The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/2056-9548.htm

Received 2 July 2020
Revised 2 October 2020
8 December 2020
21 January 2021
Accepted 12 February 2021

Teachers' perceptions of their schools changing toward professional learning communities

Loes de Jong
Leiden University Graduate School of Teaching, Leiden, The Netherlands and Faculty of Behavioural, Management and Social Sciences, University of Twente, Enschede, The Netherlands
Tom Wilderjans
Faculty of Social and Behavioural Sciences, Leiden University, Leiden, The Netherlands; Faculty of Psychology and Educational Sciences, KU Leuven, Leuven, Belgium and Leids Universitair Medisch Centrum, Leiden, The Netherlands
Jacobiene Meirink
Leiden University Graduate School of Teaching, Leiden, The Netherlands
Wouter Schenke and Henk Sligte
Kohnstamm Institute, Amsterdam, The Netherlands, and
Wilfried Admiraal
Leiden University Graduate School of Teaching, Leiden, The Netherlands

Abstract

Purpose – In professional learning communities (PLCs), teachers collaborate and learn with the aim of improving students' learning. The aim of this study is to gain insight into teachers' perceptions of their schools' changing toward PLCs and conditions which support or hamper this change.

Design/methodology/approach – Questionnaires were completed by a total of 2.111 teachers from 15 Dutch secondary schools for three years. With the use of multilevel regression analyses, the research questions were answered.

Findings – Although the development of a school toward a PLC seems to be a slow process, the findings demonstrate the influence of school conditions on this development. Human resource management (HRM) stands out, as this school condition has a direct and longitudinal effect on the change.

Practical implications – The main recommendation is to embed PLC elements in HRM policies such as facilitating teachers to collaboratively work and learn and aligning teachers' professional development with schools' vision and ambitions.

Originality/value – PLCs have been studied occasionally in longitudinal in-depth case studies or in large-scale, cross-sectional research. This large-scale longitudinal study provides insights into the sustainability of schools as PLCs and the school conditions that are associated with sustainability.

Keywords School organization, Professional learning communities, Teacher collaboration, Longitudinal study, Human resource management

Paper type Research paper

In the domain of education, the concept of professional learning community (PLC) is commonly used for groups of teachers sharing and critically examining their teaching practices and collaborating on how to support student learning (Stoll *et al.*, 2006). A PLC can

This work was supported by the Netherlands Initiative for Education Research [NRO grants 405-14-700 and 405-14-300-015], which resides under the Netherlands Organization for Scientific Research (NWO).
Declarations of interests: None.

Journal of Professional Capital and Community
Vol. 6 No. 4, 2021
pp. 336-353
© Emerald Publishing Limited
2056-9548
DOI 10.1108/JPCC-07-2020-0051

be understood as a means to enhance both teachers' professional development and a professional school culture (Achinstein, 2002; Grossman *et al.*, 2001). Positive effects of PLCs in secondary schools are found on students' learning outcomes (Lomos *et al.*, 2011). Related to the organization of schools, PLCs may be operating at different levels (Stoll *et al.*, 2006). A vast amount of the PLC literature refers to groups of teachers within secondary schools, such as departmental PLC's or specific teacher groups (e.g. Campbell and Lee, 2017; de Jong *et al.*, 2019; Slavit and Nelson, 2010; Tam, 2015; Wong, 2010).

Schools as PLCs have been studied occasionally in longitudinal in-depth case studies concerning one or two schools (e.g. Hipp *et al.*, 2008; Rismark and Sølvberg, 2011) or in large-scale – mainly cross-sectional – studies (e.g. Antinluoma *et al.*, 2018; Heggen *et al.*, 2018). These longitudinal and large-scale studies reflect different educational levels, including primary and secondary education. Insights into factors that impact the change of secondary schools toward PLC's are lacking, requiring the need for long-term studies. Studying the change provides insights into the sustainability of schools as PLCs. The aim of this study is to gain insight into teachers' perceptions of their schools' (further) change toward PLCs and factors which support or impede this change. Central to this study are teachers' perceptions from 14 Dutch secondary schools. In these schools, a series of interventions to foster schools' development as PLC's were implemented over a period of three years.

Theoretical framework

The present study draws on two concepts relevant for studying teachers' professional learning and collaboration in schools, including PLCs and learning organizations.

PLC reconceptualized

Several scholars those reviewed the literature on *PLCs* point at the fuzziness that comes with defining PLCs. Because a universal definition of PLCs is lacking (Stoll *et al.*, 2006), studies on PLCs differ in their conceptualizations and methodological approaches used (Lomos *et al.*, 2011; Sleegers *et al.*, 2013). For example, different sets of teacher teachers are considered as PLCs, like informal groups of teachers, distinct organizational sub-units or the entire staff of schools (Warwas and Helm, 2018).

In a recent study, Sleegers *et al.* (2013) point at three capacities of the entire school staff those define the PLC concept in primary education: personal capacity, interpersonal capacity and organizational capacity. Personal capacity refers to teachers' reflective professional inquiry and application of knowledge and best practices in their teaching practice. In a PLC, teachers use available knowledge and sources of information to reflect on, assess and reconstruct their knowledge constantly. Interpersonal capacity entails shared values and vision, collective learning and shared or deprivatized practices among teachers. Organizational capacity is identified by resources (e.g. time, materials and learning opportunities), relationships, the professional climate of the school and stimulating and participatory leadership (Sleegers *et al.*, 2013).

Warwas and Helm (2018) set out three core dimensions of PLCs in departments of vocational upper secondary education: behavioral dimension, ideational dimension and structural dimension. The first dimension is collaborative development, which captures the behavioral dimension as members engage in collaborative efforts to improve pedagogical practices. The behavioral dimension includes activities of collaboration, monitoring and improvement about learning and instruction, such as collegial observation. Normative agreement refers to the second –ideational – dimension as collaborative efforts need to serve a shared purpose and need to be closely aligned with what constitutes effective teaching. The third dimension entails the supportive infrastructure that depicts the structural dimension of a PLC and refers to routines and resources that promote collaboration (Warwas and Helm, 2018).

The research of Sleegers *et al.* (2013) and Warwas and Helm (2018) focuses on purposefully organized PLCs, which is different from research that focuses on naturally occurring PLCs (e.g. Little, 1990, 2003; Westheimer, 1999). Research on naturally occurring PLCs is concerned with how teachers initiate collaboration themselves with little external interference. Sleegers *et al.* (2013) and Warwas and Helm (2018) investigate how teachers' professional learning and collaboration is purposely facilitated and stimulated in schools, which is reflected in the "organizational capacity" (Sleegers *et al.*, 2013) or "structural dimension" (Warwas and Helm, 2018) of PLCs.

