



Professional learning communities at a primary and secondary school network in India

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Abstract

Schools in India typically provide teachers with professional development in the form of workshops with a one-size-fits-all approach. However, a large body of international studies show this to be ineffective in transforming classroom practice, and the draft National Education Policy of India released in 2020 lists several shortcomings of current in-service professional development practices across the country. On the other hand, a large body of international research has emerged to show that professional learning communities (PLCs) are one of the most effective means to improving teacher practice and student learning. Yet, the National Education Policy does not make any explicit mention of PLCs. This study shows that the benefits of PLCs researched in international contexts may apply to the Indian context too because it was found that participation in PLCs might have supported increased collaboration among teachers, improved classroom teaching, and increased unity and consistency in practice across classrooms, at two schools in India. Also, this paper presents important findings related to the successful planning and operationalization of PLCs in the context of Indian schooling. It is hoped that with the publication of this study, public and private schools in India will be encouraged and better prepared to take steps towards the establishment of PLCs in their institutions as a key lever for school improvement.

Keywords Professional learning community · Teacher professional development · Teacher training · Communities of practice

Introduction

Teachers and the quality of their classroom practice have a significant influence on student learning (Darling-Hammond et al. 2017; Hattie 2008; Hightower et al. 2011; Ministry of Human Resource Development 2018, 2020; National

Council for Educational Research and Training in India 2011). Hence, it is critical for teachers to receive effective professional development to support their teaching performance (Darling-Hammond et al. 2017). However, teachers in India feel like they receive professional development that is either insufficient or irrelevant to their needs and interests (Ministry of Human Resource Development 2018). One-size-fits-all lecture-based workshops are the typical in-service professional development format (Das et al. 2013). However, such event-based engagements have limited impact on classroom instruction (Darling-Hammond et al. 2017; Knight 2002). Instead, teachers should participate in sustained engagements that encourage collaborative problem solving and engage them in active learning over sustained durations of time (Corcoran and Goertz 1995; Darling-Hammond et al. 2017; Desimone 2009).

A growing body of research shows that professional learning communities (PLCs) help in-service programs to better meet key indicators of evidence-based professional development. DuFour and Eaker (2005) explained that, “the most promising strategy for sustained, substantive school

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improvement is developing the ability of school personnel to function as PLCs” (p. xi). This assertion was recently validated by a study that compared the effects of six different kinds of engagements namely professional development programs, teacher collaboration including PLCs, university or college courses, professional conferences, informal communication, and individual learning activities (Akiba and Liang 2016). The study concluded that collaborative activities such as PLCs were more successful than the other activities in improving student learning outcomes (Akiba and Liang 2016).

In order to enhance their in-service professional development, the ABC School Network¹ in India established PLCs on 12 campuses with 778 teachers serving 32,000 students from Grades K-12. This paper explores the nature and effects of PLCs at two of its 12 campuses—School 1 and School 2.²

Literature review

Theoretical framework

PLCs aim to increase student learning by improving teacher practice (Vescio et al. 2008) through engagement in collaborative problem solving, data-driven decision making, and continuous improvement (DuFour and DuFour 2013; Hord 1997). PLCs are spaces where educators collaborate and engage in recurring cycles of inquiry or reflective dialogue to increase student learning (Dogan et al. 2016). In this sense, PLCs are conceptually grounded in *social constructivism*, *situated learning*, and *improvement science*.

A fundamental idea in social constructivism is the *zone of proximal development*—the difference in learning outcomes between an individual’s independent efforts and their efforts when supported by more capable collaborators (Vygotsky 1978). Based on this theory, educators will perform better when they have the opportunity to interact with and support each other, rather than work independently (Gee 2008). PLCs provide such opportunities for collaboration (Schaap and Brujin 2018; Zhang and Sun 2019).

Situated learning theory asserts that knowledge of practice is generated from interactions between peers while engaging in work that takes place in their unique social context (Brown et al. 1989; Cobb and Bowers 1999). This knowledge is inextricably connected to, and is an output, of the learning situation itself (Svinicki 1999). Further, the emergence, redevelopment, and transfer of such knowledge is situated or located in these communities of practice and further developed through collaborative social interactions

(Lave and Wenger 1991). PLCs support the building and evolution of such context-specific knowledge, by engaging teachers in sharing, reflection, and collaborative problem solving (DuFour and DuFour 2013; Zhang and Sun 2019).

