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Elements affecting the development of professional learning communities in schools

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Abstract This article focuses on the development of professional learning communities (PLCs), which are communities within schools, composed of voluntary participating teachers facilitated by school principals with a specific task to accomplish as part of a larger innovation project. Four PLCs were observed during 3 years by using questionnaires and participatory research. The questionnaires revealed that PLCs differed in their group characteristics, collective learning processes and outcomes. Through participatory research, we explored seven elements affecting the development of PLCs, namely, task perceptions, group composition, tensions between roles, beliefs about alignment, reflective dialogues, socialisation and ownership. Beliefs about alignment, ownership and socialisation had sufficient impact on the development of the PLCs. A case study including two contrasting PLCs indicated interrelations between task perceptions and ownership by members and between ownership and socialisation activities. Regarding implications, this research suggests to explicitly create and facilitate reflective dialogues and ownership over time for PLCs to flourish.

Introduction

Professional learning communities (PLCs) are understood as effective learning environments when they have "impact on the professional learning and morale of the staff-teachers, school leaders and other adult workers and, most importantly, impact on student

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achievement" (Bolam et al. 2005, p. 3). Based on the original work of Newman (1996), Vescio et al. (2008) showed that effective PLCs draw upon at least five elements, namely, shared values and norms, clear and consistent focus on student learning, deprivatisation of practices, focus on collaboration and reflective dialogues. Effective PLCs are often intended and designed as learning environments for voluntary participating teachers facilitated by school principals (Binkhorst et al. 2015; Scribner et al. 2007). Participation in such PLCs requires dedicated and intentional effort from its members to learn through reflective dialogues in which they are exchanging experiences (Brown and Duguid 1996; Fuller et al. 2004).

As the potential of PLCs in enhancing professional development and school improvement is promising, and in practice many PLCs have both aims (Enthoven and De Bruijn 2010; Supovitz 2002), it is important for increasing our understanding of how elements affect the development of PLCs in schools (Vescio et al. 2008). The current body of knowledge regarding PLCs predominantly focuses on frameworks to identify learning processes within PLCs (Admiraal et al. 2012), characteristics of PLCs (Hindin et al. 2007), effects of existing teams that are marked as PLCs on student results (Lomos et al. 2011; Visscher and Witziers 2004) or the relationship between schools as PLCs and school outcomes (Sigurdardóttir 2010). However, most of this research neglects the complex interactions and transfer possibilities of teachers in PLCs and their schools (Hindin et al. 2007; Opfer and Pedder 2011).

This article presents an exploratory study that aimed to contribute to the existing body of knowledge by adding an in-depth understanding of elements affecting the development of PLCs in schools (Vangrieken et al. 2015), the study went beyond a simple list of elements and aimed to gain insight into their occurrence and interrelatedness over time (Cranston 2009, DuFour 2004). In the following section, we discuss existing literature in order to develop a conceptual frame of elements. After that, we present our research questions and explain the context of our study. The "Method" section specifies why and how we used longitudinal and participatory research.

Theoretical framework

The current study used the framework developed by Mittendorff et al. (2006) for revealing differences between PLCs. They distinguished group characteristics, collective learning processes and collective learning outcomes as three categories to reveal how PLCs develop. Group characteristics refer to the group composition, atmosphere and learning climate in the PLC. Collaborative activities refer to the activities of members in a PLC in the context of the school, while collective outcomes refer to the realisation of desired outcomes for professional development or school improvement (and can even affect the learning processes in the PLCs).

To add to this general framework and to be more specific, we drew on previous research to identify more specific elements which affect the development of PLCs, such as reflective dialogues, shared vision and collaborative activities (Brouwer et al. 2012). Those elements refer to collective learning in the context of PLCs (Decuyper et al. 2010; Grossman et al. 2001; Hord and Boyd 1995; Lomos et al. 2011; Sigurdardóttir 2010). Other research stressed the importance of stability of the composition of PLCs and ownership of its members (Stoll et al. 2006). The stability of the group composition refers to the role of school principals (e.g. the extent to which principals are able to align with teachers' needs)

and to ownership of principals as well as members (e.g. extent to which teachers take the initiative and/or perceive the PLC as their community (see Palinscar et al. 1998). Those five elements are further elaborated in the next two subsections.

Reflective dialogues, shared vision and collaborative activities

Reflective dialogues, originally referred to as inquiry learning in PLCs (Hord 1997), are generally conceived of as types of talk in which knowledge is exchanged and developed to enhance understanding and problem-solving (Mercer 2008). Horn and Little (2010) showed the importance of reflective dialogues in teacher teams as sources for exchanging experiences and accessing, conceptualising and learning from problems in teaching practice. Lomos et al. (2011) concluded from their meta-analysis of the relation between subject-related teacher teams and student achievement that an increasing extent of reflective dialogues and collaborative activities in PLCs has positive effect on school improvement. Perceived emotional safety to share personal and confidential information, collective responsibility and mutual trust appear to be important for dialogues to be reflective (Admiraal et al. 2012; Hord 2004). Snow-Gerono (2005) showed that participating in PLCs increases uncertainty among members, for example, in accepting a role as learner instead of being an expert teacher. Scholars like Supovitz (2002) concluded that PLCs affect school cultures, but that a lack of reflective dialogues and collaborative activities decreases its impact on teacher professionalisation and student outcome. Although reflective dialogue is widely assumed to be important for PLCs (Vescio et al. 2008), it is still often a virgin area of in-depth research (Stoll et al. 2006). Subsequently, it is too often assumed that conversations in PLCs lead to extensive and continuing reflective dialogues among teachers about curriculum, instruction and student development (Newman 1996). De Groot et al. (2014), among others, postulated that more studies are needed to better understand how reflective dialogues have an impact on the development of PLCs.

Besides reflective dialogues, both Stoll et al. (2006) and Vescio et al. (2008) showed in their reviews of the impact of PLCs on capacity building in schools that collaborative activities are important for the development of PLCs. Although identified as important, collaborative activities are often referred to as a general category without specifying actual activities. Philips (2003) specified collaborative activities of members in PLCs into classroom observations, studying literature, reviewing videotaped lessons, developing new educational materials and investigating new ideas for teaching. Recently, Tam (2015) confirmed the importance of collaborative activities such as action research and classroom observations and showed that the outcomes of such activities often serve as a starting point for reflective dialogues about teaching and learning. These reflective dialogues provide alternative ways of thinking and learning.

Andrews and Lewis (2007) showed that having a shared vision and sense of purpose on school improvement is important for developing PLCs. More recently, Lomos et al. (2011) showed that a shared vision of, for example, professional development and student learning, enhances school improvement, while Decuyper et al. (2010) referred to the impact of developing a shared mental model as a team on school improvement.

