervention and students' achievement increased. However, this approach provides no further information about which instructional features and underlying processes during TPD might account for teachers' and students' change (Alonzo & Kim, 2018; Beisiegel, Mitchell, & Hill, 2017; Desimone, 2009; Santagata & Bray, 2015; Steffensky & Kleinknecht, 2016). In this context, Desimone (2009) identified core features of TPD that might impact positively on teacher learning and proposed a conceptual framework for investigating the effects of TPD from multiple perspectives. However, regardless of any emerging consensus about particular TPD core features, previous research has paid little attention to how to best to combine and balance these features in specific programs (OECD, 2017; Santagata & Bray, 2015).

The dissertation is set in the context of the *Dialogue* project, funded by the Deutsche Forschungsgemeinschaft (DFG) and conducted at the Technical University of Munich (TUM). The project involved the implementation and empirical study of the Dialogic Video Cycle (DVC), a video-based TPD program focusing on classroom dialogue. The dissertation is not representative of a typical intervention study because its primary goal was not to assess the overall effectiveness of the DVC but to use the case of the DVC exemplary to look beyond the prevailing focus on teacher and student learning outcomes.

Overall, the dissertation's findings make an important contribution to TPD research by highlighting the potential of situated TPD as compared to traditional TPD. More specifically, the findings provide in-depth insights into the micro-processes of teacher learning in terms of changes in thinking and in the progress of TPD core features over time. Based on the findings, recommendations are made for combining and implementing TPD core features more effectively.

The dissertation begins by describing the conceptual framework and the empirical state of research (Chapter 2). Chapter 3 presents the research questions, and Chapter 4 provides an overview of the methodological approach. Chapter 5 presents the main findings of the associated essays, and conclusions are derived in Chapter 6, discussing the main results and making recommendations for future research and TPD practice.

2. Conceptual framework and current state of empirical research

This chapter is divided into four sections. It begins by providing an insight into teachers' instruction with regard to goal clarity for productive classroom dialogue, which is the content of the investigated TPD program (section 2.1). Section 2.2 goes on to describe the power of video-based reflection of teaching as a means of initiating change in teachers' thinking, and section 2.3 reviews the current literature on TPD core features. Finally, section 2.4 includes a visual summary of the theoretical and empirical framework.

2.1 Goal clarity for productive classroom dialogue

According to Santagata and Bray (2015), it is important to choose a lever for changing teachers' approach to instruction. As this dissertation was embedded in the *Dialogue* project, the lever selected for present purposes was goal clarity for productive classroom dialogue. This represented a suitable entry point into teachers' practice because classroom dialogue is a predominant mode of teaching worldwide, offering students rich opportunities to engage in discourse, to think together, and to elaborate on their own ideas (Alexander, 2008; Hiebert et al., 2003; Osborne, Simon, Christodoulou, Howell-Richardson, & Richardson, 2013; Reznitskaya et al., 2009). However, classroom dialogue often follows tight communication structures (so-called initiation-response-evaluation (IRE) patterns), especially in math and science lessons, where teachers ask narrow questions, students provide brief answers, and teachers quickly evaluate those responses (Mehan, 1979; Mercer & Dawes, 2014). As these tight interaction patterns often fail to activate and challenge students sufficiently (Emanuelsson & Sahlström, 2008; Howe & Abedin, 2013; Kovalainen & Kumpulainen, 2005), efforts have been made to train teachers to improve their dialogic strategies. TPD programs such as *Accountable Talk* (Michaels, O'Connor, & Resnick, 2008) (which offers teachers concrete talk moves for orchestrating productive classroom dialogues) or *Cam Talk* (Higham, Brindley, & van de Pol, 2012) (which trains teachers to open up classroom dialogue to engage their students) are pioneers in this field. Additionally, a number of current and recent studies have empirically investigated the effects of TPD on teachers' dialogic practices (Gomez Zaccarelli, Schindler, Borko, & Osborne, 2018; Pehmer, Gröschner, & Seidel, 2015b; Reznitskaya & Wilkinson, 2015; Sedova, Sedlacek, & Svaricek, 2016).

In this context, goal clarity is an important aspect of classroom dialogue but is often poorly implemented (Borich, 2014; Seidel & Prenzel, 2006; Seidel, Rimmele, & Prenzel, 2005), as

teachers may struggle to explicate teaching and learning goals or to make planned teaching and learning processes transparent. Clear communication of lesson goals and content structure is known to have positive effects on students' learning processes and motivation (Hugener et al., 2009; Rakoczy, Klieme, Lipowsky, & Drollinger-Vetter, 2010). For instance, in their meta-analysis of 112 studies of teaching strategies, Seidel and Shavelson (2007) identified positive effects of goal setting and orientation on students' learning processes, motivation, and cognitive achievement. In another study investigating the effects of structured presentation of learning contents, Rakoczy et al. (2006) reported positive effects on students' performance. These and similar findings raise the question of how teachers can be helped to improve classroom dialogue and to communicate lesson goals more clearly in order to activate students in the classroom.

The TPD program examined here sought to improve classroom dialogue by activating students (activity 1) and by scaffolding student learning processes (activity 2) (Walshaw & Anthony, 2008). Activity 1 involved the clarification of rules and responsibilities as a basis for productive classroom dialogue that would activate students to participate in teacher-student interactions. Activity 2 comprised strategies to scaffold students' ideas. The dissertation focuses on goal clarity as one essential instructional strategy for student activation (activity 1).

2.2 Video-based reflection of teaching practice

Video-based reflection of teaching practice has been identified as a promising means of initiating change in teachers' thinking and instructional approach (Blomberg, Sherin, Renkl, Glogger, & Seidel, 2014; Borko, Jacobs, Eiteljorg, & Pittman, 2008; Coles, 2013, 2013; Marsh & Mitchell, 2014). Reflection refers to the process in which teachers look back at their teaching and rethink and reconstruct situations and events in order to improve their teaching practice (Calandra, 2015; Schön, 1983).

Reflective practices help us understand the links between what we do (what we can call our practice) and how we might improve our effectiveness (by developing our practice). For example, reflective practices can help us understand the importance of high quality work, and provide ideas and options for developing this work. Reflection is therefore linked to practice (Ghaye, 2011).

The immediate purpose of reflection is to effect individual cognitive change in how teachers redefine their teaching practice. The results of this change are action-oriented, which means ensuring that teachers intend to make further changes in their practices (Yost, Sentner, & Forlenza-Bailey, 2000).

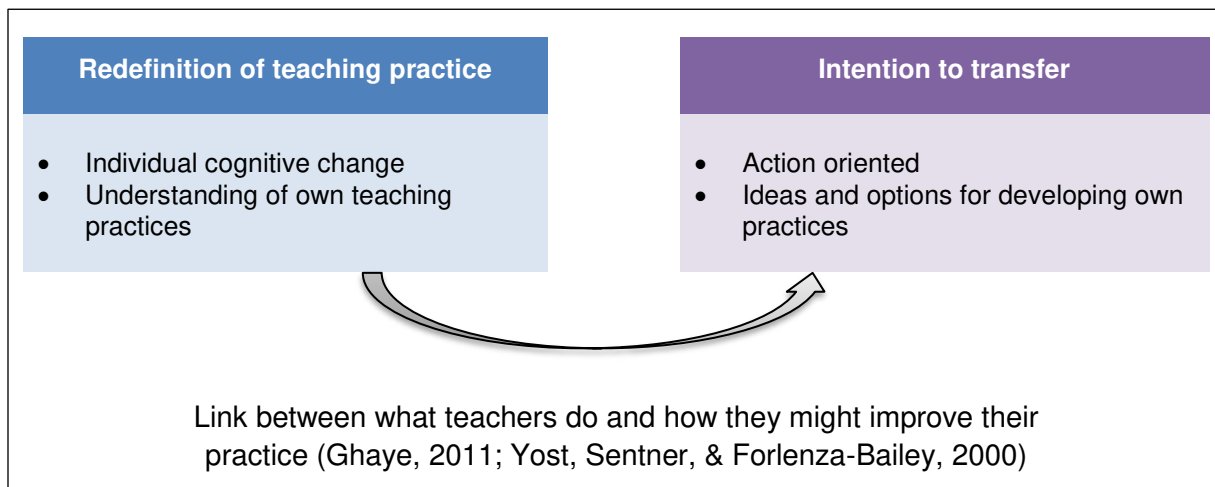


Figure 1: Components of teacher reflection

Unless teachers recognize that their instructional practices are less effective than they thought, it is unlikely that they will attempt to transfer new strategies to their teaching practice (Santagata & Bray, 2015). To foster teachers' reflection, TPD has made increasing use of artifacts such as lesson plans, teaching materials, students' work, and video footage of lessons (Ball & Cohen, 1999; Tripp & Rich, 2012). Video in particular is frequently used to bring the teachers' classrooms into TPD as a powerful context for reflection (Brophy, 2008; Coles, 2013; Gaudin & Chaliès, 2015; Miller, 2007; Zhang, Lundeberg, Koehler, & Eberhardt, 2011). Video provides extensive access to the classroom; it can be viewed several times, paused, and requires no immediate reaction (Beisiegel et al., 2017). For example, Santagata and Bray (2005) examined teachers' video-based reflection and detailing of new practices in the context of their TPD program. Their findings suggest that video helps teachers to recognize student misconceptions of which they were unaware and motivates them to initiate instructional changes. This aligns with Streffensky and Kleinknecht (2016), who demonstrated that video-based learning environments foster prospective teachers' capacity to analyze classroom events. It is also known that opportunities for reflection differ with the form of video usage. In the case of the Dialogic Video Cycle, teachers' own videos were used, as there is evidence that viewing their own video enables teachers to see their teaching from a new (external) perspective (Seidel, Stürmer, Blomberg, Kobarg, & Schwindt, 2011) and makes the classroom accessible in a new way (Beisiegel et al., 2017). The own video encourages teachers to redefine their practice by identifying elements they would have no time to detect while teaching (Blomberg et al., 2014; Harlin, 2014; Krammer et al., 2006; Richey, Merk, Bohl, Kleickmann, & Leuders, 2017). In short, video seems to offer a means of linking TPD to the teacher's everyday classroom setting.

However, there is evidence that video excerpts do not automatically lead to teacher reflection (Beisiegel et al., 2017; Kleinknecht & Schneider, 2013; Santagata & Bray, 2015; Seidel & Thiel, 2017). Especially when watching their own video for the first time, teachers' feelings of self-consciousness can inhibit critical reflection on their teaching (Kleinknecht & Poschinski, 2014; Kleinknecht, Schneider, & Syring, 2014) or suggestion of teaching alternatives (Beisiegel et al., 2017; Seidel et al., 2011). Supportive facilitation may therefore be needed to "make practice studyable" (Ghousseini & Sleep, 2011, p. 142) — for example, by selecting content-rich video excerpts, formulating guiding questions for systematic reflection, fostering collective participation among the group of teachers, and engaging in close examination of new practices (Beisiegel et al., 2017; Borko, Jacobs, Seago, & Mangram, 2014; Gröschner, Seidel, Pehmer, & Kiemer, 2014; van Es, Tunney, Goldsmith, & Seago, 2014).