Finally, the framework of improvement science explains the process of generating local knowledge through the use of plan-do-study-act cycles for reflection on action (Langley et al. 2009; Lewis 2015). Effective PLCs engage in such continuous improvement cycles, where teachers collect student learning data, collaboratively design interventions for increased student learning, implement the interventions, analyse process and outcome data related to the implementation of the intervention, and finally, apply the knowledge generated from this process to further enhance the intervention (DuFour and DuFour 2013).

Effects of PLCs

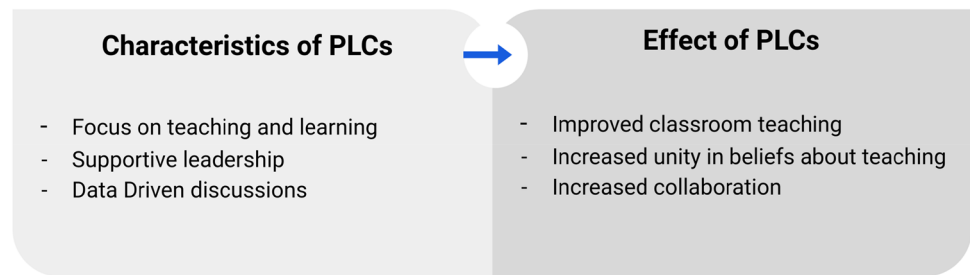
Research shows that PLCs provide teachers with the time and opportunity to come together and share practice (Schaap and Brujin 2018). This improves collaboration and connectedness among colleagues (Tam 2015; Vescio et al 2008), promotes inquiry on practice, helps build common beliefs on teaching and learning, and creates unity of purpose and shared responsibility (Pella 2011; Tam 2015; Zhang and Sun 2019). The positive influence of PLCs on teachers’ classroom practice has been presented in earlier literature (Hord 1997; Vescio et al 2008), and reiterated in contemporary literature. A study across 200 schools showed that teachers perceived an improvement in classroom practice due to participation in PLCs where collaborative lesson planning and problem solving took place (Williams 2013). A recent analysis of 14 peer-reviewed empirical studies found that teachers participating in PLCs showed a more learner-centred approach to teaching (Dogan et al. 2016). This finding was echoed in multiple studies (Burns et al. 2018; Dogan and Adams 2018). The use of improved teaching methods was likely because teachers shared their expertise and acquired perspective during their conversations in the PLCs (Dogan et al. 2016).

Characteristics of effective PLCs

Earlier research shows that several variables influence the functioning of PLCs (DuFour and DuFour 2013; Hord 1997; Louis et al. 2010; Stoll et al. 2006). Contemporary research has confirmed some of these characteristics, such as supportive leadership, focus on teaching and learning, and data-driven discussions. Studies show that leadership influences the manner of collaboration and effectiveness with which PLCs are implemented, thereby significantly affecting their influence on student learning (Burns et al. 2018; Ismail et al. 2019; Luyten and Bazo 2019; Zheng et al.

¹ ABC School Network is a pseudonym.

² School 1 and School 2 are pseudonyms.

Fig. 1 Characteristics and effects of PLCs

2019). Another characteristic of successful PLCs is that they demonstrate a focus on teaching and student learning-related matters (Dogan and Adams 2018; Ismail et al. 2019; Mu et al. 2018), where collaboration entails study of curriculum, lesson design, and decisions regarding classroom practice (Ronfeldt et al. 2015). Finally, effective PLCs are characterized by collaborative analysis using student learning data to inform discussions and instruction (Burns et al. 2018; Marsh et al. 2015; Voelkel and Chrispeels 2017). A summary of the characteristics and effects of PLCs, as found in research, are depicted in Fig. 1.

Implementation of PLCs at School 1 and School 2

A series of workshops were conducted at each campus before the launch of PLCs. The entire team of teachers and school leaders participated. The workshops introduced participants to the concept of PLCs, their benefits, and the characteristics of successful PLCs, as per research. The workshops ended with a planning session where each school consulted over how to operationalize PLCs in terms of teacher grouping, and meeting dates, times, location, and agenda templates. Also, each campus appointed a PLC-in-charge to supervise the implementation of the initiative with high fidelity based on findings from research regarding the characteristics of effective PLCs. After six month of implementation, each campus conducted a reflection meeting with all PLC participants and school leaders to engage in consultation about the extent to which they had conducted their PLCs with fidelity, the effects of PLCs they had experienced, and discussion over any changes that needed to be made to their PLC protocols to make it more effective in their unique context. Also, a workshop on how to engage in data-driven decision making at PLC meetings was conducted to empower teachers on this subject and support more productive discussions during PLC meetings.