Stability of group composition and ownership

Research showed that enhancing the development of PLCs in schools is a challenging enterprise for school principals and project leaders (DuFour 2004). Scribner et al. (2007) showed that the effectiveness of teacher teams working on innovations greatly depends on

the extent to which school principals are able to align teacher needs and organisational needs in PLCs. School principals often wonder how to stimulate PLCs and experience tensions between structuring, managing and facilitating PLCs and struggle with often unpredictable processes and outcomes of PLCs (Burke et al. 2007). They tend to control the progress and results of PLCs, while members prefer professional autonomy (Hargreaves and Fullan 2012). Simultaneously, school principals are often responsible for connecting PLCs with actual developments in schools (King 2014; Vangrieken et al. 2015).

At the same time, if teachers in PLCs experience ownership, they take more responsibility that increases the effectiveness of innovations (Scribner et al. 2007; Vähäsantanen 2015). However, ownership is still a diffuse concept and too often used as a 'panacea for everything' (Breitling 2008). It is here generally referred to as a teacher's mental or psychological state of feeling that he/she is the owner of a PLC, which develops through mental and/or physical investments in that initiative (Pierce et al. 2003). Research on distributed leadership showed that ownership is an emergent property of interacting individuals, which arises through collective expertise development (Decuyper et al. 2010). Ownership also depends on the extent to which PLCs are aligned to innovation strategies and change management processes in schools (Desimone 2009; Fullan 2009; Kooy and Van Veen 2012).

Using a predominantly top-down approach to teacher professional development, without taking the situational and social nature of teacher learning into account (Clarke and Hollingsworth 2002), potentially threatens ownership and consequently the impact of professional development programmes such as PLCs (Guskey and Sparks 2004; Wayne et al. 2008). Research showed that a top-down approach often negatively affects outcomes at different levels, ranging from teacher satisfaction and ownership to student learning outcomes (King 2014; Stoll et al. 2006). More specifically, it can negatively affect, for instance, teacher autonomy (Scribner et al. 2007) and self-efficacy for learning (Visscher and Witziers 2004).

Research questions

The three main questions of the present study were: (1) To what extent do PLCs differ in their group characteristics, collaborative activities and collective outcomes? (2) How do PLCs manifest in practice using illustrations from members and school principals? and (3) How do reflective dialogues, shared vision and collaborative activities, stability of group composition and ownership affect the development of PLCs and to what extent are they interrelated? The first research question involved exploring PLCs in a deductive manner, while the second and third research question involved exploring development of PLCs using a combination of deductive and inductive analysis, referring to elements based upon previous research as outlined in the theory section and to elements that might arise from the data. Perceptions of members and school principals were used to study the development of PLCs in schools, because perceptions indicate multiple voices, truths and meanings, which seems to be an adequate perspective for exploring the development of PLCs and answering the three research questions (McCormack 2004).

Method

Design

This study used a site-based, mixed-method and longitudinal case-study approach to reveal elements affecting the development of PLCs in schools and how these elements are possibly interrelated and might even change over time. Four PLCs were followed for three years using participatory research and questionnaires. For revealing how differences among the PLCs developed, we traced the perceptions of the members of the PLCs of group characteristics, collaborative activities and collective outcomes. We administered questionnaires during the second and third research year. The outcomes of the questionnaires in the first ($n = 16$) and second measure ($n = 24$) were used to gain a general view of the PLCs in terms of group characteristics, collaborative activities and collective outcomes.

Participatory research was used to enhance ecologically valid understanding of the four PLCs in schools (Denzin and Lincoln 2000). One researcher who participated in the group and used observational schemes to articulate processes and results of the PLC (Singleton et al. 1993) studied each PLC. The participatory researchers used the observational schemes to collect meaningful quotes or statements from both members and school principals (see "Appendix 1"). Six observational schemes were filled in for each of the four PLCs ($n = 24$).

Context of the study

In the present study, PLCs are referred to as neither schools (Stoll et al. 2006) nor external networks (Jackson and Temperley 2007), but as a community of teachers within one school (Levine and Marcus 2010). Moreover, the PLCs have a specific task to accomplish as part of a larger innovation project. They are organised as a community with a flat hierarchical structure in which one of the participants was a primus inter pares (i.e. a project leader) and in which each participant had equal value in decision-making and problem-solving (Grossman et al. 2001).

PLCs in this study formed the heart of an innovation project by three schools for pre-vocational education and one institute for teacher education in the Netherlands. The project was initiated by the schools themselves as a three-year innovation to develop and realise new professionalisation practices for vocational teachers. Self-organisation and ownership were key elements of the innovation strategy of the project. The PLCs were supposed to have autonomy in developing strategies and outcomes, within the frame of the innovation project. An internal project team in which the project leaders of all PLCs participated and was validated and facilitated by a steering committee composed of the four school principals formulated the innovation strategy. The steering committee was responsible for the finance, administration and organisation of the project. The steering committee and the school principals were the legal holders of the innovation project. New practices had to be developed by the schools themselves. PLCs were supposed to be a relevant instrument to realise sustainable change in schools. Each school, including the school for teacher education, organised a PLC within the school. The four PLCs worked together by exchanging ideas and reflecting on preliminary results.

The problem statement of the overall innovation project expressed the concern that regular teacher education did not initially develop the knowledge and skills that teachers in

vocational education need to prepare their students for occupational practice. The current study was established as part of a research programme associated with the innovation project in order to explicate and evaluate findings. The innovation project was subsidised from a governmental programme under the terms that strategies, processes and results would be made public. The main purpose was to learn from the successes and failures of the projects. All project members, including members of the PLCs, participated voluntarily in awareness of these terms, following the research code of educational research and the legal privacy code in the Netherlands.

General features of the PLCs, participants and ethical approvals

The PLCs were part of an innovation project in which their school took part. All PLCs therefore had the same aim, means and time to fulfil their task. Teachers of the four schools volunteered to participate in a PLC because their task and interest matched with the aim of the innovation project. For instance, some members were teachers and also supervisors of student teachers or curriculum developers of the pre-vocational programmes. Some members were particularly interested in further professionalisation of teachers within their school/institute. The members chose a primus inter pares, a project leader, among themselves. Meirink et al. (2010), among others, showed that a project leader is important in guiding and facilitating the PLC as well as in enhancing ownership. Only in the institute for teacher education did the school principal participate in the selection process of the project leader, whereas this project leader was also the chair of the meetings of project leaders of all schools and the direct contact with the steering committee. Furthermore, in all PLCs for pre-vocational education, one teacher educator from the teacher education institute participated in order to interconnect the work of the PLCs in the pre-vocational schools and the teacher education school. These teacher educators had formal roles at the pre-vocational schools as coaches and sparring partners for workplace learning as part of the regular teacher education programmes. Thus, it was quite natural to participate in the PLCs too. The PLCs differed in size, composition and initial position in the school (Table 1), and they were facilitated by school and project funds (e.g. in terms of extra time and administration facilities).