2.3 Core features of teacher professional development

A situated approach to learning and professional development has been identified as a powerful means of fostering changes in teachers' thinking and instructional approach (Borko, 2004; Greeno, 2003; Putnam & Borko, 2000). In particular, situated approaches may prove useful in addressing inert knowledge — that is, knowledge acquired in a learning setting that has not been transferred to a real-world situation (Seidel & Krapp, 2014). Allowing for different perspectives (Greeno, 1998; Lave & Wenger, 1991; Resnick, 2004), situated approaches are generally based on the assumption that cognition is supported by the context in which learning takes place, and that cognitive achievements depend on the interaction between the individual and the situation. To ensure that TPD is not unduly removed from the reality of teaching practice and to foster teachers' transfer of TPD content into practice, knowledge is best acquired in authentic contexts linked to situations in the participants' classrooms and to prior knowledge and beliefs (Desimone & Garet, 2015; Mandl & Kopp, 2005; Putnam & Borko, 2000). Teaching artifacts, like lesson plans or teaching videos, can be useful in this context, allowing teachers to present excerpts of their teaching to others and providing a rich basis for linking TPD content to teachers' daily practices (Borko et al., 2008; Seidel & Thiel, 2017; van Es, 2011).

From a situated perspective, learning is social — that is, it involves participation in socially organized activities and discourses within some kind of learning community (Greeno, 2003; Lave & Wenger, 1991; Mandl & Kopp, 2005). In this context, a learning community is defined as a group of teachers who come together for a period of time to collaborate and to discuss their teaching in relation to a shared goal (van Es, 2012). Previous research (Little, 2002; Scheerens,

2010; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006) suggests that teacher learning communities can support learning and professional development.

Based on these assumptions about situated learning and professional development, previous research has described a number of TPD core features that may promote changes in teachers' thinking and instructional approach (Desimone, Porter, Garet, Yoon, & Birman, 2002; Timperley et al., 2007). In particular, these include the following (Desimone, 2009; OECD, 2017; Wilson, 2013):

- **Content focus.** A focus on specific subject-matter, general pedagogy, or specific pedagogical content related to participants' teaching practice, such as classroom dialogue when teaching mathematics and science.
- **Active teacher learning.** Engagement of teachers in active learning — for example, through reflection on video excerpts of their own classroom practices.
- **Collective participation.** Opportunities to initiate potential interactions and discourses, as for example in stable teacher learning communities.
- **Coherence.** Linking TPD to teachers' prior knowledge and beliefs and to existing school or district structures.
- **Duration.** Long-term interventions involving multiple workshops spread over a significant period of time to achieve sustainable results.

The findings of the Teaching and Learning International Survey (TALIS) confirmed that teacher participation in TPD informed by these core features is systematically associated with more intense use of appropriate classroom practices (OECD, 2017).

Before explicating the core features of content focus, active teacher learning, and collective participation in more detail (sections 2.3.2 and 2.3.3), the next section considers the relevance of a positive learning atmosphere and conversation culture as a further TPD core feature (section 2.3.1) for situated video-based TPD.

2.3.1 Positive learning atmosphere and conversation culture

Previous research confirms that a positive learning atmosphere and conversation culture forms the basis for collective participation and changes in teachers' thinking (Borko et al., 2008; Gröschner et al., 2014; van Es, 2012). A positive learning atmosphere and conversation culture can be defined as “a trustful atmosphere of learning and exchange, in which critical aspects, as well as critical situations of classroom practice, can be addressed, existing teaching routines can be realized, and alternatives can be suggested without judgments” (Gröschner et al., 2014, p.

276). With reference to van Es's (2012) framework of video-based learning environments, a positive learning atmosphere and conversation culture ensures that participants "develop sustained relationships and have a shared commitment to support each other's development" (van Es, 2012, p. 183). Teachers should understand their own contribution as a learning resource for the whole group, as well as benefit from differences in participants' beliefs, knowledge, and teaching practices (Grossman, Wineburg, & Woolworth, 2001). A positive learning atmosphere and conversation culture further requires that the learning community's members develop joint norms and rules for their interactions, such as listening carefully to each other, respecting different perspectives, and being open to alternative teaching practices (van Es, 2012). Shared understanding of discourse rules fosters productive discussion of teaching and student learning by providing a framework for critical examination of classroom situations, questioning of each other's teaching, and collective identification of teaching alternatives (Borko et al., 2008; Brodie, 2014). Borko et al. (2008) systematically investigated the changing nature of teachers' discussions after watching video excerpts of their own teaching during a long-term TPD program. Their findings confirm that the video-related discussions became more productive, as the teachers focused increasingly on relevant issues in a more detailed and analytical way. The researchers identified the ongoing development of a strong learning community and the establishment of shared discourse norms as possible reasons for these changes. Dobie and Anderson (2015) investigated the role of interaction and expression of contrasting ideas as important components of a video club-based teacher learning community. Based on their analysis of talk, gaze, and gesture, they noted that discourse norms build teachers' confidence in advancing views that may differ from those of other group members. In addition, they highlighted the role of the TPD facilitator in encouraging or discouraging teachers from responding to one another by providing guidelines that promote collaborative reflection. In summary, a positive learning atmosphere and conversation culture means that conversation within the community tends to focus on issues of teaching and student learning (van Es, 2012), requiring teachers to reflect on their teaching practices and their impact on student learning.

A positive learning atmosphere and conversation culture is especially important in the case of video-based TPD, as engaging in critical discussion of one's own teaching practice on video can be challenging (Beisiegel et al., 2017; Borko et al., 2008; Calandra, 2015). For that reason, teachers need to "feel confident that showing their videos will provide learning opportunities for themselves and their colleagues, and that the atmosphere will be one of productive discourse" (Borko et al., 2008, p. 421). Previous research has shown that when watching practice-oriented video excerpts of their teaching, teachers are inclined to attend more to their own activities than to those of their students and often judge classroom events before describing what is happening

(Sherin & van Es, 2002, 2008). In this context, again, conversation norms can help to guide teachers' discussion (Beisiegel et al., 2017); for example, norms might require teachers to first describe what they have observed before offering an explanation and then integrating their knowledge by inferring the impact of teaching on student learning (Santagata, 2009; Sherin, Linsenmeier, & van Es, 2009; Stürmer & Seidel, 2015).

The literature includes different frameworks for planning and orchestrating video-based TPD (Arya, Christ, & Chiu, 2014; Borko, Jacobs et al., 2014; Gröschner et al., 2014; Jenlink & Kinnucan-Welsch, 2001; Molle, 2013; van Es et al., 2014), all of which conceptualize facilitation moves for fostering a positive learning atmosphere and conversation culture. These moves generally involve formulating shared rules for discourse and feedback, supporting teachers in thinking specifically about the lesson segment, probing for evidence for their claims, and clarifying the context of the video excerpt in order to avoid misunderstandings, as well as expanding on and clarifying teachers' ideas to facilitate a common understanding within the learning community.

2.3.2 Content focus

As described by Desimone (2009) in her review of TPD research, content focus is the most important element of supporting teacher learning in communities because it lends coherence and structure. "Without content on which to base deeper understandings and extend teaching skills, there is no foundation for change" (Timperley et al., 2007, xxxi). Content focus means that the TPD program attends to specific subject-matter, general pedagogical or pedagogical subject-matter content that relates to the participants' teaching practice (Desimone, 2009; OECD, 2017; Villegas-Reimers, 2003; Wilson, 2013). Previous research has indicated the positive effects of all three types of TPD content on teachers' practice and student achievement (Lipowsky, 2014; Timperley et al., 2007). For instance, Desimone et al. (2013) showed that TPD focused on mathematical content significantly increased teachers' focus on advanced topics in the classroom.

This dissertation focuses on general pedagogical content in the context of mathematics and science teaching, including knowledge of instructional strategies and teaching quality. In Germany, the specificity of teacher education programs according to school type and subjects and the strong emphasis on subject-matter content means that teachers embark on their careers with relatively advanced subject-matter knowledge (OECD, 2005). In contrast, in the United States or Sweden, teachers' initial education is more general and allows them to move between different levels of education, subjects, and even types of school. In those countries, demand for subject-matter TPD programs is much higher. Indeed, the findings of the Programme for

International Student Assessment (PISA) (2012) showed that 60% of teachers from the United States, Estonia, and Croatia had attended a TPD with a focus on mathematics during the previous three months while in Germany, Switzerland, and Japan, only about 20% of teachers had participated in such programs (OECD, 2014). The Teaching and Learning International Survey (TALIS) has further described how, for instance, demand among teachers in Austria or Germany for subject-matter TPD is less than the OECD mean; in contrast, there is higher demand there for general pedagogical content (Schmich, 2009). There is also evidence that teacher education institutions in many countries overestimate subject content knowledge rather than balancing different types of teacher knowledge (OECD, 2017). Regardless of differences in TPD systems (e.g., as a compulsory requirement for remaining employed), there is support for the assumption that all kind of content (specific subject-matter, general pedagogical, or pedagogical subject-matter content) are of equal value, depending on regional demands.

2.3.3 Active learning and collective participation

In contrast to passive learning, active learning occurs when teachers engage in productive discussions of their own and other teachers' practices (Borko et al., 2008; Levin, 1995; Wilson & Berne, 1999). According to Borko et al. (2008, p. 421), productive discussions "should promote a critical examination of teaching, they should enable teachers to collectively explore ways of improving their teaching and support one another as they work to transform their practice." Active learning in professional learning communities supports teachers in processing new understandings and their implications for teaching (Scheerens, 2010; Timperley et al., 2007; Vangrieken, Meredith, Packer, & Kyndt, 2017). For example, Alonzo and Kim (2018) showed that active and collective learning facilitated teachers' cognitive work in making judgments about student thinking, resulting in a deeper understanding of teacher thinking as well as a more considered response than in the interview setting. In an earlier study, van Es (2012) illustrated how a group of teachers evolved from their initial level into a high-functioning learning community with a commitment shared by teachers and facilitators to support each other's learning.