The effectiveness of PLCs is affected by the extent of commonality in content and grade level taught between its participants (DuFour and DuFour 2013). Thus, PLC teams at School 1 and School 2 were organized around grade levels and subjects taught. One English and one math PLC were formed for each grade level from 1 to 5. Also, one English PLC and one math PLC were formed for teachers of grades

6–8 combined, given that the same teachers taught across grade levels. Each PLC consisted of 5–9 teachers, of which one was appointed as facilitator. In order to ensure active participation, free discussion, and focus on teaching and learning matters only, a specific meeting protocol and supporting agenda template were created (Annexure 1). Meetings were structured for 45 min at School 1 and 60 min at School 2, at a frequency of not more than twice per month. A PLC head was appointed at each campus and expected to ensure the implementation of meeting protocols and the schedule with fidelity, and solve any technical doubts or concerns that PLC facilitators might have had.

In order to assess the fidelity of implementation of PLCs, and understand its influence on teachers' classroom practices and collaboration, the following research questions guided this study:

1. To what extent were the PLCs implemented with fidelity?
2. In what ways did participating in PLCs influence teachers' classroom practice?
3. In what ways did participating in PLCs affect collaboration amongst teachers?

Methodology

This mixed methods study (Leech and Onwuegbuzie 2006) relied on a partially mixed concurrent qualitative dominant status design. "Mixed methods research...combines elements of qualitative and quantitative research approaches... for the purposes of breadth and depth of understanding and corroboration" (Johnson et al. 2007, p. 123). Such designs can be fully or partially mixed with differentiation given to the integration or mixing of quantitative and qualitative approaches across the phases of research (Leech and Onwuegbuzie 2006). A "partially mixed concurrent dominant status design involves conducting a study with two facets that occur concurrently, such that either facet has the greater emphasis" (p. 268). For this study, the two facets included the implementation and outcomes of the PLCs with English and math teachers. Further, the quantitative and qualitative data were mixed across multiple phases of the research study. This

Table 1 List of participants in the study

Quality assurance and innovation department participants (<i>n</i>)	School 1 Participants (<i>n</i>)		School 2 Participants (<i>n</i>)		
Team members	7	Teachers	18	Teachers	16
Head of Department	1	Facilitators	6	Facilitators	8
Total	8	Department coordinators	9	Department coordinators	9
		PLC Head	1	PLC Head	1
		Principals	2	Principal	1
		Total	36	Total	35

included the research questions, data collection, and analysis stages. The research questions, including “to what extent” and “in what ways” question types, warranted the collection of qualitative and quantitative data. As such, data were collected from focus groups, interviews, meeting minutes, PLC Tracker Reports, and PLC Reflection Reports, to answer the research questions and satisfy the research purpose. Further, the quantitative and qualitative data were mixed during the analysis phase such that broad themes emerged to address the process and outcome evaluation questions while using both data sources (Creswell and Plano-Clark 2018).

Participants

The study had $n = 79$ participants (Table 1). The participants included teachers ($n = 34$), facilitators ($n = 14$), department coordinators ($n = 18$), PLC heads ($n = 2$), and principals ($n = 3$) across the two schools, as well as Quality Assurance and Innovation Department team members ($n = 7$), its head of department ($n = 1$). All the participants gave informed consent, and the study has fulfilled the technical requirements reflecting the use of ethical procedures in researching human participants. A total of 23 teachers and facilitators at each school site possessed B.Ed. degrees. One teacher from School 1 was still pursuing her B.Ed. The most qualified teachers had Masters Degrees in the sciences, business, and humanities. All teachers possessed the minimum qualifications to teach their grade level, as per government prescription. One teacher—in School 1—was male, while the rest across both schools were female. The teachers possessed between 2 and 25 years of experience.