PLC in relation to learning organizations

The construct PLC was proposed by DuFour *et al.* (1998) as the educational counterpart of the construct learning organization (Senge, 1990) to emphasize the importance of common interest in a group (Vangrieken *et al.*, 2017). However, according to Stoll and Kools (2017), the term PLC limits its potential for school-wide change and "a more holistic concept is needed to merge the caring, pedagogically focused and collectively responsible aspects of PLC, with further research and theory from other disciplines to capture an organization-wide collaborative culture, which places learning at all levels – individual group and collective – [at the] front and center of school's way of being and operating" (p. 6). Therefore, Stoll and Kools (2017) propose an integrative perspective on the concept of *secondary schools as learning organizations* and set out seven dimensions, which schools should focus on: (1) developing and sharing a vision centered on student learning, (2) creating and supporting professional learning opportunities, (3) promoting team learning and collaboration, (4) establishing a culture of inquiry in which development and research processes guide innovations, (5) embedding systems for professional learning such as data use to inform school-improvement process and collaborative structures for regular dialogue and knowledge exchange, (6) learning with and from the external environment and (7) modeling and growing learning leadership. Stoll and Kools (2017) explain that adding the notion of community to learning organizations brings "heart" into the concept. In other words, it represents the human experience of teachers, students and school leaders in schools that is not necessarily evident in a learning organization (Mitchell and Sackney, 2006; Stoll and Kools, 2017).

The link between PLCs and learning organizations has been made before by Giles and Hargreaves (2006). These authors stress that in learning organizations, not only innovative structures enable secondary schools to develop their professional capacity but also the community aspect that draws on shared vision and the collective capacity of staff supports the continuous improvement in schools. In this, connections between personal, interpersonal and collective learning in school are the keys to change and success. Through teamwork and leadership and by using data to inquire into and evaluate progress over time, schools build the professional capacity to solve problems and make decisions about teaching and learning. Instead of "quick fixes of superficial change" (p. 126), PLCs in school support sustainable improvements that last over time (Giles and Hargreaves, 2006).

Supportive conditions for professional learning and collaboration

Various forms of teacher collaboration are currently deliberately initiated in schools to strengthen their culture of professional learning (Admiraal *et al.*, 2019; Hargreaves and O'Connor, 2017). Sustainability and long-term effects of interventions aimed at teacher professional learning and collaboration in schools are however questionable. Successful implementation of interventions, in the sense that teacher professional learning and collaboration actually take place, depends on a range of factors.

At *the individual teacher level*, supportive factors entail, for example, teachers' self-efficacy. When teachers believe that they can cope with work-related difficulties, they will engage more in reflective learning activities (Runhaar *et al.*, 2010). Another supportive factor is

commitment to professional learning. Teachers who are committed feel a strong moral responsibility to improve their teaching quality and keep themselves up to date and thus seek for learning opportunities in schools (de Jong *et al.*, 2019; Thoonen *et al.*, 2011). Teacher autonomy is a third teacher-level factor that influences teacher learning and collaboration, although results are not straightforward. In their review, Vangrieken *et al.* (2015) explain that certain levels of autonomy support teachers' engagement in collaboration, but that high feelings of autonomy might lead to disengagement and isolation in school. Vangrieken *et al.* (2017) provide a conceptualization of autonomy in relation to collaboration. Autonomy that is combined with a strong desire for individual and independent work is defined as reactive autonomy. Autonomy that is paired with openness toward collaboration is defined as reflective autonomy. Reflective autonomy does not mean excluding consulting others. Rather, reflective autonomy is seen as making personal choices through an interpersonal process (Vangrieken *et al.*, 2017, quoting; Koestner and Losier, 1996).

At *the group level*, factors can be identified as well. For example, teacher collaboration is supported when teachers have a clear role in a group (Vangrieken *et al.*, 2015) or when the group has a clear focus or common goal (Hadar and Brody, 2010; Kintz *et al.*, 2015; Vangrieken *et al.*, 2015).

At *the level of the school*, a common factor is leadership, relating to school leaders who inspire and support their staff, facilitate learning opportunities and have a clear vision for the future (e.g. Admiraal *et al.*, 2016; De Neve and Devos, 2017; Ioannidou-Koutselini and Patsalidou, 2015). In some studies, this type of leadership is also referred to as transformational leadership (Runhaar *et al.*, 2010; Thoonen *et al.*, 2011). Other school-level factors relate to a culture of openness, understanding, teamwork and trust (de Jong *et al.*, 2019; de Neve and Devos, 2017; Ioannidou-Koutselini and Patsalidou, 2015; Vangrieken *et al.*, 2015), a shared school mission and vision among the staff members (Admiraal *et al.*, 2016; Opfer *et al.*, 2011), time and space to meet (Admiraal *et al.*, 2016; de Neve and Devos, 2017; Opfer *et al.*, 2011; Vangrieken *et al.*, 2015) and embeddedness of teacher professional learning and collaboration in school practices and human resource management (HRM) (Admiraal *et al.*, 2019). With HRM, we refer to the school policy that facilitates and encourages teachers to professionalize and collaborate. For example, addressing co-design and inquiry-based working during performance appraisals and letting teachers keep a portfolio to monitor their professional development.

Purpose of the study

A range of studies has identified factors that support teachers' professional learning and collaboration in school. These factors relate to features at the level of individual teachers, teacher groups or teams and schools. In the present study, we focus on school factors, which we indicate as *PLC conditions*. PLC conditions reflect contextual indicators that are expected to enhance professional learning and collaboration in school. We use the term *PLC elements* to denote indicators of teachers' professional learning and collaboration, such as teachers' reflective professional inquiry, collective learning and shared or deprivatized practices in school.

Similar to Sleegers *et al.* (2013) and Warwas and Helm (2018), we focus on schools that purposely facilitated and stimulated teachers' professional learning and collaboration. The context of the current study is a Dutch government initiative to support schools during a three-year period to stimulate collaborative practices and learning of their teachers. In (secondary) education, one major challenge in supporting collaboration relates to teachers' primary task of teaching. In general, teaching reflects autonomous and isolated work because it takes place behind closed doors (Hodkinson and Hodkinson, 2003). In secondary education, the division of teachers over departments can create even more distance between teachers (Hargreaves and Macmillan, 1995). Opportunities for teacher learning and collaboration in secondary schools concern teachers' shared target group, as students are taught school

subject by different teachers. Central to this study are teachers' perceptions of their secondary schools' PLC elements and PLC conditions during this period. By studying the change, we aim to gain insight into the sustainability of schools as PLCs. Thus, the following research questions are formulated:

(1) How do teachers' perceived PLC elements and PLC conditions in school change over time?

(2) In what way do teachers' perceived PLC conditions predict teachers' perceived PLC elements in school?

(3) In what way do teachers' perceived PLC conditions (and the change therein) explain changes in teachers' perceived PLC elements in school over time?

Methods

Across the three school years, a questionnaire was completed by 2.111 teachers from 15 schools, which represents a teachers' response rate of 60%. School sizes ranged from 700 to 2.635 students and 67 to 210 teachers per school. After year 2, one school opted out from the research due to closing. Demographic information about the sample is presented in Table 1. The sample included 48% female teachers, which is similar to the gender distribution in Dutch secondary education (Dutch Ministry of Education, Culture and Science, 2019). Teachers working ten years or more in education represented the largest proportion of teachers (55%), followed by teachers working 5–10 years in education (19%).