The research project complied with the standards of the Organization for Scientific Educational Research in the Netherlands, including guidelines and criteria for anonymously collecting as well as processing data and voluntary participation in scientific research. Further, an ethics proposal was drafted based on legal standards and privacy codes in general in the Netherlands. All participants agreed with the guidelines and approved the form regarding legal privacy codes.

Procedure

The questionnaire was based on the three main categories of Mittendorff et al. (2006), which were specified into concrete questions in recognisable language for teachers in the PLCs. For example, group characteristics was translated into four questions (e.g. "The PLC enhances dialogue between members and the school principals"). Collaborative activities were specified into four questions (e.g. "We exchange experiences to learn from each other"). Collective outcomes were specified into five questions (e.g. "Teachers in our school take advantage of the development insights and products of our PLC"). The questions were measured with a five-point Likert scale, both regarding evaluation (e.g.

Table 1 General features of the four PLCs

Feature	PLC 1	PLC 2	PLC 3	PLC 4
School type	Teacher education for 14 general subjects and one vocational subject, bachelor and master, part-time and full-time. The institute was contractor of the innovation project (e.g. leading party and the school principal was chair of the steering committee)	Part of a regional college for agricultural education in a rural area. The school is a separate unit – a small school in a separate building, for pre-vocational programmes (12–16 years old)	Innovative and flourishing school for pre-vocational education (12–16 years old) in a small city, incorporating both general and vocational tracks	Small school in one of the four big cities in a disadvantaged urban area, offering only pre-vocational tracks. In the final year of the project, the school merged with another pre-vocational school (12–16 years old)
Members and school principals	At the start, six teacher educators participated in the PLC. Three of them also participated as 'linking pins' in each of the three PLCs in pre-vocational education. At the end of the project, two members were less involved. In the final stage of the innovation project, one of the members, the chair of the group, also was the project leader of the innovation project	At the start, four teachers participated. At the end of the project, six teachers participated. One teacher was responsible for workplace learning of student teachers, who were temporary interns. This teacher acted as the chair of the group. One teacher-educator from teacher education participated	At the start, four teachers participated. At the end, five teachers participated; the teachers who participated from the beginning were perceived as core members. One teacher as chair of the PLC was primarily responsible for workplace learning of student teachers, who were temporary interns. One teacher-educator from teacher education participated	At the start, three teachers participated. At the end, five teachers participated. One teacher was primarily responsible for workplace learning of student teachers who were temporary interns. This teacher acted as the chair of the group. One teacher-educator from teacher education participated
Focus	Professionalisation of teachers in vocational education and innovation of teacher education itself (i.e. better preparing for teaching in vocational education)	Educating and professionalisation of (student) teachers for teaching in vocational education in particular with respect to context-based education and authentic assignments	Educating and professionalisation of (student) teachers for teaching in vocational education in particular with respect to pre-vocational technical education	Educating and professionalisation of (student) teachers for teaching in vocational education, particularly with respect to the school in relation to the neighbourhood and family contexts

strongly agree/disagree) and frequencies (e.g. always/seldom). Cronbach alpha coefficients were calculated and showed acceptable indications for reliability concerning group characteristics (0.77), collaborative activities (0.71) and collective outcomes (0.87).

As for the participatory method, teachers in the PLCs were informed about the research goals and the dual role of the participatory researchers, both as facilitators and motivators in PLCs (particularly during the first year) as well as researchers who had to observe, analyse and report findings (particularly in the second and third year). The participatory researchers in the PLCs engaged in the process of the PLCs as external members because they were not teachers from the school itself. In their role as (external) member, they actively and critically discussed, reflected and developed decision-making and problem solving. They were also present during the meetings that PLC members had a few times each year with the school principal, either to prepare for the PLC meeting or to discuss the activities of the PLC. At the same time, the participatory researchers observed and artic- ulated processes, activities and results from the PLC. In their role as both external member and researcher, they regularly used their observations to give feedback to the PLC (En- thoven and De Bruijn 2010).

The observational schemes were intended to articulate the observations of participatory researchers in the three general categories of Mittendorff et al. (2006), which also allowed exploration of the five from previous research identified elements (i.e. reflective dialogues, collaborative activities, shared vision, role of school principals and ownership). Such an open way of collecting data allowed other categories to pop up from the data or allowed participatory researchers to articulate other observations (Miles and Huberman 1994). Participatory researchers made notes during group meetings and analysed notes of mem- bers and school principals and video recordings of the meetings. In line with Guba (1981), we used different sources for collecting authentic and referential material. Participatory researchers completed six observational schemes for each PLC in the second and third years of the research. This means that the observational schemes reflected episodes of approximately three months of participatory researchers' observations, as the summer holidays and Christmas period were not included.

The six observational schemes per PLC ($n = 24$ in total) were checked by the two authors for comprehensibility, referring to the extent to which the observations were comprehensible for others to understand (Guba 1981). The authors independently checked the data and subsequently crosschecked their findings. Each completed observational scheme was discussed in a session with the entire research team after the period when the scheme was completed. In the session, the four participatory researchers and the two authors discussed how to make interpretations more precise in wording and meaning. At the end of the session, the observational scheme was finalised by the participating researcher. During this process, the participatory researchers were asked to make their observations more concrete with illustrations and examples of activities of the PLCs. The two authors were part of the research team in the roles of coordinator to support the participatory researchers and overall supervisor.

Analysis

The analysis included four main steps including both deductive and inductive ways to answer the three research questions. Questionnaires were used to reveal differences between PLCs concerning group characteristics, collective learning processes and out- comes (i.e. research question 1). Participatory research was used to gain insight into elements affecting the development of PLCs (i.e. research question 2) and how elements are interrelated and eventually change over time (i.e. research question 3). PLCs were viewed as the main units of analysis (Yin 2003).