Purposive sampling (Teddlie and Yu 2007) was used to identify math and English PLCs at both campuses as subjects. One English focus group and one math focus group consisting of 12 participants each took place at both campuses. A stratified sampling strategy (Teddlie and Yu 2007) was used to determine participants based on their role as facilitator or teacher. First, three facilitators from different PLCs were chosen at random. Then, nine teachers from nine remaining PLCs were chosen at random. Thus,

each focus group consisted of one member from each PLC. An additional focus group was conducted at each campus consisting of nine department coordinators and the PLC Head. Further, one focus group was conducted with the Principal and Senior Principal at School 1, and one personal interview was conducted with the Senior Principal at School 2. Finally, a focus group was conducted with eight core members of the school network’s Quality Assurance and Innovation Department who played a key role in launching and implementing the PLCs. These members were previously high-performing senior teachers at the ABC School Network. All members possessed the minimum qualifications to teach their grade level, as per government prescription.

Data collection

Fidelity of implementation

Data related to fidelity of implementation indicators—adherence and dosage—were collected from focus groups, personal interviews, PLC meeting minutes, and PLC Reflection Reports for the period November 2018 to April 2019. Data were also collected from PLC Trackers—documents that recorded weekly updates regarding participant attendance, whether or not meeting agendas were shared beforehand with participants in each group, whether or not meeting agendas included discussions around teacher and student data, and other key implementation fidelity details for each and every PLC at the school.

Adherence

Supportive leadership, structure and focus on teaching and learning, and use of data for discussions were considered *adherence*-related indicators of implementation fidelity (Dusenbury et al. 2003; Nelson et al. 2012). Adherence implies the extent to which implementation reflects key elements of a program’s design (Dusenbury et al. 2003). In this study, supportive leadership was examined in terms of teachers’ perceptions regarding the availability of resources such as time, technology, and space, needed to effectively run meetings (Louis et al. 2010; Stoll et al. 2006). The focus on teaching and learning during meetings was measured by the extent to which agendas, protocols for discussion, and tools to focus on teaching and learning matters were used (DuFour and DuFour 2013; McDonald et al. 2013). The use of data for discussions was measured by the extent to which teacher and student data were brought to meetings and used to drive conversations about improving teaching and learning (DuFour and DuFour 2013; Marsh et al. 2015).

Dosage

On the other hand, frequency and duration of meetings, and attendance of participants were considered *dosage*-related indicators of fidelity (Dusenbury et al. 2003; Nelson et al. 2012). Dosage implies the extent to which implementation reflects the total time that participants had planned to invest in the program (Dusenbury et al. 2003). Frequency and duration of meetings were measured in terms of the number of times that PLCs took place over each week and over the period of the study, while the duration of meetings was measured in terms of the number of minutes each meeting lasted. Studies show that effective PLC meetings range from 40 to 50 min (Jones et al. 2013; Saunders et al. 2009), 75 min (Gersten et al. 2010), between 1 and 2 h (Ahn 2017; Damjanovic and Blank 2018; Ndunda et al. 2017), and even up to half a day (Coburn 2001). While, meeting frequencies range from once a week (Brodie 2013; Ndunda et al. 2017; Williams 2013), two to three times a month (Riley 2015; Saunders et al. 2009), and up to once in 5 or 6 weeks (Schechter 2010). Attendance at meetings was measured in terms of the average percentage of PLC members present over the study period. While attendance measures were not found in any prior PLC literature, attendance of participants during interventions in program evaluation literature is a general indicator of dosage related to implementation fidelity (Dusenbury et al. 2003).

Teacher classroom practice

A large body of literature shows that PLCs positively influence teacher practice (Chou 2011; Gersten et al. 2010; Pella 2011). These findings were categorized into PLC's effects on evidence-based practice, and unity and consistency in practice across team members. The Framework for Teaching was used as the measure for evidence-based practice (Daniei 2013). This instrument is premised on empirical evidence related to teacher practice that shows student learning is affected by indicators within the domains of (1) planning and preparation; (2) classroom environment; (3) instruction; and (4) professional responsibility (Danielson 1996). The Framework for Teaching is the most widely used paradigm for teacher practice in the U.S. Unity and consistency in practice across team members was measured by the extent to which PLCs engaged teachers in collective sense making of curricular goals and resources, and encouraged them to synthesize their diverse prior knowledge and experiences to reach a unity in beliefs about teaching and learning that were transferred to their classrooms (Chou 2011; Coburn 2001; Pella 2011). Data related to teacher classroom practice was collected from focus groups, personal interviews, and minutes of PLC meetings.