The TPD facilitator's role as a continuous companion is essential in fostering teachers' social and active learning of content (Arya et al., 2014; Borko, Koellner, & Jacobs, 2014; Harrison, Lawson, & Wortley, 2005; Jenlink & Kinnucan-Welsch, 2001; Molle, 2013; van Es, Tunney, Seago, & Goldsmith, 2015). In line with previous research (Borko, Koellner et al., 2014; Gröschner et al., 2014; van Es et al., 2015), the facilitator's task is to encourage all teachers (those in the learning community as well as the on-screen teacher whose video is being discussed) to participate in the exchange and to provide a safe and positive learning atmosphere that allows each to freely discuss their own teaching practice.

2.3.4 Implementation examples

For a deeper understanding of how to effectively implement and combine TPD core features, Table 1 details three TPD programs, each focusing on a different type of content. The three programs are the Dialogue Video Cycle (DVC) (examined in this dissertation), the Problem-Solving Cycle (PSC), and a TPD program initiated by Santagata and Bray (2015) that focuses on pedagogical subject-matter content.

Table 1: Implementation of TPD core features

	Dialogic Video Cycle (DVC) (Gröschner, Seidel, Kiemer, & Pehmer, 2015)	Problem-Solving Cycle (PSC) (Borko et al., 2008)	Video-based TPD (Santagata & Bray, 2015)
Content focus	General pedagogical content: Classroom dialogue in mathematics and science teaching	Subject-matter content: Mathematical problem solving	Pedagogical subject-matter content: Student mathematical errors
Active Learning	Individual lesson planning in small groups Teaching the adapted lesson Collaborative video reflection	Collaborative solution of rich mathematical problems Collective lesson planning Teaching the planned lesson Collaborative video reflection	Collective examination of teaching practices Implementation of new practices and teaching the lesson assisted by facilitator Collaborative video reflection
Coherence	Interplay between TPD and teachers' daily practice through situated learning opportunities (e.g., own video) Set of two DV cycles, each involving three workshops on planning, acting, and reflecting	Interplay between TPD and teachers' daily practice through situated learning opportunities (e.g., own video) Set of two PS cycles, each involving three workshops on solving, planning, acting, and reflecting	Interplay between TPD and teachers' daily practice by integrating teaching artifacts (e.g., own and other video) Set of examination, implementation, feedback, and revision cycles
Duration	Total: 22 hrs Two DV cycles, each involving three 2-hr workshops Long-term TPD over the course of the academic year	Total: 18-36 hrs Two PS cycles, each involving three 3- to 6-hr workshops Long-term TPD over the course of the academic year	Total: 21 hrs Two 6-hr days at the beginning, then 90 min monthly after school meetings Long-term TPD over the course of the semester
Collective Participation	Facilitated collaboration between 6-10 teachers from lower and higher secondary schools in Germany, meeting six times during the academic year	Facilitated collaboration between 4-15 mathematics teachers from middle schools within the state of California, meeting six times during the academic year	Facilitated collaboration between 4 teachers of Grades 4-6 from the western United States, meeting 8 times during the semester

At first glance, the three TPD programs look quite similar in terms of opportunities for situated teacher learning. Each program is based on a set of cycles of planning/acting/reflecting, consisting of several separate workshops with a total duration of about 18–36 hours. Lesson plans and video excerpts of the participants' teaching were used in all programs to provide

authentic contexts for teachers' professional development and to engage teachers in productive discussion of their own teaching practice.

However, closer inspection reveals minor differences in the arrangement of cycles and the respective workshops. Each program has a different content focus; while the DVC emphasizes classroom dialogue as general pedagogical knowledge, the PSC focuses on subject-matter content, and Santagata and Bray's (2015) video-based TPD concentrates on pedagogical subject-matter content. In contrast to the DVC and PSC, the third program uses video excerpts both of participants' own teaching and of other teachers to encourage reflection on typical teaching practices around the world that lead to student errors. The PSC starts with collaborative work on a rich mathematical problem to help teachers to develop the requisite content knowledge for planning and implementing the PSC problem in the classroom; the DVC begins by almost immediately adopting a subject-specific lesson plan; and the video-based program begins by reflecting on video excerpts of other teachers. In short, despite minor differences, each of the three TPD programs provides rich opportunities for situated teacher learning and highlights alternative ways of effectively combining and implementing TPD core features.

To introduce the research questions, the next section elaborates the dissertation's conceptual framework and the current state of empirical research.

2.4 Framework of the dissertation

The aim of the dissertation was to look beyond learning outcomes as measures of TPD effectiveness and to examine in more depth the micro processes of change in teachers' thinking and action. The conceptual framework was based on Desimone's (2009) proposed core features, which sought to illuminate how TPD works by identifying interactive, non-recursive relations between core features, changes in teacher knowledge and beliefs, changes in instruction, and improved student learning, all embedded in a specific context (e.g., policy environment or curriculum). According to the framework,

...a core theory of action would follow these steps:

- 1. Teachers experience effective professional development.*
- 2. The professional development increases teachers' knowledge and skills and/or changes their attitudes and beliefs.*
- 3. Teachers use their new knowledge and skills, attitudes, and beliefs to improve the content of their instruction or their approach to pedagogy, or both.*
- 4. The instructional changes foster increased student learning. (Desimone, 2009, p. 184)*

The present study did not investigate the entire framework but focused on selected variables in the first three areas: (1) implementation of core features of professional development; (2) changes in teachers' knowledge and beliefs; and (3) changes in teaching practice. Figure 2 integrates the dissertation's research questions into a single framework.

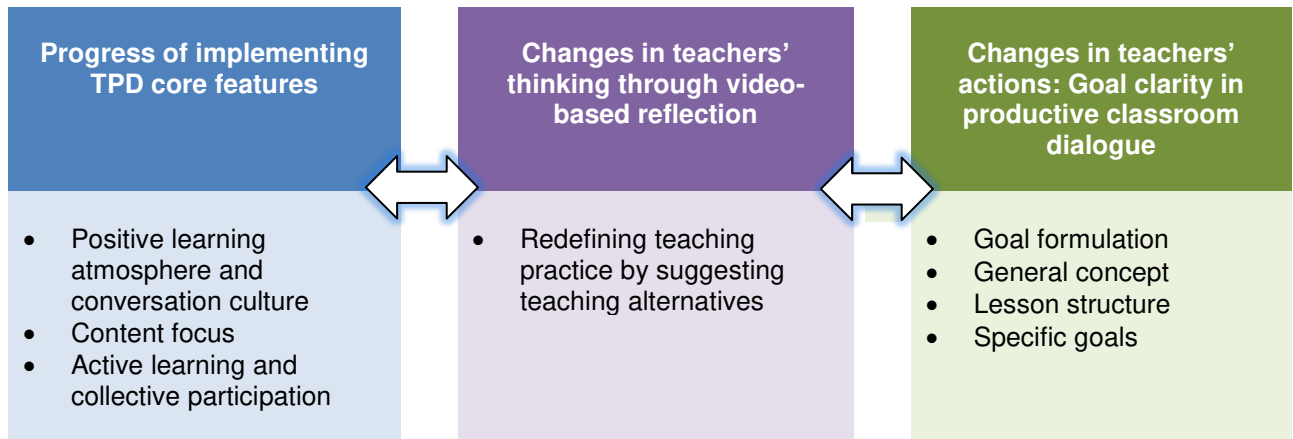


Figure 2: Key features of teacher change (adapted from Desimone, 2009)

By investigating teacher change from different perspectives and at the micro level, this dissertation goes beyond earlier studies. In line with existing research, change in teachers' instructional approach was examined as a first indicator of TPD effectiveness. To acquire further information about changes in teachers' thinking, video-based reflection on their own teaching was analyzed in terms of redefinition of teaching practice by suggesting teaching alternatives. Additionally, selected core TPD features (positive learning atmosphere and conversation culture, content focus, and active learning and collective participation) were investigated to learn more about progress, combination, and implementation over the course of the program.

The next section introduces the research questions, which originate from the author's own research interest as informed by the described framework.

3. Research questions

The dissertation addresses three main research questions — one for each area of the framework as described (see Figure 2). More detailed research questions and hypotheses will be elaborated in relation to the specific studies and research results (see Chapter 5).

- (1) *To what extent do DVC teachers change their teaching practices toward better goal clarity in classroom dialogue in comparison to ATP teachers [teachers in a control group]?*

In line with previous studies, we analyzed changes in teachers' instructional approach as a first indicator of TPD effectiveness, comparing DVC participants with teachers attending a more classic TPD program with fewer opportunities for situated learning. Based on previous evidence of the power of situated learning, we expected to see a positive change in the DVC group as compared to the control group (conjecture 1).

- (2) *To what extent is there a change in DVC teachers' thinking that redefines their dialogic teaching practice in terms of suggested teaching alternatives?*

The next step was to investigate how change in teachers' instructional approach may be linked to changes in teachers' thinking as expressed during DVC workshops. Thereby, redefinitions of teaching practice were examined in relation to teaching alternatives suggested during the course of the TPD workshops. With reference to previous research, it was assumed that linking TPD to practice and providing opportunities for mutual exchange within learning communities would encourage teachers to verbalize any experienced links between TPD contents and their daily practice and to suggest teaching alternatives (conjecture 2a). It was further anticipated that the facilitator's role in supporting teachers would be more important at the beginning of the DVC program, when teachers watched the first video excerpts and hardly knew each other (conjecture 2b).

- (3) *How do core features of TPD, such as content focus, develop over the one-year time span of the DVC?*

Finally, to gain a deeper insight into the process of implementing core TPD features, the progress of these features over the DVC's timespan was analyzed. In light of previous research on the development of learning communities, it was anticipated that the learning atmosphere would become more positive over time (conjecture 3a). As time was needed to establish the learning atmosphere and conversation culture, we expected that the facilitator would play a leading role in this regard at the beginning of the DVC (conjecture 3b). It was

further anticipated that situating TPD in practice through teaching artifacts such as lesson plans and video excerpts would help teachers to maintain a focus on the content of dialogic teaching (conjecture 3c) and would activate teachers to actively engage and collectively participate in discussions (conjecture 3d).

This publication-based dissertation was grounded in two essays that addressed the three main research questions. Essay 1 (“Towards better goal clarity in instruction: How focus on content, social exchange and active learning supports teachers in improving dialogic teaching practices”) was accepted by the *International Education Studies* and published in January 2018. Essay 2 (“Exploring a framework for fostering teacher learning communities in the context of video-based professional development”) was accepted by *Professional Development in Education* and published in January 2018. After describing the dissertation’s methodology, the Essays are summarized with regard to the research questions. The Essays are attached in the supplement.