Step 1

Deductive analyses were performed by the two authors, who independently analysed the observational schemes for testing and confirming the initial elements of reflective dialogue, collaborative activities, shared vision, role of school principal and ownership (Daly et al. 2010; Trochim and Donelly 2008). The authors independently analysed the 24 observational schemes to identify elements that appear to be key in the development of the PLCs (i.e. the five elements served as a frame of reference, Denzin and Lincoln 2000). Both activities (i.e. words and phrases of members and school principals referring to formal and informal activities and behaviour) and processes (i.e. words and phrases of members and school principals indicating changes over time or sequences of events) were used to identify and illustrate the five initial elements (Bogdan and Biklen 2007). The results of this first step were considered in one discussion with both authors lasting about four hours. Following a naturalistic way of dealing with trustworthiness, the discussion was aimed at reaching consensus about the five elements (Guba 1981). The authors finally concluded that the element reflective dialogues (i.e. referring to the extent to which PLCs receive feedback, collectively reflect and solve problems) and ownership (i.e. feeling responsible and showing motivation for working and learning in the PLC) were explicitly identified in the data. During the discussion, shared vision was reformulated into task perceptions because members and school principals often reflected on the extent to which and the way in which the PLCs were able to identify their tasks and aims. The element collaborative activity was replaced by socialisation, referring to all activities of members in transferring their outcomes to the school context. The role of the school principal was reformulated into 'tensions between roles', because the data particularly reflected tensions between the roles of both members and school principals. Tensions were observed, for example, between being a member of the PLC and the task of teaching, as well as between different views on the role of PLCs.

Step 2

Inductive analyses were performed to identify additional elements by independently going 'back and forth' between data and the five initial elements, by asking analytical questions to sharpen our first analysis and to test our ideas (Denzin and Lincoln 2000). Additional elements were identified when articulated observations and statements of members and school principals repeatedly included reflections on activities with perceived impact on the development of PLCs which cannot be related to our five initial elements (Miles and Huberman 1994). A second discussion between the two authors was organised, aimed at verifying the five initial elements and identifying other elements. This second discussion took about three hours before consensus was reached. In this discussion, the central question for analysis was: 'What are words and phrases of members and school principals regarding activities and processes falling beyond the scope of the five initial elements and relevant for the development of PLCs in schools?' (Bogdan and Biklen 2007). Two additional elements were identified: beliefs about alignment of PLC in schools (i.e. how members and school principals believe that PLCs need to be aligned in schools); and composition of the PLC and school principals (i.e. changes in the composition of the PLC or changes in the management of the school). Both authors showed agreement in their identified elements during the second discussion. Three out of seven elements relate to characteristics of PLCs themselves, namely, composition, socialisation and reflective

dialogues. Task perceptions, tensions between roles and ownership are elements related to members of PLCs, whereas ownership by school principals and beliefs about alignment of PLC in schools are more related to the school context. Understanding the seven elements in the development of PLCs was deepened by searching in the observational schemes for meaningful illustrations and examples using the voices of members and school principals.

Step 3

The results of the second step were presented by the authors to the participatory researchers for validation (Miles and Huberman 1994). The participatory researchers had the possibility to verify the elements with their experiences and observations. Some small revisions were made, for example, by adding concrete examples to illustrate the elements.

Step 4

To reveal how the elements affect the development of PLCs over time and how they interrelate, a contrast analysis approach was used. The outcomes of both the questionnaires and participatory observations were used to select for an in-depth case study two PLCs that showed the relatively largest differences among their development. PLC 2 and 4 were selected. The observational schemes were used for constructing a narrative for PLC 2 and 4, which involved producing stories (Leeferink et al. 2015). The aim was to construct a configuration of the data for each PLC into a temporally organised narrative that was sensitive to the context of the PLC (McCormack 2004). The narratives for each PLC include a description of the most important and meaningful events that happened in the context of PLCs, as well as a visual representation in the form of a 'web' (i.e. a relational whole of different factors and/or phenomena interrelated in a complex system, Davis and Sumara 1997).

Results

The results are presented in three sections. First, the outcomes of the questionnaire are presented in order to give an overview of the four PLCs regarding group characteristics, collaborative activities and collective outcomes. Averages for each question are used to explore differences among the PLCs. Second, the seven identified elements that affect the development of the PLCs are illustrated with quotes from teachers and school principals. Third, two PLCs are purposefully compared, using a contract analysis approach to illustrate how the elements affect the development of the two PLCs.

General overview the PLCs

The general response was relatively high for each PLC, although the response was lower for the second measurement (Table 2). On average, all members of the four PLC perceive the four group characteristics as relatively strong (Table 3).

The questions concerning group characteristics of the four PLCs showed that members of PLC 2 ascribed positive meaning to the PLC as an instrument for professionalisation. This was the case in both measurements.

Table 2 Response for the questionnaires	PLC	Time 1		Time 2	
		N	%	N	%
	PLC 1	5	100.0	5	80.0
	PLC 2	4	100.0	6	83.3
	PLC 3	4	100.0	7	85.7
	PLC 4	3	100.0	6	83.3
	Total	16	100.0	24	83.1

Interestingly, all four PLCs showed a decline on the third question in the second measurement concerning the perceived extent in which the PLC enhances alignment between individual teacher learning and school development. PLC 1 showed the lowest score here in the second measurement.

Generally, concerning the collaborative activities, all four PLCs showed a decline between the first and second measurement (Table 4). Again, the members of PLC 2 scored higher on all four questions. The members of PLC 4 scored relatively low on the extent of collaborative activities in their PLC. Specifically, collaborative problem solving was less frequently perceived.

With respect to the collective outcomes, the members of PLC 2 perceived that their PLC fosters some collective outcomes, such as professionalisation of colleagues and the school as organisation (Table 5). It is noteworthy that this was mainly the case during the second measure: the scores changed from 2.6 into 3.2.

Interestingly, the question concerning the outcomes of the PLC for the environment of the school (e.g. the neighbourhood, companies, non-governmental organisations) showed relatively low scores among all four PLCs. Perhaps this project goal was too ambitious to achieve during the three years of the project.

Illustrations of the elements affecting the development of PLCs

Illustrations are presented (Table 6) using quotes from both members and school principals as noted in the observational schemes by the participatory researchers. Quotes from the school principals are explicitly marked, whereas the other quotes without marks are from members. Rather than presenting all quotes, only the most significant and representative ones for illustrating general tendencies in the four PLCs are provided. It is also noteworthy that not all elements are necessarily recognisable for all four PLCs.

The illustrations show what the seven identified elements might look like in practice. For example, members of the four PLCs mentioned different tensions. Two tensions explicitly mentioned were between participation in the PLC and daily work in the schools (e.g. indicated by high work pressure, mode of survival, stress) and between the PLC and school development (e.g. indicated by positioning in the school, relation to the larger project). This was explicitly noticeable in PLC 1 and 2.