Procedure

The 15 secondary schools under study participated as a result of a call of the Dutch government to support schools in their development as PLCs. To this end, each school

Demographic	Year 1 (N = 1251)	Year 2 (N = 474)	Year 3 (N = 386)	Total (N = 2111)
Age (M (SD))	42.81 (12.44)	41.98 (12.56)	41.40 (12.65)	42.06 (12.55)
Gender				
Female	47	50	49	48
Male	53	50	51	52
Years of working in education				
<1 year	5	7	12	7
1–2 years	5	8	8	6
2–5 years	12	13	12	13
5–10 years	20	19	18	19
≥10 years	58	53	50	55
Years of working at the current school				
<1 year	11	20	26	16
1–2 years	7	9	12	8
2–5 years	16	16	14	16
5–10 years	25	17	15	21
≥10 years	41	37	34	39
Additional task				
Management	<1	<1	<1	<1
Middle management	4	3	2	3
Quality/policy officer	2	1	1	1
Other	11	8	3	9

Table 1. Teachers' mean age (standard deviation) and percentage of teachers for demographics per first year the teacher filled in the questionnaire

planned and implemented a series of interventions and tailor-made needs, during three school years (September 2014 to June 2017). The interventions related to school vision, professional learning of staff, collaboration, school organization and leadership. Examples of interventions are the implementation of collegial observation and a school academy as formal structure to bring together all professional development activities (Admiraal *et al.*, 2019). The schools were supported by an external project leader in planning, designing and implementing interventions. The researchers were invited to monitor the changes in the schools because of their expertise in research on teacher collaboration and professional development in secondary schools. The researchers were unaffiliated with the project leader and carried out the research independently from the work of the project leader.

Instrument

We used the questionnaire school as a PLC (Schenke *et al.*, 2015) to assess teachers' perceptions of professional learning and collaboration in their school. The questionnaire was designed drawing from the literature on elements and conditions of a PLC. The *elements* refer to indicators of schools as PLCs, such as sharing knowledge and collaboration (e.g. Hipp *et al.*, 2008; Stoll *et al.*, 2006). The *conditions* refer to matters that support the development and sustainability of schools as PLCs, such as leadership and communication in school (e.g. Opfer *et al.*, 2011; Runhaar *et al.*, 2010). We carefully translated and adapted the items drawn from the English literature to meet the Dutch secondary educational context. To fine-tune the questionnaire, educational scientists those were not involved in the study were invited to a session to review item formulations (in Fall, 2014). The outcome of this session was to keep the original scales but adapt some item formulations to match the educational practice better. The questionnaire has been validated and has good psychometric properties (Schenke *et al.*, 2015).

The original questionnaire consists of 66 items, each scored on a five-point Likert scale ranging from 1 (entirely not applicable) to 5 (entirely applicable). The option to select a sixth category "I do not know" was also available. This option was coded as a missing value for the item in question. For each item, teachers indicated the extent to which it is applied to their school at that particular moment in time. Items refer to five elements of a school as a PLC (e.g. co-design and inquiry-based working) and seven conditions for the development and sustainability of a school as a PLC (e.g. professional autonomy and Leadership). A description and sample items of the PLC elements and conditions are provided in Table 2.

We conducted a confirmatory factor analysis using the statistical software R (version 3.6.0) and R Studio (version 1.1.456; R Core Team, 2019) to examine the factorial measurement structure of the questionnaire for the elements (five factors) and conditions (seven factors) separately. For all three years (i.e. year 1, 2 and 3), the five-factor measurement model for the elements and the seven-factor measurement model for the conditions demonstrate a good to very good fit to the data, as demonstrated by the comparative fit index > 0.90, the Tucker–Lewis index > 0.90, the root mean square error of approximation < 0.08 and the standardized root mean square residual < 0.08. Regarding the elements, we allowed the residuals of three pairs of items from the subscales such as school-based professional development and co-design to correlate as these items were related to designing educational materials. Furthermore, the internal consistency of all scales for all years is good as Cronbach's $\alpha > 0.80$, except for the scales professional development outside school and school-based professional development with α ranging from 0.64 to 0.74, which is probably due to the small amount (i.e. three) of items of these two scales.

Data imputation

The largest proportion of missing data was found in the data of year 1 on the scale professional autonomy (59%) due to an online technical error. The proportion of missing data on the remaining scales of years 1, 2 and 3 ranged from 1 to 15%. The sample size per PLC

PLC elements and PLC conditions	Description	Sample item
PLC elements		
Professional development outside school	Professional development that takes place outside the school, such as workshops and master's programs	In our school, external training and courses for teachers are offered
School-based professional development	Professional development that takes place inside the school, such as teacher design teams or collegial observation	In our school, it is common practice that teachers observe and discuss each other's lessons
Knowledge sharing	Teachers' knowledge sharing on teaching experiences, the quality of education and their educational vision	In our school, teachers share knowledge and experiences that are important to the quality of education
Co-design	Teachers' collaborative design of new methods and year programs or to solve problems	In our school, teachers collaboratively develop new teaching methods
Inquiry-based working	Teachers' use of inquiry-based methods to improve teaching, such as data-use, feedback or theory	In our school, teachers use available data (like test results of students) systematically to develop their teaching practice further
PLC conditions		
Shared support	Shared vision on key issues of education and shared commitment to pursuit the school vision	In our school, teachers are willing to contribute to changes/innovations in school
Professional autonomy	Possibilities for teachers to develop and decide on teaching and the extent to which teachers take responsibility in the educational quality	In our school, teachers have a say in themes that the school wants to develop further
Leadership of theprincipal	Facilitation, support and encouragement from the board to (further) develop the school toward a PLC	The board involves teachers actively in developing a vision for education
Leadership of middle management	Facilitation, support and encouragement from the middle management to (further) develop the school toward a PLC	The middle management (team or department leader) involves teachers actively in developing a vision for education
HRM	School policy that facilitates and encourages teachers to professionalize and collaborate by, for example, addressing c-design and inquiry-based working during performance appraisals and letting teachers keep a portfolio to monitor their professional development	In our school, teachers are facilitated in time and space to collaborate in the development of teaching practices
Communication in school	Oral and digital communication on developments in school such as the schools' ambition and communication between teachers and school leaders	In our school, themes on which the schools wants to develop further are discussed during meetings
Collegial support	The expression of mutual respect and being open showing vulnerability	In our school, we are open to each other

Note(s): The school as professional learning community (SPLC) questionnaire consists of 66 items, with six items per PLC element and condition, except professional development outside school and school-based professional development, which include three items each

Table 2. Description and sample items of elements and conditions of a school as a PLC

element and PLC condition for years 1, 2 and 3 can be found in Table 3. Little's missing completely at random test indicated that the missing data from year 2 were missing *completely at random* (χ^2 (444) = 485.10; p = 0.09). This indicates that the participants

PLC element and condition	Year 1	Year 2	Year 3
Total sample	1.251	961	928
Response rate (M, [min-max])	69%, [43–91%]	56%, [35–100%]	56%, [39–94%]
Elements			
Professional development outside the school	1192	948	905
School-based professional development	1185	930	897
Knowledge sharing	1221	949	897
Co-design	1187	932	862
Inquiry-based working	1133	902	812
Conditions			
Shared support	1174	922	825
Professional autonomy	519	903	818
Leadership of the principal	1134	901	819
Leadership of middle management	1067	894	805
HRM	1105	886	819
Communication in school	1149	900	823
Collegial support	1155	900	905

Table 3.
Sample size (amount of teachers) per PLC element and condition per year of data collection

with completely observed data are a random sample of all the participants from the population and not a subgroup that behaves differently than the participants with missing data (Little and Rubin, 2019). The missing data from years 1 and 3 were not missing completely at random (for year 1: χ^2 (850) = 1133.19 and $p = 0.00$; for year 3: χ^2 (533) = 725.06 and $p = 0.00$). Although it is not possible to test whether missing data are missing *at random* or missing *not at random*, inspection of the data and *t*-tests suggested that the missing data from years 1 and 3 were missing at random. Namely, although the probability to be missing is not the same for all cases (i.e. teachers), the probability of missing seems to depend on observed information (Grund *et al.*, 2016a; Rubin, 1976).