4. Methodology

4.1 Implementation of the TPD programs

The dissertation research was conducted in the context of the *Dialogue* project. In this context, two TPD programs were developed: the Dialogic Video Cycle (DVC) and the Advanced Traditional Program (ATP) (see Figure 3). The main difference between the programs related to how situated learning opportunities were provided. An implementation study confirmed that both programs generally targeted TPD core features such as content focus (on classroom dialogue), comparable duration (22h) and coherence (Gröschner et al., 2015). The features of collective participation and active learning were fully observed in the DVC and at an intermediate level in the ATP. While concrete lesson plans and video excerpts of teachers' own practices were implemented in the DVC, the ATP was designed as a more traditional TPD program, with fewer opportunities for situated learning and professional development.

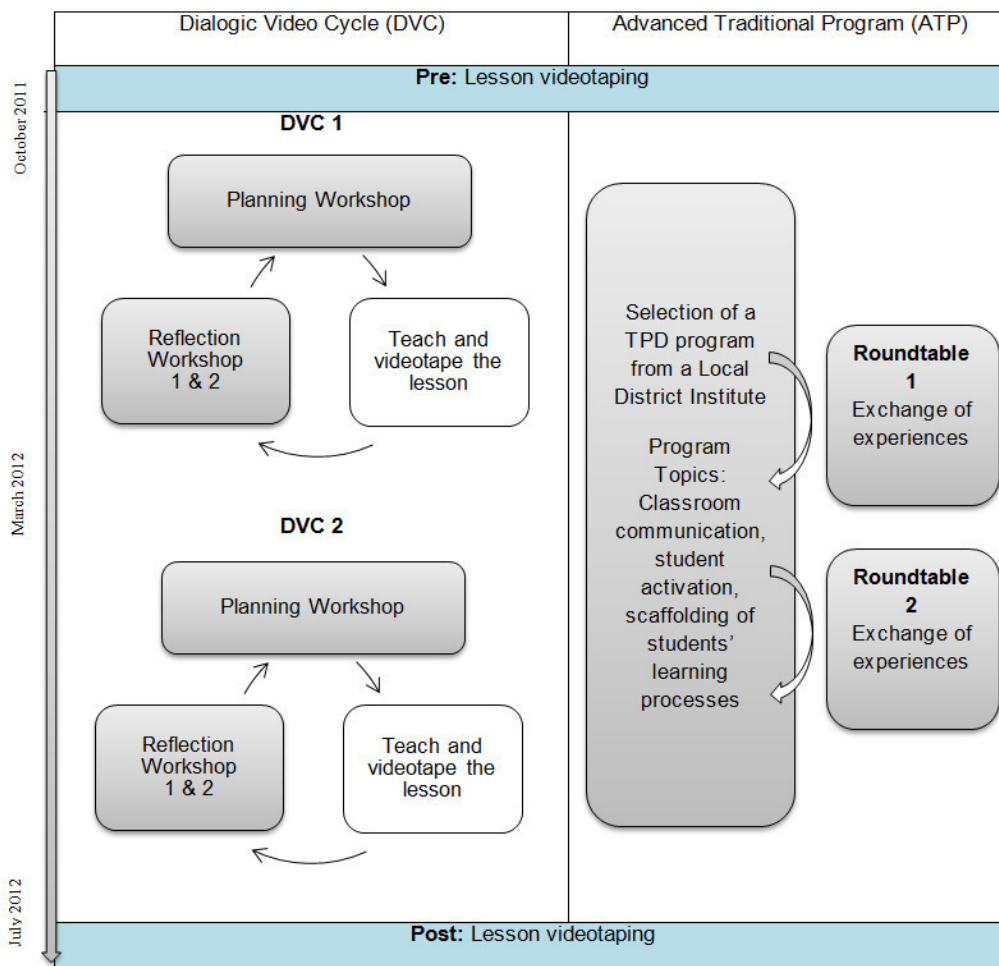


Figure 3: Overview of implementation of the two TPD programs (Alles et al., 2018)

4.1.1 Dialogic Video Cycle (DVC)

More specifically, the DVC comprised two successive cycles: one in the first term of the school year 2011/2012 (DVC 1) and one in the second term (DVC 2). Each cycle consisted of three interconnected workshops (each lasting about 120 minutes) and a videotaped lesson delivered by each participating teacher (each lasting about 45 minutes).

In each DVC Planning Workshop, the teachers referred to existing lesson plans for teaching mathematics and science topics and adapted these by implementing concrete activities to ensure productive dialogue and goal clarity. For example, the teachers learned about the role of goal clarity in student activation and became familiar with several teaching practices for clarifying goals. Four facilitation moves served as the framework for adoption of the lesson plans (Gröschner et al., 2014). First, the facilitator provided a knowledge base in relation to classroom dialogue and associated activities and introduced conversation and feedback rules for critical discussions. The facilitator then supported teachers' discussions about revising lesson plans and ended the workshop with a summary. Following the Planning Workshop, the adopted lesson was taught and videotaped by the research team. Excerpts of 2-3 minutes from each teacher's videotape were selected for joint discussion in the two subsequent Reflection Workshops.

In the Reflection Workshops, the teachers watched selected video excerpts from their own teaching and discussed their experiences when teaching the lessons. The discussion was led by guiding questions such as "How did Laura [a teacher in the DVC group] ensure that all students understand the goal of the lesson?" More specifically, the facilitator supported the video-based discussions by using five facilitation moves (Gröschner et al., 2014). First, the facilitator recapitulated the knowledge base on productive classroom dialogue and reinforced the rules for conversation and feedback. Next, guiding questions were presented for each video excerpt, and the context of the recorded lesson was clarified. Finally, the facilitator guided discussion about the excerpts and ended with a short summary for each video.

4.1.2 Advanced Traditional Program (ATP)

The second program resembled a traditional German TPD program, in which teachers typically choose one-shot workshops on specific teaching and learning topics (Richter, Kunter, Klusmann, Lüdtke, & Baumert, 2011). For present purposes, the research team selected a number of workshops of comparable duration on the topic of productive classroom dialogue, which was offered by a local TPD institute at the time of the DVC program. To foster the teachers' learning community, two additional roundtables were offered by the facilitator. As these were not typical of German TPD programs, this was called the Advanced Traditional Program (ATP). In contrast to the DVC, the teachers in the ATP did not explicitly adopt existing lesson plans, nor did

they explicitly reflect on concrete examples of teaching practices in video excerpts of their own teaching.

4.2 Sample and design

Ten math and science teachers from higher and lower secondary schools in the metropolitan area of Munich, Germany, participated voluntarily in the TPD programs during the school year of 2011/2012 (Gröschner et al., 2015). As TPD in Germany is commonly based on teachers' voluntary participation, the two programs had to be compatible with teachers' usual routines and organizational standards.

Table 2: Teacher sample (Alles et al., 2018)

Teacher pseudonym	TPD program	Age	Gender	Teaching experience	Subject in the TPD	Secondary level
Sarah	DVC	39	F	10	Math	High
Marc	DVC	45	M	4	Math	Low
Laura	DVC	33	F	2	Physics	Low
Caroline	DVC	44	F	5	Physics	High
Lucy	DVC	33	F	2	Math	High
Thomas	DVC	43	M	5	Math	Low
Peter	ATP	43	M	10	Physics	High
Susan	ATP	30	F	4	Math	High
Helena	ATP	33	F	7	Biology	High
Karin	ATP	40	F	8	Physics	High
		<i>M</i> = 38.30 (<i>SD</i> = 5.56)		<i>M</i> = 5.70 (<i>SD</i> = 2.95)		

Note. Lower and higher secondary teachers in Germany usually study and teach two subjects. For international contextualization, the subjects Physics and Biology are referred to as "Science" throughout.

Following a pre-meeting, six teachers chose to participate in the DVC and four in the ATP. On a four-point Likert scale ($U = 7.00$, $z = -1.14$, $p = .25$), there was no difference in motivation to learn about productive classroom dialogue between the DVC group ($M = 3.51$, $SD = .47$; $M_{Rank} = 4.67$) and the ATP group ($M = 3.81$, $SD = .38$; $M_{Rank} = 6.75$) (Gröschner et al., 2014). In addition, the two groups showed no significant differences in terms of age, teaching experience, gender, or subject (math and science) (Pehmer et al., 2015b; Pehmer, Gröschner, & Seidel, 2015a).

The study was subdivided by four measuring points (MPs) (see Figure 4). Regarding the first research question, a lesson of each teachers was video recorded at the beginning and end of the 2011/12 school year ($N = 20$; $n = 10$ for pre-test, $n = 10$ for post-test). For research questions 2 and 3, all DVC workshops ($N = 6$; DVC 1: $n = 3$, DVC 2: $n = 3$) were also video-recorded in order to investigate changes in teachers' thinking and the progress of TPD core features over the course of the workshops.

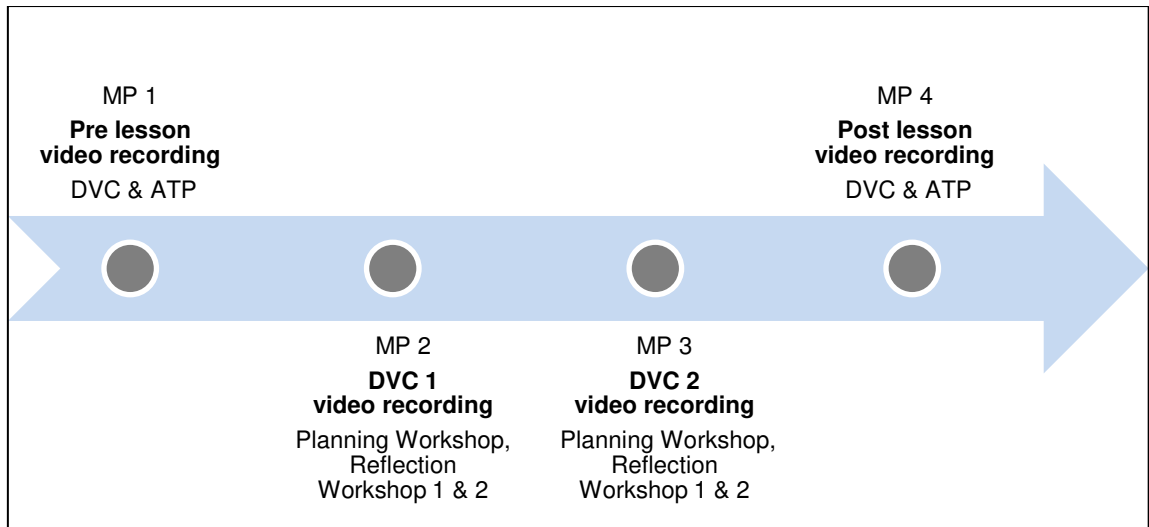


Figure 4: Study design and measurement points

4.3 Video coding

4.3.1 Coding of lesson video recordings

Changes in teachers' actions (research question 1) were analyzed using a rating scheme of four items (see Table 3) rated on a four-point Likert scale (0 = not true, 1 = partly untrue, 2 = partly true, 3 = true) (Seidel, Prenzel, & Kobarg, 2005). The recordings were coded by two independent raters, using Videograph software (Rimmele, 2002). To examine changes in teachers' instructional approach from pre- to post-measurement, the unit of analysis was the lesson. Based on independent inter-rater correlations, reliability was found to be satisfactory (ICC: $M = .58$).