Members also articulated the relevance of reflective dialogues. More specifically, members explicitly mentioned reflection and feedback. The illustrations show the way in which the reflective dialogues that occurred differed for each PLC and over time. For example, in PLC 2, feedback enhanced reflection while, in PLC 4, the extent of feedback and reflection decreased. Similarly, ownership both increased and decreased over time in the different PLCs. Members and school principals differed in their ownership. For

Table 3 Means and standard deviations for group characteristics for each PLC

Characteristic	Mean (SD) for Time 1				Mean (SD) for Time 2			
	PLC1	PLC2	PLC3	PLC4	PLC1	PLC2	PLC3	PLC4
PLC for collective professionalisation	4.0 (0.7)	5.0	4.0 (0.5)	3.8 (0.9)	3.8 (0.5)	4.6 (0.5)	4.3 (0.8)	3.4 (1.1)
PLC enhances reflective dialogue	3.0 (0.7)	4.0 (1.7)	3.3 (1.7)	3.3 (1.5)	3.5 (1.3)	3.6 (.09)	3.8 (0.8)	3.4 (1.1)
PLC enhances alignment	3.2 (0.5)	4.7 (0.6)	3.8 (0.5)	3.8 (0.5)	2.3 (1.3)	4.0 (0.7)	2.8 (1.3)	3.4 (0.9)
PLC structural for teacher learning	3.8 (0.4)	5.0	4.4 (0.5)	4.0 (0.8)	4.0 (1.2)	4.6 (0.5)	4.2 (1.1)	4.0 (1.4)
Average	3.5 (0.6)	4.6 (0.6)	3.9 (0.8)	3.6 (0.9)	3.4 (1.1)	4.2 (0.7)	3.8 (1.1)	3.5 (1.1)

Table 4 Means and standard deviations for collaborative activities for each PLC

Characteristic	Mean (SD) for Time 1				Mean (SD) for Time 2			
	PLC1	PLC2	PLC3	PLC4	PLC1	PLC2	PLC3	PLC4
Exchanging experiences	3.2 (0.84)	3.7 (0.58)	3.3 (0.50)	3.3 (0.50)	3.0	3.0 (0.7)	2.8 (0.8)	2.6 (1.1)
Working and learning together	2.8 (0.84)	3.7 (0.58)	3.5 (0.58)	3.0 (0.82)	2.3 (0.5)	3.2 (0.8)	2.3 (0.5)	2.4 (1.1)
Collective reflection	3.0 (0.71)	3.7 (0.58)	2.8 (0.50)	2.5 (0.58)	2.8 (1.3)	3.6 (0.9)	3.2 (0.8)	3.0 (0.7)
Collaborative problem solving	2.8 (0.84)	3.7 (0.58)	3.0 (0.82)	2.5 (0.58)	2.3 (1.1)	2.2 (1.3)	2.5 (0.5)	2.2 (0.8)
Average	3.0 (0.81)	3.7 (0.58)	3.1 (0.61)	2.8 (0.62)	2.6 (0.8)	3.0 (0.9)	2.7 (0.7)	2.2 (0.9)

Table 5 Means and standard deviations for collective outcomes for each PLC

Characteristic	Mean (SD) for Time 1				Mean (SD) for Time 2			
	PLC1	PLC2	PLC3	PLC4	PLC1	PLC2	PLC3	PLC4
Colleagues benefit from PLC	2.6 (1.1)	2.0	2.5 (1.1)	2.1 (0.9)	2.5 (0.6)	3.6 (0.5)	2.2 (0.4)	2.4 (0.9)
Students benefit from PLC	2.2 (1.3)	3.0 (1.1)	2.0 (0.5)	2.0 (1.2)	2.0	3.0 (1.2)	2.7 (0.8)	2.0 (0.7)
PLC enhances educational quality	2.6 (1.1)	2.0 (1.1)	2.3 (0.5)	2.1 (0.8)	2.3 (0.5)	3.0 (0.7)	2.0	2.8 (1.1)
The school benefits	2.4 (1.1)	3.5 (0.7)	2.5 (1.1)	2.0 (0.8)	3.0 (0.8)	3.4 (0.9)	2.8 (1.1)	2.6 (1.1)
The schools' environment benefits	2.3 (1.3)	2.7 (1.5)	1.8 (0.5)	2.5 (0.6)	1.8 (1.1)	2.8 (1.5)	2.8 (0.8)	2.0 (0.7)
Average	2.4 (0.2)	2.6 (0.8)	2.2 (0.7)	2.2 (0.9)	2.3 (0.6)	3.2 (1.1)	2.5 (0.6)	2.4 (0.9)

Table 6 Illustrations per PLC for the seven elements using quotes from members and school principals

Elements	PLC			
	1	2	3	4
Reflective dialogues	"For our group it is extremely relevant that we are listening carefully to each other. However, really listening is difficult for us" "We collectively learn mainly through exchanging our experiences, but only superficially"	"Giving each other feedback as a critical friend enhances critical self-reflection" "The informal culture in our group is often enhances more incidental than systematic reflection. I think we can do that more professionally"	"During our research we organised interviews with experts. We all used the same format, with room for own questions and input from the experts. The feedback of such experiences truly inspires me" "Collectively reflecting is a problem for us. In our meetings there is little to no room for reflection because other issues need priority. This while reflection is at the core of what a PLC should be"	"Reflection and feedback decreased during the project. This is also due to a lack of experience with critical reflection and possibly a lack of adequate support to learn to reflect" "Foremost receiving feedback is sometimes difficult; members often experience feedback in the PLC and in the school as interfering and irrelevant. We present preliminary results to each other, but no open dialogue takes place"
Ownership	"There is a large difference in commitment. Most members are explicitly involved but only in conversations. When it comes to specification and implementation only some colleagues are involved"	The focus on the primary process of teaching increases our enthusiasm for developing ideas. This also affects our motivation for the PLC" "We all show dedication"	"When I compare the three different years of our group I notice a change in responsibility: our school principal became more responsible and as a consequence, ownership by the members increased"	"I work mainly together with one colleague. We share our thoughts and ideas. After each plenary meeting we make a document in which we both articulate our reflections" "I notice that the members of our PLC are not really enthusiastic about formulating goals in accordance with the project and the school. However, the school principal is really motivated to do so"