To deal with missing data, we performed multiple imputations. The results from the cross-sectional analyses were obtained after performing multiple imputations for the year 1 data. The results from the longitudinal analyses were obtained after performing multiple imputations for the data from years 1, 2 and 3. Auxiliary variables were included in the imputation model to enhance the possibility of missing at random (Collins *et al.*, 2001; Grund *et al.*, 2016a), including teachers' age, gender, level of education and the department in which they (mostly) work. Because of the hierarchical structure, as teachers are nested in schools and in the longitudinal analysis, measurements are nested in teachers; hence, we used the *R* pan package (Schafer and Zhao, 2014) in conjunction with the mitml package (Grund *et al.*, 2016b) to carry out multiple imputations while taking the multilevel structure into account. Based on recommendations by Grund *et al.* (2016a), we ran pan for 50,000 burn-in iterations, after which 100 imputed data sets were drawn, each spread 5,000 iterations (cross-sectional analyses) and 10,000 iterations (longitudinal analyses) apart from fitting a random-intercept model. Based on the potential scale reduction factor and the diagnostics plots, we concluded that the pan algorithm has converged and that the imputed data sets are approximately independent draws from the posterior predictive distribution (Gelman and Rubin, 1992; Grund *et al.*, 2016a).

Data analysis

To answer the first research question, we tested for a significant mean difference between each pair of years in PLC elements and PLC conditions by means of a multilevel *t*-test.

To answer the second and third research question, two sets of multilevel analyses were used (i.e. multilevel cross-sectional and multilevel longitudinal regression analysis) by adopting the lmer function from the lme4 package in R (Bates *et al.*, 2015). To evaluate whether data within schools are correlated, we estimated the empty model without any predictor, also called the unconditional means model. Based on this model, for each PLC element in years 1, 2 and 3 separately, we computed the intraclass correlation.

To answer the second research question, we conducted, for each year apart, multilevel *cross-sectional* regression analyses for the five outcome measures (i.e. PLC elements) separately, with the PLC conditions used as predictors. We used two-level multilevel techniques with random intercepts (but not random slopes) because the data have a hierarchical structure as teachers (level 1) are nested in schools (level 2), allowing to account for the data from teachers from the same school being correlated (Hox, 2010).

To answer the third research question, we conducted *longitudinal* multilevel analyses to get more insight into the predictive value of the (time-varying) PLC conditions. Again, we conducted separate three-level multilevel regression analyses for the five outcome measures (i.e. PLC elements), including random intercepts (but not random slopes) for teachers and schools. A three-level model was specified with level 1 representing the repeated measurements over time. Level 2 modeled teacher-level variance in PLC elements, whereas level 3 modeled school-level variance in PLC elements. Due to the multiple imputations, no single estimate of model fit was available (Grund *et al.*, 2016a).

To evaluate whether the required assumptions for the multilevel regression analysis were met, we checked the assumptions of homoscedasticity, normality, linearity and multicollinearity and checked for outliers in the data. No (substantial) violations of these assumptions were encountered.

Results

Change of PLC elements and conditions

The PLC elements and PLC conditions were tested for a significant mean difference between (pairs of) years with a multilevel *t*-test. Overall, as can be seen in Figure 1, the average scores on the PLC elements and PLC conditions significantly increase after the first year and significantly decrease after the second year. Nevertheless, the average scores in year 3 are significantly higher than the average scores in year 1. All PLC elements and conditions are moderately positively correlated across all years.

The prediction of PLC elements by PLC conditions

The results of the cross-sectional analyses are depicted in Table 4. The intraclass correlations were significantly different from zero which means that overall, the perceptions of the PLC elements of two teachers from the same school are more similar to each other than the perceptions of two teachers from different schools. The intraclass correlations varied from 0.01 to 0.23, indicating that 1–23% of the total variance in perceived PLC elements is situated at the school level (i.e. between school differences), whereas 77–99% is attributed to individual differences between teachers (i.e. within school differences).

Out of the seven PLC conditions, shared support and HRM are – for (almost) each year – significantly contributing to the prediction of all PLC elements, indicating that more shared support and HRM is related to more professional development outside school, school-based professional development, knowledge sharing, inquiry-based working and co-design. Communication in school significantly predicts all PLC elements except school-based professional development. As for leadership in school, more leadership of the principal predicts more school-based professional development and co-design, whereas more

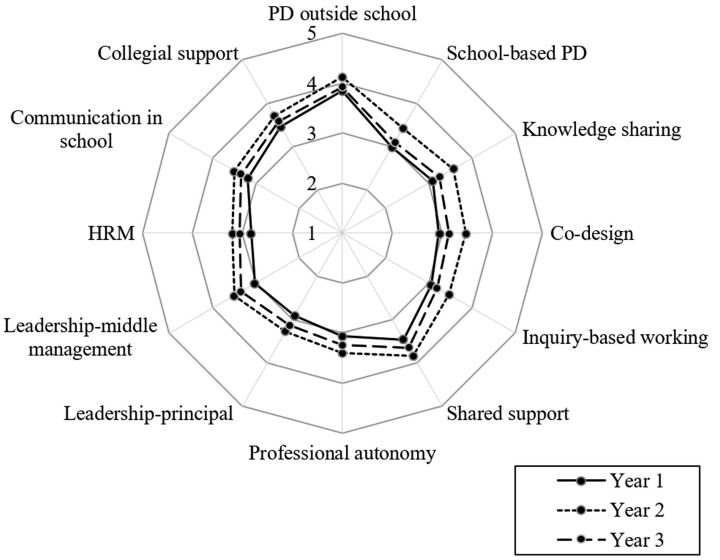


Figure 1.
Mean scores of PLC elements (professional development outside school, school-based professional development, knowledge sharing, co-design and inquiry-based working) and PLC conditions (all others) in years 1, 2 and 3

leadership of the middle management predicts more knowledge sharing. With respect to the two remaining PLC conditions, professional autonomy and collegial support, no consistent predictive relations with PLC elements exist.

Explaining change in PLC elements over time by PLC conditions

As can be seen in Table 5 (row "Time"), the time (main) effect for the five PLC elements was not statistically significant, indicating that professional development outside school, school-based professional development, knowledge sharing, inquiry-based working and co-design did not significantly change over time.