Collaboration

Successful collaboration was measured in terms of the extent to which PLCs engaged teachers in “sharing, reflecting, and taking the risks necessary to change” (Vescio et al. 2008, p. 84). Also, collaboration was measured by the extent to which teachers and leaders perceived the PLCs as positively affecting school culture by moving them away from the traditionally isolationist culture to a higher degree of connectedness (Vescio et al. 2008). Data related to collaboration was collected from focus groups, personal interviews, and minutes of PLC meetings.

Data analysis

The researchers relied on emergent and deductive approaches (Rossman and Rallis 2011) to analyse focus group and personal interview data to examine the outcomes of the intervention. As such, a priori as well as emergent codes were used during the analysis. First, the corpus of data was explored to identify responses that addressed the implementation of the intervention and its outcomes. The researchers coded data using first- and second-cycle coding procedures (Miles et al. 2014). When examining the fidelity of implementation of PLCs, the researchers relied primarily on descriptive coding during the first cycle, and pattern coding using a deductive analysis approach for the second cycle. Descriptive coding is used to apply labels for the purpose of summarizing data (p. 73). Pattern coding using deductive analysis relied on a priori themes from the literature to explore program adherence (p. 86). The themes aligned with characteristics of effective PLCs (DuFour and Dufour 2013).

The examination of the outcomes related to PLCs relied on first cycle in vivo coding. This approach to coding assigns labels using the words or phrases of the participants (Miles et al. 2014, p. 73). For example, as teachers explained how the PLC influenced their practice, codes such as *activity based*, *interactive*, and *assessment data use*, were assigned using the language of the participants. The second-cycle coding process relied on the pattern codes that summarized emergent themes from the codes developed during first cycle coding. For example, the codes *activity based*, *interactive*, and *assessment data use* were examined for commonality, which resulted in the theme *evidence-based practice*.

Finally, assertions were made (Erickson 1986) to describe the implementation of the PLCs, changes in practice, and collaboration amongst teachers. For example, the codes and themes that were developed on changes in classroom practice were analysed to make an assertion about how classroom practices evolved over the course of the intervention. The qualitative data were also triangulated (Shenton 2004) with data from the PLC tracker and meeting minutes. Descriptive analysis was used to examine the implementation of the

intervention using percentages related to program adherence and dose. Finally, the data on program implementation and its outcomes were merged around broad themes to address the research questions.

Limitations

This study did not have a comparison group, and there was no baseline or pre-intervention data collected to measure the effects of PLCs over time. The design could only present participant perception in correlation to the intervention but not causality, thereby exposing the study to threats of validity (Shadish et al. 2002). And, the use of only two study sites impacted the reliability of the findings. Furthermore, the relatively small sample of this study did not allow for generalizability of the findings using quantitative measures. Also, the influence of PLC participation on classroom practice was determined solely on teacher and leader perception data. No pre- and post-classroom observation data were available to support such perceptions. Finally, considering the short period of the study, the influence of PLCs on student learning could not be assessed.

Results

Research question 1

Findings for the first research question—to what extent were the PLCs implemented with fidelity—showed that the intervention was executed with acceptable fidelity on all indicators except the number of meetings at School 2. Leaders supported PLCs by providing teachers with time for meetings within the workday, space for meetings, and technology to facilitate productivity during meetings. Leaders also supported PLCs by actively participating in some meetings themselves and sharing encouraging words with team members via group communications. PLC meeting agendas were structured and focused squarely on teaching and learning matters. More than 90% of the meetings on average across both schools demonstrated data-driven discussions. Attendance at meetings was an average of 95% across both schools. Meetings lasted approximately 60 min at both schools and were considered to be of optimal duration by participants. Finally, the total number of meetings implemented versus planned was 91% at School 1 and 48% at School 2.

Supportive leadership

School leaders supported PLCs by providing essential resources of time, space, and technology. First, principals changed the timetable so that students were dismissed from school 90 min earlier than usual on Saturdays, enabling

teachers to use the remaining time for PLC meetings. Making time within working hours of teachers, instead of extending work hours—as had been done in the first year at School 1—was appreciated by the team and deemed more effective by all focus group participants. As far as space and technology were concerned, it was found that all teachers from both schools agreed that the classrooms and interactive white boards with WiFi access maximized productivity of meetings.