Table 6 continued

Elements	PLC			
	1	2	3	4
Task perception	"It is complex to figure out what our task is. What is our common assignment? What is our vision? We have too many roles and tasks and operate on various levels in the project"	–	"Searching is also a way of learning. However, it takes much of the available time and consequently, the content and project goals have been pushed into the background a bit and become more implicit" (school principal PLC 3)	"When we are seeking and feeling uncertain about the goals of the project and the PLC we talk and reflect with each other until we see new perspectives"
Tensions	"For me meaningful learning in the PLC is difficult to achieve when I work in a "mode of survival". My energy level becomes lower and lower, also due to a high workload caused by combining participation in the PLC and my regular work" "However, the PLC still remains a loosely coupled group in relation to the larger project. We do not make explicit connections between our outcomes and the main goals"	"I think the PLC is an inefficient way of working. Due to a high work pressure in my regular work I experience stress and dissatisfaction with the project goals and organisation" "It stays difficult to position ourselves in the dynamics of everyday educational practice, which for example makes moments for plenary meetings difficult to find"	–	"We all have little experience with practice-based research or design-based working. This implies a very different way of how we work and who we are. This takes a lot of time"
Changes in group composition	"Due to change in the management, we formulated some concrete tasks and elements in order to create a solid transfer. Unfortunately, we were not able to discuss the tasks and elements"	–	–	One member of PLC 4 reflected: "It cost us a relative lot of time to form a PLC. This was mainly due to the absence of the school principal. But also due to a lack of a clear view on our tasks and roles"

Table 6 continued

Elements	PLC			
	1	2	3	4
Beliefs about alignment	"The awareness that teachers need a much broader perspective is stimulated by working in a PLC. The dialogue should be encouraged on a higher level: the realisation that each teacher indeed can empower and improve educational practices within and outside their school" (school principal PLC 1)	"Insights from outside the PLC need to be translated first into concrete educational practices, before the PLC can learn collectively" (school principal PLC 2)	–	"A PLC is not automatically a suitable instrument for professionalisation of teachers. A school principal needs to think about the organisation of PLCs in a complex environment"
Socialisation	–	"In the school an explicit dialogue takes place as a result of our work as a group, for example about the curriculum, quality and evaluation"	"Developed products or insights are implemented and evaluated with practice-based research"	–

example, ownership in PLCs 1 and 3 decreased during the project. Differences between ownership by members and principals changed over time. This was most explicit in PLCs 3 and 4. The quotes show that ownership at least refers to commitment to project goals and tasks, taking responsibility and showing enthusiasm.

Case study of two contrasting PLCs

We selected PLCs 2 and 4 for comparison because the members not only showed the highest differences in their scores on group characteristics, collaborative activities and collective outcomes, but also because they perceived the elements affecting their PLCs differently, both in terms of nature and in time. Focusing on these two PLCs helped us to understand the way in which the seven elements together affected the development of PLCs. The narratives of PLCs 2 (see Fig. 1) and 4 (see Fig. 2) are presented in two forms: a web and a description. The webs are visual representations of the occurrence of the elements over time. The organising principle in the webs is the timeframe (i.e. the three
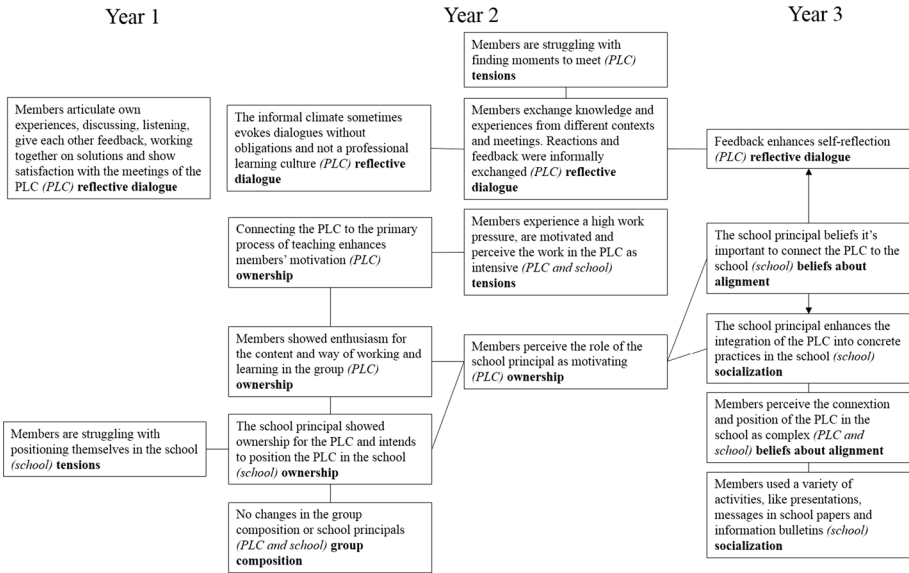
Year 1   Year 2   Year 3

Fig. 1 Web of PLC 2 (chronologically presented from year 1, 2 to 3)

years when the PLCs were studied) which means results are chronologically presented from the left to the right side (i.e. horizontally). Each component of the webs is labelled by two modalities: (1) in cursive, PLC, school or PLC/school, which refers to the primary context of the component and (2) in bold, one of the seven identified elements. The arrows and lines refer to observed and experienced relations by the participatory researchers; solely in the case of arrows, a 'direction' of the relation is articulated.

Case 1: PLC 2

This PLC starts with a phase of exploring tasks and aims, which is followed by a phase in which concrete activities are developed. Members present themselves in the school as a team and they share a common vision about their aims and professionalisation. They also experience a relatively high level of commitment to the community and to the goals of the project. The members perceive that their individual and collective learning activities positively affect practices in their school. The members have different fields of expertise, which enhanced learning. The output of the PLC is discussed during the meetings, in which members give each other feedback on ideas. Experiences are exchanged, in both formal and informal meetings. Synchronisation between the activities of the PLC and the school increases, because of different socialisation activities of the members (e.g. presentation, messages in school papers and information bulletins) and the facilitating role of the school leader who strongly supports these activities. Such activities outside the community generate insights in fundamental and practical problems. These problems are negotiated in the PLC, because members perceive them as challenges and starting points for further development. The members of PLC 2 exchange knowledge and experiences from different contexts and meetings. Reactions and feedback are also informally exchanged. Both members and the school principal experience this exchange and reflections as a meaningful way of externalising the results of the PLC.
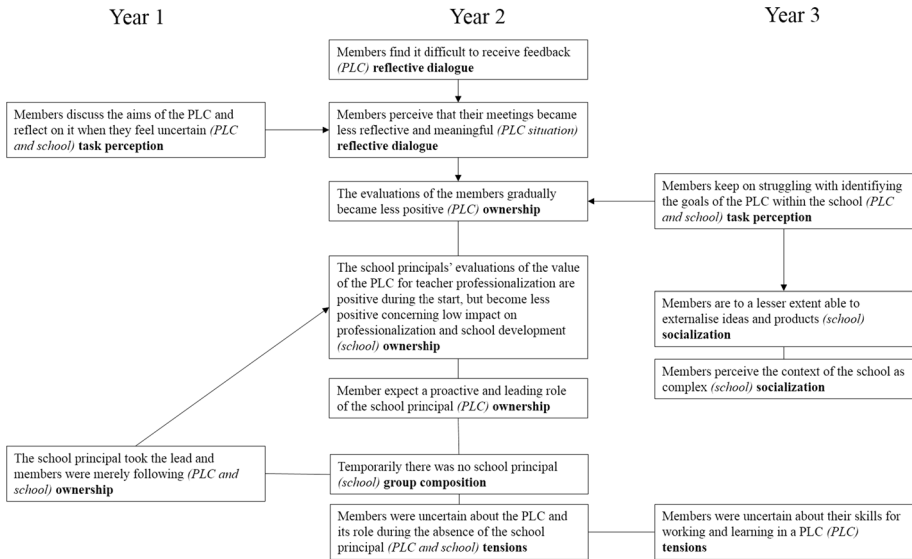
Year 1   Year 2   Year 3