The significant (main) effects for the PLC elements found in the longitudinal analyses (the seven rows below the "Time" row in Table 5) relate to the effects for the scores in year 1, and thus are very similar to the effects found in the cross-sectional analyses for year 1 (see Table 4). Regression coefficients, although, differ slightly in size because teachers who did not complete the questionnaire in year 1 (but completed the questionnaire in year 2 and/or year 3) were excluded from the cross-sectional analyses for year 1 but were included in the longitudinal analyses.

We found one PLC condition, HRM, predicting the change of PLC elements across three years (i.e. interaction between a PLC condition and time). In particular, HRM predicts the change (i.e. slope) in co-design ($b = 0.06$; $p \leq 0.05$). A visual representation of this interaction effect can be found in Figure 2 in which the (estimated) change in co-design over time is displayed for various levels of HRM. As can be seen, specifically those teachers who initially reported (relatively) high levels of HRM, increased in their perception of co-design (indicated by the upper line) over time. Teachers who initially reported (relatively) little or average HRM had no growth or even showed a decline in their perception of co-design (indicated by lower and middle line) over time.

Conclusion and discussion

The aim of this study was to gain insight into the change of teachers' perceptions of the learning culture of their school over time and what conditions support or hinder this change.

Table 4.
Model estimates of the two-level cross-sectional regression analysis of teachers' perceptions of PLC elements year 1, year 2 and year 3 (only showing effects significant at $\alpha = 0.05$)

	PLC element														
	Professional development outside the school			School-based professional development			Knowledge sharing			Inquiry-based working			Co-design		
Parameter	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Fixed effects (PLC condition)															
Intercept	2.19***	2.17***	2.43***	0.67***	0.63**	0.42*	0.53***	0.88***	0.36**	0.59***	0.67***	0.34**	0.44***	0.73***	0.20
Shared support		0.13**	0.16**	0.28***	0.26***	0.23***	0.34***	0.33***	0.38***	0.46***	0.49***	0.57***	0.31***	0.45***	0.40***
Professional autonomy															
Leadership of the principal		0.18***		0.26***	0.17**	0.20**							0.16**	0.12**	
Leadership ofmiddle management			0.10*				0.16***	0.09*	0.11**	0.08*					
HRM	0.12**		0.12*	0.20***	0.17***	0.31***		0.13**	0.11**	0.12***	0.14***	0.14***	0.08*	0.08*	0.18***
Communication in school	0.14**	0.20***	0.12*				0.24***	0.11*	0.16**	0.13***	0.09*	0.11*	0.17***		0.19***
Collegial support				−0.09*	0.09*			0.07*						−0.08*	
Random effects															
Level 1 – teachers (σ^2_{e0})	0.64	0.33	0.48	0.55	0.40	0.50	0.42	0.27	0.35	0.35	0.22	0.25	0.41	0.30	0.35
Level 2 – school ($\sigma^2_{\mu 0}$)	0.04	0.03	0.05	0.11	0.07	0.08	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.02
Unconditional means model															
ICC	0.12***	0.14***	0.13***	0.21***	0.19***	0.11***	0.07***	0.04***	0.03***	0.06***	0.06***	0.06***	0.08***	0.10***	0.07***

Note(s): Per cell: regression coefficient. *$p \leq 0.05$, **$p \leq 0.01$ and ***$p \leq 0.001$

Parameter	Δ PLC element: Professional development outside the school	School-based professional development	Knowledge sharing	Inquiry-based working	Co-design
Fixed effects (PLC condition)					
Intercept	2.32***	0.53**	0.46***	0.64***	0.33*
Time					
Shared support	0.13*	0.26***	0.36***	0.49***	0.38***
Professional autonomy					
Leadership of theprincipal		0.23***		0.11*	0.15**
Leadership ofmiddle management			0.15***		0.10*
HRM	0.13**	0.16***	0.08**	0.10***	
Communication in school	0.14**		0.19***		0.11*
Collegial support					
Time*Shared support					
Time*Professional autonomy					
Time*Leadership of the principal					
Time*Leadership of middle management					
Time*HRM					0.06*
Time*Communication in school					
Time*Collegial support					
Random effects					
Level 1 – teachers (σ^2_{e0})	0.14	0.13	0.02	0.10	0.13
Level 2 – school ($\sigma^2_{\mu 0}$)	0.03	0.06	0.01	0.01	0.01

Note(s): *$p \leq 0.05$, **$p \leq 0.01$ and ***$p \leq 0.001$

Table 5. Model estimates of the longitudinal multilevel analysis of teachers' perceptions of PLC elements (only showing effects significant at $\alpha = 0.05$)

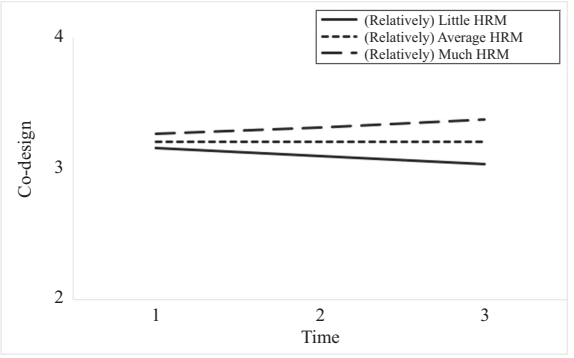


Figure 2. Visual representation of the significant interaction effect between HRM and time on co-design. The evolution of co-design over time is displayed as a function of HRM. The three lines represent little (M-1SD), average (M) and much (M+1SD) HRM

The concept of schools as PLCs has been used for this. We focused on five PLC elements (i.e. professional development outside school, school-based professional development, knowledge sharing, co-design and inquiry-based working) and seven PLC conditions

(i.e. shared support, professional autonomy, leadership of the principal, leadership of middle management, HRM, communication in school and collegial support). The findings of this study are vital to policymakers, school leaders and other facilitators of schools as PLCs because previous longitudinal research studying *how* school cultures of professional learning and collaboration change over time is scarce.

Overall, the results of our questionnaire study show that teachers' perceptions of all PLC elements and PLC conditions significantly increased after year 1 but decreased after year 2. Yet, over the three-year period, teachers' perceptions of the PLC elements and PLC conditions significantly increased. The results are in line with previous studies, which conclude that the development of a school toward a PLC is a slow process in which schools take steps forward and steps back (Admiraal *et al.*, 2019; Hargreaves and O'Connor, 2017; Hipp *et al.*, 2008). Hipp *et al.* (2008), who studied two primary and secondary schools during five years, summarize the development as "a journey as evidenced by the time and energy exerted to move schools from one level to the next, from initiation to implementation to institutionalization or sustainability" (p. 192). Our findings imply that the schools succeeded in implementing initiatives aimed at teacher collaboration and learning to some extent because teachers' perceptions of PLC elements became more positive over time. In terms of institutionalization, it remains less clear to what extent the change initiatives sustained because the increase in PLC elements during three years was relatively small.