4.3.2 Coding of DVC video recordings

In line with previous studies of TPD (Borko et al., 2008; Brodie, 2014; Sherin & van Es, 2008; van Es, 2011), the category scheme for analyzing changes in teachers' thinking (research question 2) included one item (see Table 3) and for analyzing the progress of implementation of TPD core features (research question 3) included six items ($n = 3$ for learning atmosphere and conversation culture, $n = 3$ for content focus) (see Table 3).

Table 3: Scheme for video coding

Research question	Video material	Category	Item	Coding role: Is coded if...
(1) Changes in teachers' actions	Lesson video recordings	Goal clarity in productive classroom dialogue	Goal formulation	...the teacher formulates the main goal/central question of the lesson.
			General concept	...the lesson is structured according to the teacher's general concept.
			Lesson structure	...the teacher chooses an appropriate student working phase and integrates it in a meaningful way in the lesson structure.
			Specific goals	...the goals are formulated specifically rather than generally.
(2) Changes in teachers' thinking	DVC workshop video recordings	Redefining teaching practice	Suggesting teaching alternatives	...teaching alternatives for productive classroom dialogue are mentioned.
(3) Progress in implementing TPD core features	DVC workshop video recordings	Learning atmosphere and conversation culture	General appreciation	...group members talk to each other politely, do not shout at each other, allow each other to finish speaking, and listen to each other.
			Collective and shared discourse rules	...rules of negotiation, rules of video observation, or general aspects of negotiation are addressed.
			Providing context information for the video excerpts	...there are requests and explanations in relation to the given video (for example, the context of the lesson, the introduction, or subsequent lessons).
			Content focus	...the discussion focuses on classroom dialogue and events observed in the video.
				Clarification of lesson course and student tasks
			Clarification of learning goals	...clarification of goals as a means of activating students is discussed.

Each item was coded by two independent raters, based on the analysis categories 0 = miss and 1 = hit. Where necessary, consensus validation followed the individual coding process. The inter-rater reliability of the two raters was good to very good (ICC: $M = 0.83$). While the rating scale used here meant that coding decisions were low in necessary conclusions, the category system demanded increasingly interpretative (high-inference) coding decisions (Seidel, Prenzel et al., 2005).

To analyze teachers' active and collective participation as a further category in our framework, items in the categories *learning atmosphere and conversation culture* and *content focus* captured participants in the conversation (subcategories of *learning atmosphere and*

conversation culture: (1) facilitator; (2) teachers; subcategories of *content focus*: (1) facilitator, (2) teachers in the learning community, (3) teacher on screen).

Based on our experiences with the different time units reported in the video analysis literature (Seidel, Prenzel et al., 2005), we chose to follow Borko et al. (2008), who used two-minute segments to analyze teachers' conversations during TPD. The two-minute unit allowed for meaningful rating of any changes in teachers' thinking and the progress of implementation of TPD core features over time. For the six DVC workshops (three per DVC), the total number of video-coded units of analysis was $N = 344$ ($M = 52.00$; $SD = 19.53$) (see Table 4). While every workshop lasted about two hours, the number of units of analysis differed between the workshops ($Min = 21$, $Max = 83$). For instance, there were more units of analysis in the DVC Planning Workshops than in the Reflection Workshops because in the former, there were several simultaneous small group discussions. For the purposes of video coding, these simultaneous discussions were added, yielding a higher number of two-minute units of analysis for the Planning Workshops. In addition, segments in the Reflection Workshops were not considered where teachers watched video excerpts but no discussion took place.

Table 4: Two-minute coding segments for each DVC workshop

DVC	Workshop	Number of coding segments	Average number of coding segments for each DVC
1	Planning	83	54
	Reflection 1	44	
	Reflection 2	35	
2	Planning	78	50
	Reflection 1	51	
	Reflection 2	21	
		$M = 52.00$ $(SD = 19.53)$	

4.4 Data analysis

4.4.1 Data analysis of lesson video recordings

To analyze changes in teachers' actions (research question 1), non-parametric variance analyses using the software R (Stowell, 2014) were performed for longitudinal comparison of the relative effects for DVC and ATP because of the small sample size. As conventional analyses typically refer to parametric tests, the findings were also reported by means of a Wilcoxon signed-rank test. These analyses were separately applied to show changes for each TPD program from pre- to post-test.

4.4.2 Data analysis of DVC video recordings

To examine changes in teachers' thinking and progress in implementing TPD core features, descriptive analyses were performed using SPSS 23 (Bühner & Ziegler, 2012). Because of the variation in number of two-minute units for each DVC workshop, the results for each conjecture were based on the absolute and relative frequencies of the rated items. In addition, discussions from the DVC workshops were transcribed and presented as qualitative excerpts.

The next section summarizes the associated essays, and the main findings are presented.

5. Results

5.1 Changes in teachers' actions: Goal clarity in productive classroom dialogue

Changes in teachers' instructional approach were examined in the context of Essay 1. The findings of the study were submitted to *International Education Studies* and published in January 2018. Conception, research, analysis, and preparation for publication were essential components of my input (75%), which was guided by the two co-authors, Tina Seidel (15%) and Alexander Gröschner (10%).

Alles, M., Seidel, T., & Gröschner, A. (2018). Toward better goal clarity in instruction: How focus on content, social exchange and active learning supports teachers in improving dialogic teaching practices. *International Education Studies*, 11(1), 11–24. <https://doi.org/10.5539/ies.v11n1p11> (Supplement_2: Essay 1)

The objective of the dissertation was to link changes in teacher instructional approach as an outcome variable to micro-processes of teacher thinking during implementation of TPD core features. To that end, Essay 1 first investigated the extent to which TPD impacts on teacher learning by analyzing changes in teachers' actions. Where teachers changed their practice after participating in the program, it could be assumed that TPD was effective in some way (Hattie, 2009; Timperley et al., 2007). As the dissertation was embedded in the *Dialogue* project, the Dialogic Video Cycle (DVC) was chosen as an exemplary TPD program for analysis. The DVC was systematic compared to a control group completing the Advanced Traditional Program (ATP), which offered fewer opportunities for situated teacher learning and professional development (Gröschner et al., 2015). As described earlier (in section 4.1), both TPD programs focused on the general pedagogical content of classroom dialogue in mathematics and science lessons. As classroom dialogue is the predominant mode of teaching worldwide (Mercer & Dawes, 2014), this pedagogical content focus offered a suitable entry point into teachers' classroom practice. There is evidence that teachers commonly fail to sufficiently activate students to participate in discourse (Seidel & Prenzel, 2006) and to explicate learning goals (Hugener et al., 2009; Seidel, Rimmelé et al., 2005). To support teachers in changing their practice, situated TPD elements have been identified as a helpful means of strengthening teachers' capacity to make concrete changes to their existing teaching practices (Ball & Cohen, 1999; Borko et al., 2008; Grossman, Compton, Igra, Ronfeldt, & Shahan, Emily, Williamson, Peter W., 2009; Sherin & van Es, 2002; van Es, 2011). These, however, have not yet focused on classroom dialogue as

the content of a TPD program. The Dialogic Video Cycle (DVC) addresses this issue by combining effective, situated TPD elements with elements of productive classroom dialogue as TPD program content. Accordingly, the following research question was formulated.

- (1) *To what extent do DVC teachers change their teaching practices toward better goal clarity in classroom dialogue in comparison to ATP teachers?*

We expected that the DVC program would provide situated learning opportunities for teachers to change teaching practices on a higher level than the control group (ATP). Positive changes from pre- to post-test in terms of better goal clarity were therefore anticipated for DVC teachers as compared to ATP teachers (conjecture 1).

Results were generated through coding and analysis of the video-recorded lessons (see sections 4.3.1 and 4.4.1).

- (1) Based on non-parametric variance analysis for longitudinal comparison of the two TPD programs, teachers' practice changes in terms of goal clarity before and after intervention showed a significant interaction effect (conjecture 1). Over time, the relative treatment effect (RTE) increased for the DVC program while the ATP program's RTE decreased significantly. From a parametric perspective, instructional strategies for clarifying lesson goals (e.g., clear formulation of the central question at the beginning of the lesson) were observed for the DVC, with a mean score of $M = 1.50$ ($SD = .82$) at pre-test increasing to $M = 2.06$ ($SD = .71$) at post-test. For the ATP, instructional strategies for clarifying lesson goals returned a mean score of $M = 1.44$ ($SD = .88$) at pre-test, dropping to $M = 1.25$ ($SD = .80$) at post-test. Additionally, the Wilcoxon signed-rank test identified a significant positive change from pre- to post-test in goal clarity-related practices among DVC teachers. In contrast, the ATP learning environment did not lead to any significant change in teaching practice. As anticipated (conjecture 1), the findings in Essay 1 indicate that teachers in the DVC group succeeded in changing their dialogic teaching practices and incorporated more elements of goal clarity as compared to those in the ATP group. These findings suggest that the DVC approach to TPD affords more opportunities to learn and to practice (Lampert, 2009; Loewenberg Ball & Forzani, 2009). Situating TPD in practice by using teaching artifacts like lesson plans and video excerpts of own teaching, may have stimulated both individual and community-based learning processes, as well as subsequent practice changes in the classroom (Ball & Cohen, 1999; Jacobs, Borko, & Koellner, 2009).

To sum up, the findings in relation to research question 1 may represent a first indicator of DVC effectiveness for situated TPD. The next section provides further information about which instructional features and underlying micro-processes during TPD may have prompted changes in teachers' actions. As there were no significant changes in teaching practice among those in the ATP group, the analyses focus exclusively on TPD micro-processes in the context of the DVC.

5.2 Changes in teachers' thinking through video-based reflection on teaching

Essay 2 investigated changes in teachers' thinking through video-based reflection on teaching. The study findings were submitted to *Professional Development in Education* and were published online in January 2018. In Essay 2, the author was responsible for conception, research, analysis, and publication-based presentation of findings (75%). The co-authors provided support by advising on all stages of the scientific work (Tina Seidel (15%); Alexander Gröschner (10%)).