Fig. 2 Web of PLC 4 (chronologically presented from year 1, 2 to 3)

At several moments, members experience tensions between participation in the PLC and the primary process of teaching. More specifically, the members and the school principal of PLC feel tensions between available time and the project's aspirations. Such tensions are discussed and reflected upon formally and informally. The school principal encourages the members of the PLC to position themselves explicitly in the school and to show not only ownership, but also an explicit vision about the aim and function of PLC. The school principal perceives the position of the PLC in relation to the school as important and states that the PLC contributes to school improvement. Different results of the PLC, such as presentations, formal meetings and descriptions of professionalisation activities, are documented in the school to make them available for those who are interested. Members critically reflect upon both their practice and school development. The PLC establishes more explicit attention in the school towards professionalisation of teachers and student learning. Several teachers in the school show willingness to learn because of the initiatives of the PLC.

Case 2: PLC 4

Members of PLC 4 work on concrete tasks, but they differ in their beliefs concerning the goals of the PLC and also in their commitment to the PLC. Two members share a feeling of having clear tasks as a PLC, while the other members perceive the goals of both the entire project and those of the PLC as too complex. Some members are highly motivated, while other members participate more passively. There is an informal and safe atmosphere. Coordination and alignment of project goals and the policy of the school is lacking. Because of a high workload, the members differ in their participation. The PLC is mainly used as a 'sounding board' by the school principal, which positively affects the focus of the members. The members of the PLC accept this position. Members learn foremost individually. There is a lack of a clear communication structure. Informally, experiences,

ideas, opinions and anecdotes are exchanged. However, receiving feedback is difficult for some members because they perceive feedback as threatening.

The school principal of the PLC is positive about the PLC and its results. Because of a large reorganisation and change of jobs, an interim school principal is appointed. He is also positive about the PLC but is less involved because of the ongoing reorganisation. Individual experiences are exchanged, but there is no alignment with other developments in the school. The results of the individual projects are presented and discussed in group meetings. Social interaction between the members decreases over time. Therefore, the PLC remains an isolated group in the school.

Discussion

This article is intended to contribute to current understanding of the development of PLCs by identifying elements that affect the development of PLCs in schools. In this section, we draw general conclusions about the elements affecting the development of PLCs, including their development over time, and how there are related. It is concluded that alignment, ownership and socialisation are key for developing PLC's in schools. Finally, we present some suggestions for further research.

General conclusions

Figures 3 and 4 depict the impact (size) of each of the seven elements and how they are related for the two contrasting PLCs. These figures show that: (1) the more an element is positioned in the middle, the more the element affects the development of the PLC, (2) smaller elements play a less important role, (3) a triangle represents an increasing or declining development over the years and (4) a square means few changes in the three years.

PLC 2 has the strongest potential as a robust PLC, because both reflective dialogues were generally perceived as meaningful and the school principal was positive about the PLC and active in connecting the PLC to the wider school context. Further, PLC 2 was the PLC with the least changes in composition and with strong ownership of its members. This could imply that some of our elements can be seen as dimensions (e.g. reflective dialogue, ownership, task perception, beliefs about alignment, socialisation and group composition),
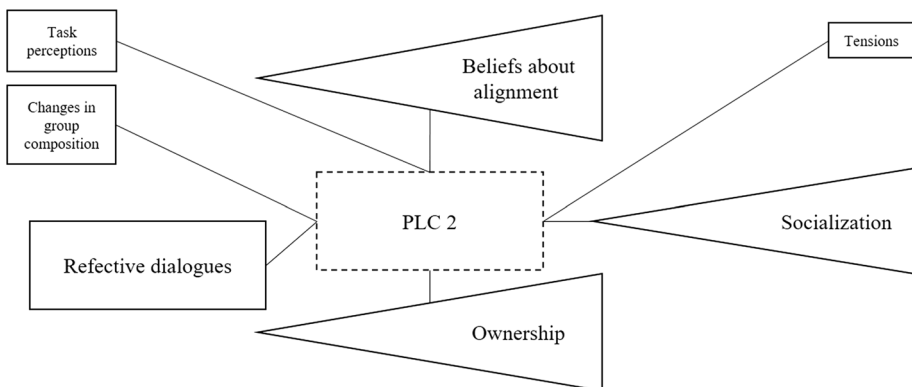

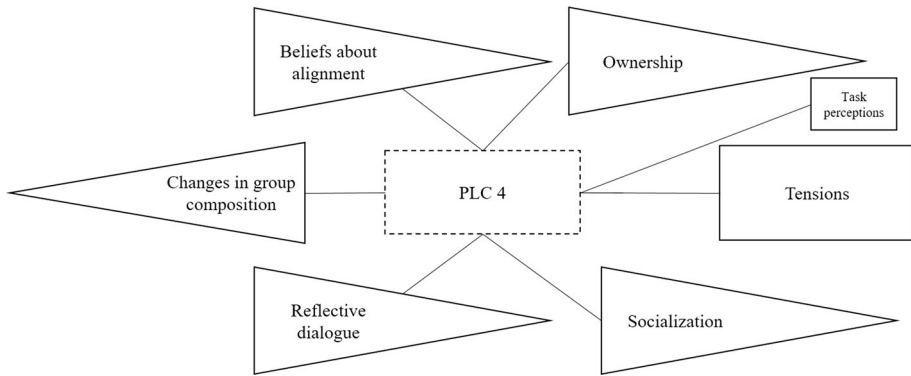**Fig. 3** Elements affecting the development of PLC 2

Fig. 4 Elements affecting the development of PLC 4

where high scores refer to more robust PLCs. The only exception here is the element tensions. Members of PLC 2 also experienced tensions between participation in the PLC and their teaching. Therefore, tensions per se do not hinder the development of PLCs. Some tensions could even foster feedback, reflection and further development. This could be further explored.