The results of this study point at the influencing potential that school conditions bring as it comes to the development of schools as PLCs. Several PLC conditions significantly contributed to the prediction of PLC elements. In this, especially the conditions shared support, HRM and communication stood out. These findings illustrate that besides innovate structures in school, the "human experience" or interpersonal caring in terms of taking shared responsibility as reflected in shared support and appreciation as reflected in HRM are important affordances for schools as PLCs (Giles and Hargreaves, 2006; Mitchell and Sackney, 2006; Stoll and Kools, 2017). Striking is that communication is a significant predictor of all PLC elements except school-based professional development, which can be explained by the nature of the PLC elements. Namely, school-based professional development reflects more intensive forms of teacher collaboration (e.g. collegial observations) than other PLC elements (e.g. knowledge sharing), and it might require intensive PLC conditions such as shared support or HRM, which make communication less relevant in this regard. Formal forms of leadership also significantly contributed to the prediction of various PLC elements. These findings indicate that school leaders may directly affect teachers' collaborative work and learning by showing enthusiasm for new ideas and projects and offering teachers time and space to put it into practice (Admiraal *et al.*, 2016; Hargreaves, 2019; Schipper *et al.*, 2019). Yet, the literature also points at the risk of hierarchical relationships between school (middle) management and teachers, which can contribute to teachers' mistrust of (top down imposed) projects, making collaboration problematic (Brodie, 2019; Hargreaves and O'Connor, 2017; Hipp *et al.*, 2008). This might explain our finding that leadership is a less stable predictor (i.e. a significant predictor of less PLC elements and in less years) than the PLC elements shared support, HRM and communication.

Surprisingly, we found no or only little evidence for the prediction of PLC elements by the PLC conditions professional autonomy and collegial support. Closely linked to the ongoing debate regarding the impact of formal leadership in school, research evidence on teachers' sense of autonomy and collegial relationships is not univocal. Top down imposed improvement can restrain feelings of autonomy (Brodie, 2019) and undermine rather than enhance levels of collegial trust (Hargreaves and O'Connor, 2017). Moreover, Vangrieken *et al.* (2015) warn that high feelings of autonomy might lead to disengagement and isolation in school, and thus limit teachers' engagement in (professional) collaboration. Yet, autonomy in itself does not exclude a desire to collaborate, and the combination of teacher autonomy

paired with a collaborative attitude indicates a more interpersonal definition of autonomy (Vangrieken *et al.*, 2017). Possibly, teachers' status or experience plays a role in this. Beginning teachers might feel less comfortable with much freedom in making decisions and need more guiding frameworks than experienced teachers. In PLCs, the coordination of collaboration can play out differently for members, depending on their needs. Furthermore, de Jong *et al.* (2019) illustrate how communities those reflect close collegial relationships may challenge and even hinder development over time by adhering to the state of affairs. Thus, our findings also show how the human experience of autonomy is a distinctive but challenging feature of schools as PLCs.

The longitudinal analyses of this study pointed at the importance of HRM in school. We can conclude that this school condition has a significant direct effect on the change of schools toward PLCs over three years. Indeed, HRM seems to hold the potential of enhancing teacher professional collaboration and learning in school (Runhaar, 2017). This requires organizational structures that provide teachers with the necessary time and facilities to collaborate, inquire and learn (Admiraal *et al.*, 2016; Admiraal *et al.*, 2019). Our study also stresses the importance of valuing PLC elements, by addressing them in performance appraisals and teacher portfolios and by expressing appreciation for the work of teachers. Thus, embedding elements of a PLC in the school organization adds to moving schools toward a culture of professional learning and collaboration. Based on our outcomes, however, this change seems to especially concern those teachers who initially reported (relatively) high levels of HRM. Our findings indicate that for teachers who have initially a more moderate perception of their school's HRM, school improvement in terms of (further) developing toward a PLC has no or little impact on them. This is in line with conclusions from Hargreaves and O'Connor (2017), who state that the success of short-term collaborative interventions depends on the prior existence of a collaborative culture in the school. Our study implicates that embedding collaborative and professionalization initiatives in HRM early on in the process supports the sustainability of such initiatives.

Limitations and implications for future research

Certain limitations must be taken into account when interpreting the results of this study. First, the data concerned self-perceptions of teachers which might reflect teacher satisfaction and entail the risk of social bias. This implies that we can only speak of teachers' perceptions of elements and conditions of the school as a PLC.

Second, our sample consisted of teachers working in schools that were involved in a Dutch government initiative, which limits the generalizability of the results. Furthermore, the generalizability across national borders is limited because countries differ in the accessibility of individual and collective professional development (OECD, 2019) and the division of responsibilities between management levels (Stoll and Kools, 2017). In the Netherlands, schools are highly decentralized and autonomous on matters related to resource allocation (OECD, 2014). In terms of collaboration and learning, teachers in the Netherlands are, on average, less likely to engage in team teaching, observe colleagues and provide feedback than their international peers (OECD, 2020).

Third, the aim of our study was to identify (teachers' perceptions of) school conditions that have a direct effect on schools' change toward PLCs. Although our results demand further research on the inconclusive impact of leadership, teacher autonomy and collegial trust, this was beyond the scope of our research.

The fourth limitation relates to the risk of common method variance. This means that the estimated effects of PLC elements on PLC conditions might be biased because they are measured with the same instrument. Future research into the development of schools as PLCs would benefit from data triangulation (e.g. by including observational data), considering a

broader range of schools, insight into different forms of leadership and an exploration teacher reflective autonomy (i.e. autonomy paired with a collaborative attitude; Vangrieken, 2017; Koestner and Losier, 1996).

Future research would also benefit from insight into how specific interventions are implemented and experienced by teachers (e.g. by conducting in-depth interviews or observing teacher meetings), which is needed to inform school leaders and other facilitators on how to support a culture of collaborative learning and working.

Another interesting area for future research on schools as PLCs relates to the within-school variance in PLC elements and PLC conditions. Because of the departmental organization of schools, teachers often work in subgroups, which can create the existence of subcultures in schools (Hargreaves and Macmillan, 1995) which is worth noting in future research.

One of the underlying reasons for schools to purposefully facilitate and stimulate a culture of professional learning and collaboration is to enhance teachers' professional development. Yet, collaboration and professional development in itself does not lead to learning. It would be worthwhile to address the microprocesses, in terms of teacher dialogue, taking place in schools as PLCs in future research. Namely, recent research shows how the engagement in critical conversations with colleagues on student learning stimulates teachers' learning (e.g. Warwick *et al.*, 2016).

By providing insight into the change of schools as PLCs over time and identifying relevant school conditions that are associated with this change, the results of this study provide future directions for research, policy and practice. Our study points to the vital role of HRM in school organizations. Therefore, our main recommendation is to embed PLC elements in HRM policies such as facilitating teachers to collaboratively work and learn and aligning teachers' professional development with schools' vision and ambitions. In conclusion, the development of schools toward PLCs is a slow process, which requires, for it to be sustainable, continuous support from teachers and school leaders and a permanent and well- considered place in the school policy.

References

Achinstein, B. (2002), "Conflict amid community: the micropolitics teacher collaboration", *Teachers College Record*, Vol. 104 No. 3, pp. 421-455.