Alles, M., Seidel, T., & Gröschner, A. (2018). Establishing a positive learning atmosphere and conversation culture in the context of a videobased teacher learning community, *Professional Development in Education*. Avance online publication. doi: <https://doi.org/10.1080/19415257.2018.1430049> (Supplement_3: Essay 2)

Referring to Schön's (1983) idea of reflective practice, it was assumed that teaching experiences do not necessarily result in learning. Instead, changing teaching practice begins from teachers' reflection on their own instruction (Schön, 1983). Reflecting on experiences provides critical perspective and engagement in a process of continuous learning (Calandra, 2015; Moon, 2008). This includes teachers' redefinition of their own teaching practice (Ghaye, 2011; Yost et al., 2000) — for example, in terms of suggesting teaching alternatives. For the purposes of this study, adopting a situated approach to learning and professional development afforded opportunities for teacher reflection through active learning, using such artifacts as lesson plans and video excerpts, along with collective participation in video-based discussions (Borko et al., 2008; Desimone, 2009). In particular, active learning based on video excerpts has been identified as a promising way of engaging teachers in reflection (Coles, 2013; Tripp & Rich, 2012). As described earlier (see section 2.2), video provides extensive access to complex teacher-student interactions in the classroom and allows teachers to observe their own teaching from an external perspective without the pressure of having to react immediately. Video recordings of teachers' own practice facilitate identification of instructional routines and promote redefinition of teaching

practice by suggesting alternatives (Harlin, 2014; Kleinknecht & Schneider, 2013; Krammer et al., 2006; Seidel et al., 2011). However, the use of video reflection in TPD must be carefully facilitated (Borko, Jacobs et al., 2014; Gröschner et al., 2014; van Es et al., 2015) in order to “make practice studyable” (Ghousseini & Sleep, 2011, p. 142).

Essay 2 investigated teachers’ rethinking in terms of suggesting teaching alternatives as one aspect of a positive learning atmosphere and conversation culture. The following research question was addressed including two subquestions as stated in Essay 2:

(2) *To what extent is there a change in DVC teachers’ thinking that redefines their dialogic teaching practice in terms of suggested teaching alternatives?*

(2a) *How do learning atmosphere and conversation culture in the teacher learning community develop over the one-year time span of DVC?*

In relation to teachers’ rethinking through suggestion of teaching alternatives, it was assumed that situating TPD in practice and providing opportunities for mutual exchange within learning communities would encourage teachers to verbalize perceived links between TPD content and their daily practice (conjecture 2a). It was anticipated that the opportunities for active learning based on video excerpts of their own instruction would engage teachers in redefining existing teaching routines by suggesting teaching alternatives.

(2b) *Who are the main stakeholders (facilitator and teachers) in establishing a positive learning atmosphere and conversation culture, and how does their involvement change over time?*

In relation to teachers’ rethinking through suggestion of teaching alternatives, it was assumed that the facilitator’s supporting role would be more important in the early stages of the DVC when teachers began to reflect on their video excerpts and hardly knew each other (conjecture 2b).

Results were generated through high-inference video-coding and analysis of the DVC workshop video recordings (see sections 4.3.2 and 4.4.2). The results are structured in relation to the two research questions.

(2a) In line with conjecture 2a, the empirical findings confirmed that both teachers and facilitator were careful at the start of their video-based discussions, in that they were quite reserved about suggesting teaching alternatives having observed each other’s classroom practices in the videos. However, by the end of DVC 2, the group members were beginning to discuss their teaching practices more critically, suggesting more teaching alternatives for each

other's teaching and weighing different options. The findings were illustrated by representative qualitative excerpts from the group's discussions of teaching alternatives.

- (2b) Conjecture 2b was not confirmed, as the facilitator and teachers' roles remained relatively constant over the course of the workshops, with no appreciable changes over time. Over the course of the DVCs, the teachers contributed mainly to the discussion about teaching alternatives, guided by the facilitator's questions (e.g., "What are some ways to increase student activation?").

In summary, our findings in relation to research question 2 provided a detailed insight into changes in teachers' thinking in relation to suggested teaching alternatives, perhaps helping to better understand changes in teachers' instructional approach. In Essay 1, qualitative excerpts of the DVC workshops' discussions illustrate the findings. The next section goes on to review findings concerning the progress of TPD core features over the course of the DVC that might also influence changes in teachers' thinking and instructional approach.

5.3 Progress in implementing TPD core features

Progress in implementing TPD core features was investigated in the context of Essay 1 and Essay 2. As noted above, the findings of Essay 1 were submitted to *International Education Studies* and published in January 2018. Essay 2 was submitted to *Professional Development in Education* and published online in January 2018. Conception, research, analysis, and preparation for publication were essential components of my work on both articles (75%), guided by the two co-authors Tina Seidel (15%) and Alexander Gröschner (10%).

Alles, M., Seidel, T., & Gröschner, A. (2018). Toward better goal clarity in instruction: how focus on content, social exchange and active learning supports teachers in improving dialogic teaching practices. *International Education Studies*, 11(1), 11-24. doi: <https://doi.org/10.5539/ies.v11n1p11> (Supplement_2: Essay 1)

Alles, M., Seidel, T., Gröschner, A. (2018). Establishing a positive learning atmosphere and conversation culture in the context of a videobased teacher learning community, *Professional Development in Education*. Advance online publication. doi: <https://doi.org/10.1080/19415257.2018.1430049> (Supplement_3: Essay 2)

In line with a situated approach to learning and professional development, the emerging consensus about TPD core features may lead to positive learning results among teachers — in other words, these components may enhance teachers' motivation to learn and to actively

change their teaching practices, as well ultimately improving student learning (Desimone et al., 2002; Desimone, 2009; Gröschner et al., 2015; Guskey, 2002; Timperley et al., 2007). These core features include active teacher learning, collective participation, content focus, sufficient duration, and coherence. As described in section 2.3, there is evidence that these features correlate positively with teachers' self-reported knowledge and skills and with changes in teaching practice (Desimone et al., 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001; Kutaka et al., 2017). According to previous research (Borko et al., 2008, van Es, 2012, Gröschner et al., 2014), a positive learning atmosphere and conversation culture that helps teachers to feel part of a safe professional environment, is also essential for teachers' learning. However, despite widespread consensus about particular TPD core features, previous research has failed to define and explicate what combinations and balance of TPD features might be most appropriate (Kennedy, 2016; Kutaka et al., 2017; OECD, 2017; Santagata & Bray, 2015). These largely vague descriptions mean that implementation of TPD core features varies from program to program. To date, little is known about how TPD works, what really happens during TPD, how teacher learning is promoted, or how TPD is expected to change teachers' practice. Most prior investigations of these features of TPD, such as Desimone (2002) or Garet (2001), are based on teachers' self-reports, and few studies have examined TPD core features systematically or in combination. In this context, the present dissertation aims to contribute to this area of TPD research by opening the "black box" and systematically analyzing the progress of particular TPD core features over the course of the one-year video-based DVC. To expand on previous findings, the following research question was addressed including three subquestions as stated in the essays:

(3) *How do core features of TPD, such as content focus, develop over the one-year time span of the DVC?*

(3a) *How does the learning atmosphere and conversation culture develop over the one-year time span of the DVC?*

It was expected that learning atmosphere and conversation culture would become more positive over time as teachers collected experiences while watching themselves on video and got to know each other better (conjecture 3a).

(3b) *Who are the main stakeholders (facilitator, teacher) in establishing a positive learning atmosphere and conversation culture, and how do their roles change over time?*

As learning atmosphere and conversation culture require time to develop, we expected that the facilitator would play a more important role in establishing a positive learning atmosphere and conversation culture at the beginning of the DVC (conjecture 3b).

(3c) *To what extent do teachers' exchange focus on the content of goal clarity in classroom dialogue and to what extent do the teachers actively participate verbally in the discussions?*

We assumed that the DVC's video-based approach would support teachers in maintaining the focus on content (conjecture 3c). We further anticipated that teachers in the DVC learning community and the on-screen teacher whose video was being discussed would be verbally active throughout the social exchange of experiences (conjecture 3d).

Results were generated through high-inference coding and analysis of the DVC workshop videos (see sections 4.3.2 and 4.4.2) and were structured in relation to the two research questions:

(3a) In line with conjecture 3a, the findings confirmed a general appreciation and highly focused inquiry in relation to the video content in the first DVC workshops. From the very beginning, teachers and facilitator spoke politely to each other, listened to each other's ideas, and allowed each other to speak. The group supported each other's ideas and used evidence from the video to support their arguments. Sometimes, the facilitator had to remind the teachers about the discourse rules for giving feedback as deliberately agreed before the first reflection workshop and before the video observations began. To gain a broader insight into each specific case, the group considered contextual information prior to the observed video excerpts. By the end of DVC 2, the learning atmosphere and conversation culture had evolved to a level where teachers had fully incorporated the discourse rules. The group began to share increased contextual information in relation to the video excerpt and explored the observed teaching situation together. The focus on events in the videos remained high but diminished slightly in the final reflection workshop of DVC 2. During that workshop, teachers sometimes digressed from the observed video sequence and talked about more general topics, such as subject-specific content or school characteristics, which were unrelated to events in the video or to the TPD program topic. However, these general discussions did refer to the teachers' daily business, which also forms part of collective TPD programs and learning events that deal with professional routines (Kissling, 2014).

(3b) Disconfirming conjecture 3b, facilitator and teachers' contributions were found to be relatively constant over the course of the workshops, with no appreciable change over time. Using specific mindful facilitation moves (Gröschner et al., 2014), the facilitator referred to shared discourse and feedback rules, supported teachers in focusing on the lesson

segment and probing for evidence for their claims, clarified the context of the video excerpt to avoid misunderstandings, and expanded on the teachers' comments.

- (3c) The findings illustrate that situating TPD in practice by introducing teaching artifacts such as lesson plans and video excerpts helped teachers to maintain their focus on the content of dialogic teaching (in line with conjecture 3c). Partly contrary to our assumptions, there was a decrease in teacher discussions of goal clarity between the first and second DVC. The program focused on goal clarity as an essential instructional strategy for verbal engagement of students. However, teachers also addressed a number of further effective instructional strategies to enhance classroom dialogue. The decrease in discussions of goal clarity can be interpreted as an artifact, as teachers shifted their attention in the second DVC to other methods and strategies (Michaels et al., 2008) such as teacher feedback. In line with conjecture 3d, the results suggest that the teachers in the DVC learning community and the on-screen teacher remained verbally active throughout the social exchange of experiences. The qualitative excerpts from the workshops presented in Essay 1 illustrate how teachers in the learning community, the on-screen teacher and the facilitator exchanged information about methods and strategies for improving goal clarity in their approach to instruction. As the examples show, the role of the facilitator changed. While teachers might need to be pushed by their facilitator to try out new instructional practices in a Planning Workshop, the learning community took the initiative as a group and reflected jointly on this issue without further input from the facilitator. In the Reflection Workshop, then, the facilitator's role was to expand the teachers' ideas or to connect different thoughts to foster active involvement and social learning (Borko et al., 2008; van Es et al., 2014).