Focus group and personal interview data revealed that the school principals also supported PLCs by actively participating in some meetings and sharing encouraging words with team members over the PLC WhatsApp³ groups. Each campus was assigned one leader as PLC Head to support logistics and oversee the fidelity of implementing PLC agendas. Teachers, facilitators, the Quality Assurance and Innovation Department team, and Principals interviewed across both schools cited the PLC Head as being a key influence on the quality of meetings. One teacher at School 2 mentioned the PLC Head “is there to guide us”. All other participants nodded in agreement. The same sentiment was visible in both focus groups at School 1. A member of the Quality Assurance and Innovation Department asserted, “I think it is all the leadership”, to which the remaining members of the focus group nodded and agreed.

Structure and focus on teaching and learning

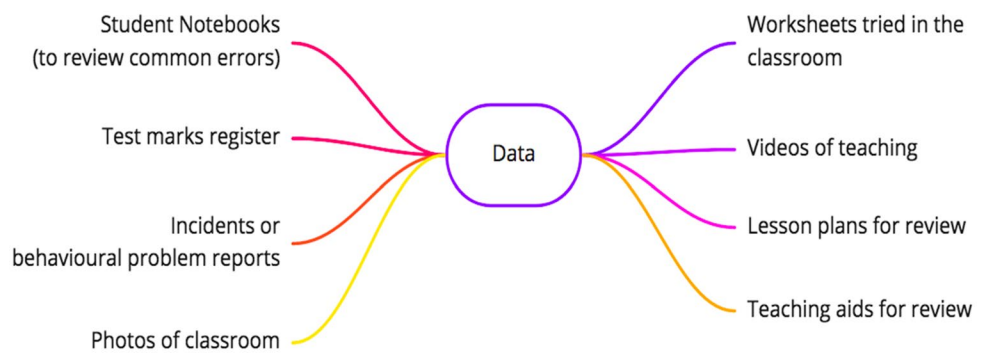
Focus group discussions revealed that PLC meetings were focused on teaching and learning through the use of structured agendas. A study of the PLC tracker confirmed this. Data for January to June 2019 showed that 53 out of 54 meeting agendas at School 2 were structured and shared with participants in advance. Similarly, 58 out of 60 meeting agendas were structured and shared in advance at School 1. More importantly, a study of 15 randomly chosen PLC meeting minutes showed that only items related to teaching and learning featured on the agenda.

Discussions driven by data

All teachers shared that bringing student data to PLC meetings was a regular practice. Teachers at School 2 and School 1 explained that a different member was asked to bring data to each meeting. PLC Tracker data for the months of January to April 2019 showed that 83% of PLC meets at School 1 and 98% of the meets at School 2 had discussions on data brought by teachers. Focus groups and PLC minutes revealed that diverse sources of data were brought to

³ WhatsApp is a free software that allows users to make groups and message each other on their phones.

Fig. 2 Types of data brought to PLC meetings



meetings, as depicted in Fig. 2. PLC members at School 1 brought student assessment sheets to their meetings and used them to reflect on student learning and areas where more support and even remedial classes might be needed. Teachers of the junior math PLC found a common trend in student notebooks where they used the transposition method to solve linear equations even when the inverse method operation was asked for. The teachers decided to re-explain both methods with the help of suitable examples and clear instructions.

Frequency and duration

Both schools planned for PLC meetings to take place on Saturdays. Each PLC was scheduled to meet at a maximum frequency of once in two weeks. Keeping the school holiday calendar in mind, PLCs were scheduled to meet between 9 and 10 times over November 2018 to April 2019. PLC Reflection Report data showed that School 1 completed about 91% of its scheduled meetings. Two of the 12 PLCs met only seven times, while the remaining 10 PLCs met nine times each. On the other hand, PLCs at School 2 completed only about 48% of its scheduled meetings. Five of the 12 PLCs met only four times, while the remaining seven PLCs met five times each. Teachers at School 2 expressed that the less-than-planned number of meetings was due to practical constraints that led to cancellations. During focus groups, every teacher at School 1 and School 2 agreed that meeting once every two weeks was optimal. More frequent meetings would “overexploit” their creativity and make it difficult to bring meaningful data to each meeting. On the other hand, meeting only once a month or less negatively affected continuity. Meetings at School 1 were scheduled for 45 min, but focus group discussions revealed that meetings invariably went overtime to about 60 min. It was found that PLCs at School 2 typically lasted 60 min, as planned.