Admiraal, W., Kruiter, J., Lockhorst, D., Schenke, W., Sligte, H., Smit, B., Tigelaar, D. and de Wit, W. (2016), "Affordances of teacher professional learning in secondary schools", *Studies in Continuing Education*, Vol. 38 No. 3, pp. 281-298, doi: 10.1080/0158037X.2015.1114469.

Admiraal, W., Schenke, W., De Jong, L., Emmelot, Y. and Sligte, H. (2019), "Schools as professional learning communities: what can schools do to support professional development of their teachers?", *Professional Development in Education*, pp. 1-15, doi: 10.1080/19415257.2019.1665573.

Antinluoma, M., Ilomäki, L., Lahti-Nuuttila, P. and Toom, A. (2018), "Schools as professional learning communities", *Journal of Education and Learning*, Vol. 7 No. 5, pp. 76-91, doi: 10.5539/jel.v7n5p76.

Bates, D., Mächler, M., Bolker, B. and Walker, S. (2015), "Fitting linear mixed-effects models using lme4", *Journal of Statistical Software*, Vol. 67 No. 1, pp. 1-48, doi: 10.18637/jss.v067.i01.

Brodie, K. (2019), "Teacher agency in professional learning communities", *Professional Development in Education*, pp. 1-14, doi: 10.1080/19415257.2019.1689523.

Campbell, M.P. and Lee, H.S. (2017), "Examining secondary mathematics teachers' opportunities to develop mathematically in professional learning communities", *School Science and Mathematics*, Vol. 117 Nos 3-4, pp. 115-126, doi: 10.1111/ssm.12209.

Collins, L.M., Schafer, J.L. and Kam, C.M. (2001), "A comparison of inclusive and restrictive strategies in modern missing data procedures", *Psychological Methods*, Vol. 6 No. 4, pp. 330-351, doi: 10.1037/1082-989X.6.4.330.

de Jong, L., Meirink, J. and Admiraal, W. (2019), "School-based teacher collaboration: different learning opportunities across various contexts", *Teaching and Teacher Education*, Vol. 86 102925, doi: 10.1016/j.tate.2019.102925.

De Neve, D. and Devos, G. (2017), "How do professional learning communities aid and hamper professional learning of beginning teachers related to differentiated instruction?", *Teachers and Teaching*, Vol. 23 No. 3, pp. 262-283, doi: 10.1080/13540602.2016.1206524.

DuFour, R., Eaker, R. and DuFour, R. (1998), *Professional Learning Communities at Work: Best Practices for Enhancing Student Achievement*, National Educational Service, Bloomington.

Dutch Ministry of Education, Culture and Science (2019), *Percentage Mannen in Het Onderwijs [Percentage of Males in Education]*, available at: https://www.onderwijsincijfers.nl/themas/onderwijspersoneel/mannen-in-het-onderwijs/percentage-mannen-in-het-onderwijs.

Gelman, A. and Rubin, D.B. (1992), "Inference from iterative simulation using multiple sequences", *Statistical Science*, Vol. 7 No. 4, pp. 457-472, doi: 10.1214/ss/1177011136.

Giles, C. and Hargreaves, A. (2006), "The sustainability of innovative schools as learning organizations and professional learning communities during standardized reform", *Educational Administration Quarterly*, Vol. 42 No. 1, pp. 124-156, doi: 10.1177/0013161X05278189.

Grossman, P., Wineburg, S. and Woolworth, S. (2001), "Toward a theory of teacher community", *Teachers College Record*, Vol. 103, pp. 942-1012.

Grund, S., Lüdtke, O. and Robitzsch, A. (2016a), "Multiple imputation of multilevel missing data: an introduction to the R package pan", *SAGE Open*, Vol. 6 No. 4, pp. 1-17, doi: 10.1177/2158244016668220.

Grund, S., Robitzsch, A. and Lüdtke, O. (2016b), "Mitml: tools for multiple imputation in multilevel modeling", Version 0.3–2, [Computer software], available at: http://CRAN.R-project.org/package=mitml.

Hadar, L. and Brody, D. (2010), "From isolation to symphonic harmony: building a professional development community among teacher educators", *Teaching and Teacher Education*, Vol. 26 No. 8, pp. 1641-1651, doi: 10.1016/j.tate.2010.06.015.

Hargreaves, A. (2019), "Teacher collaboration: 30 years of research on its nature, forms, limitations and effects", *Teachers and Teaching*, Vol. 1 No. 19, pp. 603-621, doi: 10.1080/13540602.2019.1639499.

Hargreaves, A. and Macmillan, R. (1995), "The balkanization of secondary school teaching", in Siskin, L.S. and Little, J.W. (Eds), *Subjects in Question: Departmental Organization and the High School*, Teachers College Press, pp. 141-171.

Hargreaves, A. and O'Connor, M.T. (2017), "Cultures of professional collaboration: their origins and opponents", *Journal of Professional Capital and Community*, Vol. 2 No. 2, pp. 74-85, doi: 10.1108/JPCC-02-2017-0004.

Heggen, K., Raaen, F.D. and Thorsen, K.E. (2018), "Placement schools as professional learning communities in teacher education", *European Journal of Teacher Education*, Vol. 41 No. 3, pp. 398-413, doi: 10.1080/02619768.2018.1448779.

Hipp, K.K., Huffman, J.B., Pankake, A.M. and Olivier, D.F. (2008), "Sustaining professional learning communities: case studies", *Journal of Educational Change*, Vol. 9 No. 2, pp. 173-195, doi: 10.1007/s10833-007-9060-8.

Hodkinson, P. and Hodkinson, H. (2003), "Individuals, communities of practice and the policy context: school teachers' learning in their workplace", *Studies in Continuing Education*, Vol. 25 No. 1, pp. 3-21, doi: 10.1080/01580370309284.

Hox, J. (2010), *Multilevel Analysis: Techniques and Applications*, 2nd ed., Routledge, New York.

Ioannidou-Koutselini, M. and Patsalidou, F. (2015), "Engaging school teachers and school principals in an action research in-service development as a means of pedagogical self-awareness", *Educational Action Research*, Vol. 23 No. 2, pp. 124-139, doi: 10.1080/09650792.2014.960531.

Kintz, T., Lane, J., Gotwals, A. and Cisterna, D. (2015), "Professional development at the local level: necessary and sufficient conditions for critical colleagueship", *Teaching and Teacher Education*, Vol. 51, pp. 121-136, doi: 10.1016/j.tate.2015.06.004.

Koestner, R. and Losier, G.F. (1996), "Distinguishing reactive versus reflective autonomy", *Journal of Personality*, Vol. 64 No. 2, pp. 465-494, doi: 10.1111/j.1467-6494.1996.tb00518.x.

Little, J.W. (1990), "The persistence of privacy: autonomy and initiative in teachers' professional relations", *Teachers College Record*, Vol. 91, pp. 509-536.

Little, J.W. (2003), "Inside teacher community: representations of classroom practice", *Teachers College Record*, Vol. 105, pp. 913-945.