In summary, these findings provide a deeper insight into the process of implementing core TPD features over the DVC's timespan and invite further interpretation of changes in teachers' thinking and actions.

6. Discussion

The aim of this dissertation was to examine the effects of TPD on teachers from different perspectives as exemplified in a case study of the DVC. As previous studies have focused mainly on learning outcomes in terms of teacher practice changes and increased student achievement, the purpose here was to look beyond these issues to a more comprehensive view of changes in teachers' thinking and instructional approach. To that end, the dissertation adopted Desimone's (2009) proposed conceptual framework for studying TPD effects in order to analyze changes in teacher instructional practices as a first indicator of TPD effectiveness. Additionally, changes in teachers' thinking through video-based discussion and progress in implementing TPD core features were systematically investigated to gain a deeper insight into the "black box" of TPD. The DVC program was selected as an appropriate case example for investigating the research questions at micro level.

The next section presents an overview and discussion of central findings. Section 6.2 suggests directions for further research, and section 6.3 makes recommendations for future TPD practice.

6.1 Overview and discussion of central findings

Figure 5 summarizes the dissertation findings by presenting outcomes related to Desimone's (2009) framework in three areas: (1) *progress in implementing TPD core features*; (2) *changes in teachers' thinking*; and (3) *changes in teachers' actions*. In line with the research questions, the summary and discussion of results starts with the third of these issues (*changes in teachers' actions*).

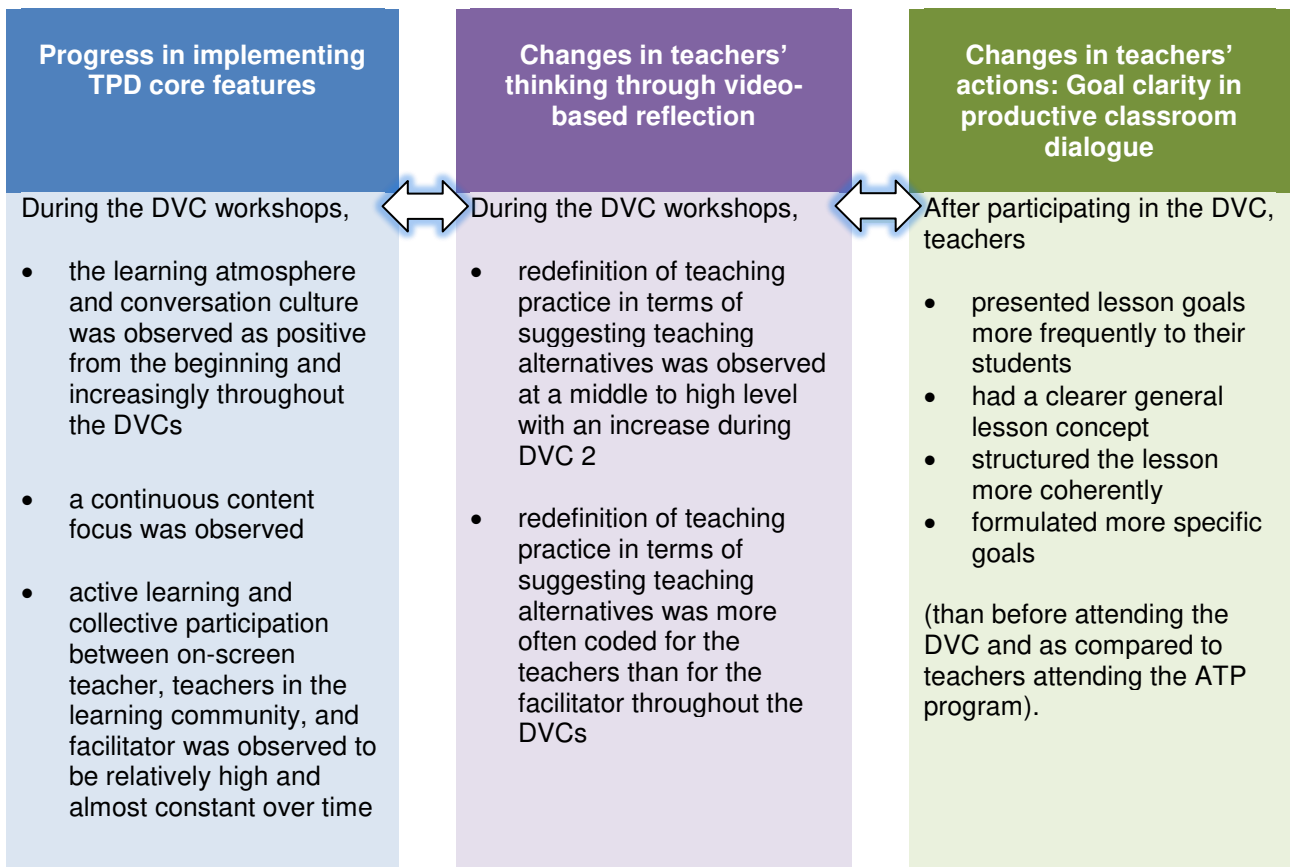


Figure 5: Overview of central findings

As anticipated in conjecture 1, our findings regarding the third area (*changes in teachers' actions*) indicate that teachers benefited from participating in the DVC as compared to teachers in the ATP. In line with the common before-and-after approach to investigating the extent of a TPD program's impact on teacher learning, these findings seem to confirm that situated learning opportunities as provided in the DVC supported teachers in changing their teaching practice at a higher level than the more traditional ATP program, which offered fewer opportunities for situated learning and professional development (Lampert, 2009; Loewenberg Ball & Forzani, 2009). Linking TPD to practice by using teaching artifacts such as lesson plans and video excerpts of their own teaching may have encouraged both individual and community-based learning processes and subsequent practice changes in the classroom (Ball & Cohen, 1999; Jacobs et al., 2009). This aligns with previous findings (Borko et al., 2008) that teaching artifacts provide rich opportunities for teachers to actively exchange information about their own teaching and to support each other in changing their practices. The findings in relation to *changes in teacher thinking* and *progress in implementing TPD core features* offer a deeper insight into the "black

box” of TPD and possible micro-processes underlying changes in teachers’ instructional approach.

As anticipated in relation to *teachers’ change in thinking* (conjectures 2a and 2b), our findings indicate that the DVC learning environment supports teachers’ efforts to change their thinking by redefining their teaching practice in terms of suggested teaching alternatives. In line with previous research (Brodie, 2014; Dobie & Anderson, 2015), our findings suggest that the learning community needed some setup time before teachers felt confident enough to offer comments that contradicted those of other group members or to suggest teaching alternatives to each other’s classroom practice. It seems that increased experience in analyzing videos (Kleinknecht et al., 2014; Stürmer & Seidel, 2015) and the deepened knowledge about productive classroom dialogue incorporated over time, fostered teachers’ critical discussion of teaching alternatives. This also echoes van Es’s (2012) work describing the development of a learning community of teachers where, to begin, conversations were one-sided and short of constructive inquiry but progressed to the point where a high-functioning community of participants would constructively press each other to explain and elaborate on their thinking. The present findings support the view that situating TPD in practice — for example, through concrete lesson planning and collaborative video analysis — helps teachers to examine their instructions from a new, external perspective, to recognize fixed teaching routines, and to be open to initiating changes. These results align with previous research (Borko et al., 2008; Marsh & Mitchell, 2014; Santagata & Bray, 2015) confirming the power of situated learning and professional development. Our findings further indicate that the facilitator played a specific and relevant role as part of the teacher learning community throughout the DVCs (Borko, Jacobs et al., 2014; Gelfuso, 2016; van Es et al., 2014). Using specific mindful facilitation moves (Gröschner et al., 2014), the facilitator supported teachers in probing for evidence for their claims and expanded on the teachers’ comments. This prearrangement and scaffolding may have helped to foster teachers’ emotional-motivational involvement (Kleinknecht et al., 2014; Kleinknecht & Poschinski, 2014). In summary, the findings in relation to area 2 (*changes in teacher thinking*) enhance our understanding of how the video-based discussions in the DVC’s reflection workshops helped teachers to change their thinking, which may in turn have initiated changes in teachers’ actual approach to instruction. Referring to the theory of planned behavior (Ajzen, 1991), it can be assumed that the individual’s intention to perform a given behavior is a central factor in “real” transfer: “Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior” (Ajzen 1991, p. 181).

Our findings in relation to the first area (*progress in implementing TPD core features*) indicate that the learning atmosphere and conversation culture in the DVC learning community were relatively positive from the very beginning and even increased slightly over time (in line with conjecture 3a). These findings support the view that an appreciative atmosphere and conversation culture meant that discussions were continually productive as the teachers remained focused on relevant issues observed in the videos (Borko et al., 2008). According to Borko et al. (2008), our findings suggest that teachers felt confident that showing their videos would provide learning opportunities for themselves and their colleagues, and that the atmosphere would be one of productive engagement. In addition, as in earlier work (Brophy, 2008; Gröschner et al., 2014; van Es, 2012), our findings confirm that it took time to learn and establish a routine for exchanging information about the videos and to fully incorporate discourse rules. In line with Sherin and van Es (2002, 2008), who showed that teachers often judge classroom events before describing what happens, our findings indicate that, throughout the workshops, the teachers began to describe what they had observed rather than hastily evaluating the content, the teaching, and the behavior of teachers and students. It seems that the discourse rules helped teachers to remain attentive without “judging” events in the video. In this context, we would further suggest that the TPD’s content on classroom dialogue may have fostered the conversation culture among the teachers and facilitator (Kissling, 2014). In the workshops, teachers learned about several discourse practices for promoting students active involvement. These practices are universal and transferable to other contexts, such as the TPD program.

Contrary to conjecture 3b, the facilitator and teachers’ contributions were relatively constant over the course of the workshops, with no appreciable changes over time. Our findings indicate that the facilitator played a specific and relevant role as part of the teacher learning community throughout the DVCs. Using specific mindful facilitation moves (Gröschner et al., 2014), the facilitator continually guided the video-based discussions and created the scope for active social learning in this community of teachers.