To a much lesser extent, PLC 4 was able to develop as a robust PLC with impact on professional development and school improvement. For example, the extent of socialisation and ownership decreased while, because of changes in the group compositions, the beliefs about alignment became less positive. Further, reflective dialogues were only observed in the first year, which also seems to affect the way in which the members experienced tensions.

Putting it generally, the elements affecting the development of the two PLCs in both a strong way (i.e. frequently explicitly mentioned in the data) and different way (i.e. increasing in PLC 2 and decreasing in PLC 4) are beliefs about alignment, ownership and socialisation (Admiraal et al. 2012). Previous studies showed, for example, that ownership is of crucial importance for professional development in schools, such as via PLCs (Ketelaar et al. 2012). In our study, members and school principals of PLC 2 showed more ownership during the project, both for working and learning in the PLC. Members of PLC 4 showed less ownership, mainly because a lack of identification with the task perceptions. They also worked foremost on their individual projects. Consequently, socialisation activities for PLC 4 in the school decreased.

Our results emphasise that ownership towards the aims of the PLCs, as well as the way of working in PLCs, are an individual as well as collective feeling of commitment and motivation of both members and school principals (Shipton 2006). The quotes of the principals and members showed that ownership at least refers to commitment to project goals and tasks, taking responsibility and showing enthusiasm. Such a feeling can differ between members as well as between members and school principals. Collective ownership is more than just cumulating individual feelings of ownership (Kelly 2015). It refers to strong positive attitudes, intentions and aligned behaviour of members who also reinforce each other in doing so (Supovitz 2002). Hairon et al. (2015) showed that collective ownership, referred to as collective and intentional teacher leadership, affects collegial and collaborative relations, teacher learning and teaching practices. In our study, PLC 2 showed how collective ownership during the entire project enhanced socialisation.

Apparently, collective ownership is critical for the development of PLCs in schools (Englert and Tarrant 1995).

The results of this study build further on recently-published research such as Hubers et al. (2016), who concluded that knowledge is created in conversations when members engage in both internalisation and socialisation activities. For example, our results show that socialisation has internal and external impact, referring to both activities within PLCs as well as activities between members of PLCs and colleagues in the schools. The members of the four PLCs explicitly shared, to a greater or lesser extent, experiences, personal knowledge and beliefs. In addition, within schools, members of the PLCs presented themselves as members of a PLC with concrete tasks to fulfil and developed services and products in relation to school development (Hindin et al. 2007). In our study, for example, the socialisation activities in PLC 2 often enhanced feedback and reflection during the reflective dialogues (Mittendorff et al. 2006).

Recommendations for further research

Although the research design allowed in-depth insights into elements affecting the development of PLCs over time and between contexts, a set of critical remarks and questions needs to be explicated. First, the design does not allow identification of causal relations and claims about the development of PLCs because of its explorative nature. However, the strength of our design is that we followed four PLCs during three years, thus obtaining insights from members and school principals and gaining further understanding through direct observations by participatory researchers. One could wonder whether the participatory researchers have had 'enough' insights into the way members of the PLCs externalised ideas or products in their schools. The participatory researchers were present during the formally-organised meetings of the PLCs, interviewed members and school leaders and had informal meetings, but it was practically impossible to follow and observe each member during conversations with colleagues.

The participatory researchers' observations of the extent and nature of socialisation are primarily based on perceptions and experiences of the members, because we used observational schemes as an instrument for participatory researchers to describe and structure their observations of the development of the PLCs. These schemes were indeed helpful for this purpose, but they could also have reduced the complexity of the PLCs in the context of the school. The schemes were designed as analytical forms and could have forced participatory researchers to downsize their observations into more superficial pronunciations. The participatory researchers were intensively trained and guided in using these schemes by external researchers and supervisors. They developed skills in finding meaningful patterns in all kinds of data, such as project meetings, minutes, proceedings and conversations, and in articulating them into meaningful observations, which allows analysis of external researchers. Nevertheless, data selection and interpretation as part of participatory research remains challenging with respect to trustworthiness (Denzin and Lincoln 2000; Guba 1981).

Given the previously-presented reflections, it is recommended that the research be expanded to include more PLCs and more members in different schools. Further research might explore if and how the seven elements are interrelated or which have more impact than others do in specific contexts. This could allow repeated measures in a multi-level design in which a larger number of teachers, PLCs and schools are included to reveal how the elements are related to different levels (e.g. teachers in PLCs and PLCs in schools). For example, one can question whether ownership is conditional for the development of PLCs, is an outcome of participation in a PLC, or both. Moreover, to what extent is ownership affected by the leadership of school principals or by the position of the PLC in the school?

To conclude, this study contributed to the body of knowledge with respect to PLCs as a way of improving educational quality (Pehmer et al. 2015). It shows that the four PLCs differed in their development and that at least three elements were significant for the development of PLCs. Those three elements were beliefs about alignment, ownership and socialisation. Actively and consciously enhancing (e.g. ownership and socialisation) or explicating (e.g. beliefs about alignment) these elements might enhance the development of PLCs. We found indications for interrelations between some elements, such as between task perceptions and ownership by members or between ownership and socialisation activities. Members who showed ownership of their professional learning and school improvement because of their participation in a PLC initiated more socialisation activities, such as creating opportunities in their school to explore the findings in practice (Stoll et al. 2006). Our results therefore could be promising for further enhancement of the development of PLCs in schools as learning environments with positive impact on educational quality.

Appendix 1

See Table 7.

Table 7 Observational Schema used during participating research in PLCs

Components	Description	Motivation	Sources*
Group Characteristics			
Learning Processes			
Learning Outcomes			
*General Questions***			

1. How can you describe, in your own words, the position of the PLC in the school (and the related activities)?
2. How can you describe your own role as participatory researcher in this PLC concerning the development of the relationship between learning in a PLC and school development?
3. Do you have other observations? If yes, explain them.
4. How can you describe, in your own words, the way and extent of collective reflection of the PLC in this phase?
5. What is the most important outcome of this PLC in this phase?

* Primary sources that the participatory researchers used, either direct or indirect (e.g. reports, meetings, minutes, assignments or emails of members)

** In the matrix, participatory researchers noted their observations quite literally (what happened, what was said, which activities were undertaken) and specified them referring to sources. In answering the general questions, the participatory researchers explicated their own interpretations and reflections

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