Little, R.J. and Rubin, D.B. (2019), *Statistical Analysis with Missing Data*, John Wiley & Sons, New York.

Lomos, C., Hofman, R.H. and Bosker, R.J. (2011), "Professional communities and student achievement: a meta-analysis", *School Effectiveness and School Improvement*, Vol. 22 No. 2, pp. 121-148, doi: 10.1080/09243453.2010.550467.

Mitchell, C. and Sackney, L. (2006), "Building schools, building people: the school principal's role in leading a learning community", *Journal of School Leadership*, Vol. 16 No. 5, pp. 627-640, doi: 10.1177/105268460601600512.

OECD (2014), *Education Policy Outlook Netherlands*, available at: http://www.oecd.org/education/highlightsnetherlands.htm.

OECD (2019), *Teachers' Professional Learning: Study Design and Implementation Plan*, available at: http://www.oecd.org/education/school-resources-review/TPL-Study-Design-and-Implementation-Plan.pdf.

OECD (2020), "TALIS 2018 results (Volume II): teachers and school leaders as valued professionals". available at: https://www.oecd-ilibrary.org/education/talis-2018-results-volume-ii_19cf08df-en.

Opfer, V.D., Pedder, D.J. and Lavicza, Z. (2011), "The influence of school orientation to learning on teachers' professional learning change", *School Effectiveness and School Improvement*, Vol. 22 No. 2, pp. 193-214, doi: 10.1080/09243453.2011.572078.

R Core Team (2016), *R: A Language and Environment for Statistical Computing*, R foundation for statistical computing, available at: https://www.R-project.org/.

Rismark, M. and Sølvberg, A.M. (2011), "Knowledge sharing in schools: a key to developing professional learning communities", *World Journal of Education*, Vol. 1 No. 2, pp. 150-160, doi: 10.5430/wje.v1n2p150.

Rubin, D.B. (1976), "Inference and missing data", *Biometrika*, Vol. 63 No. 3, pp. 581-592, doi: 10.2307/2335739.

Runhaar, P. (2017), "How can schools and teachers benefit from human resources management? Conceptualising HRM from content and process perspectives", *Educational Management Administration and Leadership*, Vol. 45 No. 4, pp. 639-656, doi: 10.1177/1741143215623786.

Runhaar, P., Sanders, K. and Yang, H. (2010), "Stimulating teachers' reflection and feedback asking: an interplay of self-efficacy, learning goal orientation, and transformational leadership", *Teaching and Teacher Education*, Vol. 26 No. 5, pp. 1154-1161, doi: 10.1016/j.tate.2010.02.011.

Schafer, J.L. and Zhao, J.H. (2014), "Pan: multiple imputation for multivariate panel or clustered data", Version 0.9, [Computer software], available at: http://CRAN.R-project.org/package=pan.

Schenke, W., Sligte, H., Admiraal, W., Buisman, M., Emmelot, Y., Meirink, J. and Smit, B. (2015), *Scan School als Professionele Leergemeenschap [Scan School as Professional Learning Community]*, Kohnstamm Institute, Amsterdam.

Schipper, T.M., de Vries, S., Goei, S.L. and van Veen, K. (2019), "Promoting a professional school culture through lesson study? An examination of school culture, school conditions, and teacher

self-efficacy", *Professional Development in Education*, Vol. 46 No. 1, pp. 1-18, doi: 10.1080/19415257.2019.1634627.

Senge, P.M. (1990), *The Fifth Discipline: The Art and Practice of the Learning Organization*, Doubleday, New York.

Slavit, D. and Nelson, T.H. (2010), "Collaborative teacher inquiry as a tool for building theory on the development and use of rich mathematical tasks", *Journal of Mathematics Teacher Education*, Vol. 13 No. 3, pp. 201-221, doi: 10.1007/s10857-009-9136-x.

Sleegers, P., den Brok, P., Verbiest, E., Moolenaar, N.M. and Daly, A.J. (2013), "Toward conceptual clarity: a multidimensional, multilevel model of professional learning communities in Dutch elementary schools", *The Elementary School Journal*, Vol. 114 No. 1, pp. 118-137, doi: 10.1086/671063.

Stoll, L. and Kools, M. (2017), "The school as a learning organisation: a review revisiting and extending a timely concept", *Journal of Professional Capital and Community*, Vol. 2 No. 1, pp. 2-17, doi: 10.1108/JPCC-09-2016-0022.

Stoll, L., Bolam, R., McMahon, A., Wallace, M. and Thomas, S. (2006), "Professional learning communities: a review of the literature", *Journal of Educational Change*, Vol. 7 No. 4, pp. 221-258, doi: 10.1007/s10833-006-0001-8.

Tam, A.C.F. (2015), "Exploring teachers' beliefs about teacher learning in professional learning communities and their influence on collegial activities in two departments", *Compare: A Journal of Comparative and International Education*, Vol. 45 No. 3, pp. 422-444, doi: 10.1080/03057925.2013.872025.

Thoonen, E.E., Sleegers, P.J., Oort, F.J., Peetsma, T.T. and Geijsel, F.P. (2011), "How to improve teaching practices: the role of teacher motivation, organizational factors, and leadership practices", *Educational Administration Quarterly*, Vol. 47 No. 3, pp. 496-536, doi: 10.1177/0013161X11400185.

Vangrieken, K., Dochy, F., Raes, E. and Kyndt, E. (2015), "Teacher collaboration: a systematic review", *Educational Research Review*, Vol. 15, pp. 17-40, doi: 10.1016/j.edurev.2015.04.002.

Vangrieken, K., Grosemans, I., Dochy, F. and Kyndt, E. (2017), "Teacher autonomy and collaboration: a paradox? Conceptualising and measuring teachers' autonomy and collaborative attitude", *Teaching and Teacher Education*, Vol. 67, pp. 302-315, doi: 10.1016/j.tate.2017.06.021.

Warwas, J. and Helm, C. (2018), "Professional learning communities among vocational school teachers: profiles and relations with instructional quality", *Teaching and Teacher Education*, Vol. 73, pp. 43-55, doi: 10.1016/j.tate.2018.03.012.

Warwick, P., Vrikki, M., Vermunt, J.D., Mercer, N. and van Halem, N. (2016), "Connecting observations of student and teacher learning: an examination of dialogic processes in lesson study discussions in mathematics", *Zdm*, Vol. 48 No. 4, pp. 555-569, doi: 10.1007/s11858-015-0750-z.

Westheimer, J. (1999), "Communities and consequences: an inquiry into ideology and practice in teachers' professional work", *Educational Administration Quarterly*, Vol. 35 No. 1, pp. 71-105, doi: 10.1177/00131619921968473.

Wong, J.L. (2010), "Searching for good practice in teaching: a comparison of two subject-based professional learning communities in a secondary school in Shanghai", *Compare: A Journal of Comparative and International Education*, Vol. 40 No. 5, pp. 623-639, doi: 10.1080/03057920903553308.

Corresponding author
Loes de Jong can be contacted at: l.a.h.de.jong@iclon.leidenuniv.nl

For instructions on how to order reprints of this article, please visit our website:
www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: **permissions@emeraldinsight.com**