Our findings also suggest that actual changes in teachers’ instructional approach relate to the considerable time spent discussing these aspects during the planning and reflection workshops (in line with conjecture 3c). Our findings seem to confirm previous evidence (Seidel et al., 2011) that video excerpts provide suitable conditions for teachers in TPD to pursue sustained inquiry into events in their own teaching practice. This also aligns with Borko et al.’s (2008) finding that situated learning opportunities (e.g., video analysis of teaching) support productive discussion and help teachers to focus on issues of relevance in changing their perspective on student learning. It seems that the video excerpts helped the teachers to focus on relevant issues and to change their perspective in this way. These findings also align with previous research in

the context of the DVC reporting teachers' high level of focus on classroom dialogue throughout their exchanges (Gröschner, Schindler, Holzberger, Alles, & Seidel, 2018). While this focus on dialogue during the events in the video declined in the last reflection workshop of DVC 2, this may be explained by the timing of the workshop, which took place at the end of the school year, at a time when the teachers were engaged in events such as final examinations.

In relation to conjecture 3d, the analyses presented here also indicate the importance of collective participation and active learning among teachers and facilitator for teachers' learning, both of which were observed in the DVC (Desimone, 2009; Wilson, 2013). Encouraged by the practice-based video excerpts, it seems that situated learning afforded the teachers rich opportunities to actively and collectively exchange information about their own teaching practice and to support each other in changing their actual approach to instruction. The qualitative excerpts of the workshops presented in the essays illustrate how the teachers in the learning community and the facilitator socially exchanged information about methods and strategies for improving goal clarity in their instruction, and how the role of the facilitator seemed to change and adapt. While the teachers might need to be pushed by a facilitator to try out new instructional practices in the Planning Workshops, the teachers as a learning community took the initiative to jointly reflect on this issue within the group without further input from a facilitator. In the Reflection Workshop, then, the facilitator played the role of expanding teachers' ideas or connecting different thoughts to foster active and social learning. This aligns with previous studies (Borko, Jacobs et al., 2014; Gröschner et al., 2014; van Es et al., 2014) describing facilitation moves for video-based TPD. To summarize, our findings for area 3 contribute to existing research by looking beyond a general examination of TPD core features as implemented or not implemented (Desimone et al., 2002; Garet et al., 2001; OECD, 2017). Our findings are relevant in that they seem to indicate that TPD core features develop over time and that would be difficult to capture their implementation as a one-time snapshot.

In conclusion, this dissertation serves as a first approach to examining TPD processes and teacher learning from different perspectives, based on the case of the DVC. The findings indicate that systematic micro-analyses of teachers' thinking and the progress of TPD core features over time facilitate a deeper understanding of possible indicators of how actual changes emerge in teachers' instruction. The findings illustrate how TPD core features such as content focus and social, active learning can prompt changes in teachers' thinking, leading to actual changes in their approach to instruction.

Within this context, the dissertations' limitation is the small sample size of participating teachers and thus the findings are not generalizable to broad cohorts of teachers. However, with regard to the goal of analyzing TPD processes in their entirety, the knowledge gained from this

small-scale study may encourage future researchers to engage with larger samples. In interpreting these findings, it is important to note that no causal claims can be made about the impact of TPD core features on changes in thinking and instruction, nor is it possible to systematically identify individual differences between teachers participating in the DVC (Kazemi & Hubbard, 2008). Previous research has shown that teachers vary in their responses to the same TPD (Desimone & Garet, 2015), and that classrooms can be understood as individual settings that differ in terms of options or barriers to implementing new practices (Buczynski & Hansen, 2010). For example, in relation to the DVC, Pehmer et al. (2015b) found significant changes in the level of questions asked by teachers when aggregated, but more detailed analysis showed that teachers differed in pre-knowledge on entering the study and that practice changes were heterogeneous — that is, while some teachers' questioning behavior increased, it decreased in others.

6.2 Suggestions for future research

More research is needed to fully understand TPD processes in their entirety. Based on the present findings, the main recommendation is that TPD effectiveness should be investigated from multiple perspectives. Findings from large-scale studies such as the meta-analyses of Timperley et al. (2007) and Hattie (2009), which report effect sizes for TPD in terms of student performance, offer valuable confirmation of TPD's impact on both teaching practice and student learning, so justifying TPD in general. However, as these studies fail to specify the processes underlying teacher change in the classroom, future research should also concentrate on opening the TPD "black box" to analyze TPD micro-processes along multiple dimensions. Current research refers to Desimone's (2009) core conceptual framework for studying the effects of TPD on teachers and students as an essential basis for investigating the interactive, non-recursive relations between TPD core features, increased teacher knowledge and beliefs, changes in instruction, and improved student learning. In this context, more detailed description and analysis of TPD core features is certainly needed. Despite theoretical consensus about TPD core features (Desimone, 2009; OECD, 2017; Wilson, 2013), any definitions remain quite vague, leading to varying implementation from program to program and consequent difficulty in generalizing findings. More systematic analyses of TPD core features are needed, based on multiple methodological approaches that go beyond teachers' self-reports or vague implementation checks that assess whether specific core features are implemented. Studies such as Borko (2008), Dobie and Anderson (2015), Santagata and Bray (2015), and van Es (2012) represent pioneering work in this field that broadens our understanding of what really happens during TPD and what may

prove effective in changing teachers' approach to instruction and subsequent student achievement. As these studies are predominantly based on small samples, additional research that builds on previous findings should increase samples sizes to ensure more generalizable results. To this end, future research might also pursue more effective and timesaving methods of video-coding to cope with the analysis of larger data sets.

6.3 Suggestions for future TPD practice

The present findings also have several implications for the design of TPD programs, which are summarized in Figure 6.

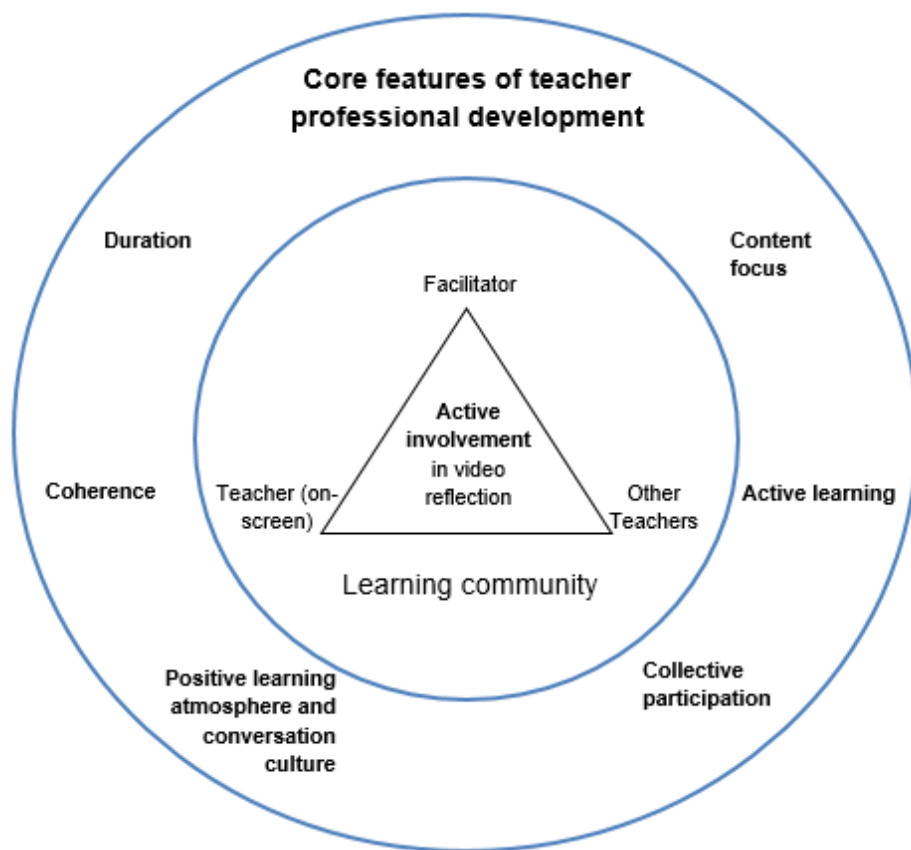


Figure 6: Framework for video-based TPD (adapted from Alles et al., 2018)

The framework described in Figure 6 promotes a situated approach to teaching and professional development and the implementation of particular TPD core features (learning atmosphere and conversation culture, content focus, active learning, and collective participation). A positive learning atmosphere and conversation culture frame TPD as a comfortable place for

teachers to share their experiences with others and to reflect on their own teaching practices (Borko et al., 2008; Gröschner et al., 2014; van Es, 2012). Additionally, a continuous focus on content — in this case, goal clarity in classroom dialogue — may serve to leverage change and active learning among participating teachers while collective participation in video-based discussions can create opportunities for teachers to rethink their instruction and to accommodate improved teaching strategies. The essential role of the TPD facilitator is also highlighted (Borko, Jacobs et al., 2014; Gröschner et al., 2014; Molle, 2013; van Es et al., 2014) in establishing a learning environment that allows teachers to share their teaching practice with others and to be open to change. Our findings indicate that the facilitator's role is not rigid; on the contrary, the role changes over time in keeping with TPD activities (lesson planning, video reflection, etc.).

The present findings also support the view that video-based reflection should be a central component of teacher learning and professional development, linking TPD to teachers' daily practice and supporting change in teachers' thinking through collective video-based reflection (Blomberg et al., 2014; Coles, 2013; Marsh & Mitchell, 2014). Seeing their own teaching on video can engage teachers in productive discussions and mediates the exchange within the learning community between the on-screen teacher, teachers in the learning community, and the facilitator. Previous research suggests that development of the learning environment may vary, depending on the kind of video used (videos of teachers themselves vs. stock video of unknown teachers) (Beisiegel et al., 2017; Seidel et al., 2011; Steffensky & Kleinknecht, 2016) and the nature of facilitation (trained facilitator-led vs. teacher-led) (Alonzo & Kim, 2018; Beisiegel et al., 2017). In this context, Kleinknecht et al. (2014) offer evidence-based recommendations for the design of video-based courses that include such issues as pedagogical approach, planning of teaching-learning-phases, selection of video type, and facilitation. While these suggestions may help in determining how to best combine and implement TPD core features in specific programs, there remains a need for additional research detailing how best to design effective TPD.

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List of Appendices

Supplement 1: Eidesstattliche Erklärung

Supplement 2: Essay 1

Alles, M., Seidel, T., & Gröschner, A. (2018). Toward better goal clarity in instruction: How focus on content, social exchange and active learning supports teachers in improving dialogic teaching practices. *International Education Studies*, 11(1), 11–24. doi: <https://doi.org/10.5539/ies.v11n1p11>

Supplement 3: Essay 2

Alles, M., Seidel, T., & Gröschner, A. (2018). Establishing a positive learning atmosphere and conversation culture in the context of a videobased teacher learning community. *Professional Development in Education*. Avance online publication. doi: <https://doi.org/10.1080/19415257.2018.1430049>