High-participant attendance

Attendance at meetings across both schools was near perfect according to data from the PLC Reflection Report. Attendance during the period of January to August 2019 was 94%

at School 2 and 96% at School 1. Teachers expressed that the leadership did not appreciate participants missing meetings. One teacher also shared, “we look forward to PLCs so we also avoid taking leave on PLC days”.

Research question 2

Findings for the second research question—in what ways did participating in PLCs influence teachers’ classroom practice—revealed that participation in PLCs may have increased the use of evidence-based classroom practice by helping teachers move from didactic to active engagement pedagogy, and increasing the use of effective teaching resources, group work, and assessment and feedback during teaching. Further, an increase in consistency of teaching, planning, and assessment practices was noted across participant classrooms.

Evidence-based practice

Teachers expressed that there was a considerable transfer of ideas from PLCs to the classroom, and that they became better teachers because of it. One teacher said that the PLCs gave “more new ideas which help us in our teaching”. Many examples of such ideas being translated to action were shared. One teacher asserted, “just writing on the board and students copying is not the best method”. Teachers and leaders expressed that because of the PLCs, teaching had become more “activity based” and “interesting”. One teacher exclaimed, “my teaching method has changed; I never used to implement activities before; (but) we can make it more interactive”. Another teacher echoed this sentiment and shared, “boring lecture methods have changed; children are enjoying class”. At School 1, teachers agreed that, “traditional methods have changed to modern methods”. This reflects *proficient* teaching as per the Framework for Teaching (Danielson 2013), which states that evidence-based practice implies minimal lecture time so that “students are intellectually engaged in the lesson” (p. 51).

One teacher explained, “we were able to break the monotony of the math class because of new ideas shared”. Another

teacher said, “children in our class would get confused, they used to forget and get confused where to write what; (so) one group member introduced the *MSD method* (to connect the concept of) Minuend—Subtrahend—Difference with MS Dhoni; now all children remember as they are familiar with this name”. She was alluding to the fact that students were able to remember Min-Sub because she connected it with the name of a famous Indian cricketer M.S. Dhoni that the students idolized. The teacher claimed that this idea emerged from a PLC meeting and is an example of proficient classroom practice as per the Framework for Teaching (Danielson 2013) where lesson plans are adjusted based on formative assessment data. It is also an example of how teachers were empowered to leverage student interest to make the lesson more relatable and engaging—another indicator of evidence-based practice as per the Framework for Teaching (Danielson 2013) stating that proficient teachers “plan activities using knowledge of students’ interests” (p. 11) and “incorporate students’ interests into the lesson” (p. 58).

In addition, the PLCs may have helped teachers source-effective teaching resources. One language teacher at School 2 shared, “when we were in school we were taught only from the book; so when I was new I did it as I knew; but via the PLC I was made to observe and understood; then I started by taking a *burger sheet* and even my quiet students participated”. This example shows that the PLC may have supported the teacher to display proficiency in practice through “skilful use of resources, when necessary obtained from outside the official materials provided by the school through her own initiatives” (Danielson 2013, p. 15).

Also, effective use of group work may have been supported by PLCs. In a focus group at School 1, the English teacher explained that they once talked about pairing strategies to support students and that because of it, “we have started asking the fast writers to help the slow writers”. Another such example was presented by a PLC member who explained that “(we) divided class into four and each group had to take one page and find different types of sentences; even the weakest ones were able to read and participate”. Grouping is an important evidence-based practice in the Framework for Teaching (Danielson 2013), where proficient teaching shows “instructional groups are organized thoughtfully to maximize learning and build on students’ strengths” (p. 20), “students are productively engaged in small group work” (p. 33), and the “teacher uses groupings that are suitable to the lesson activities” (p. 51).

PLC meeting discussions may have also supported the effective use of assessment and feedback in class. One teacher shared that because of her PLC meetings she started “giving one question a day as challenge of the day”. School 1’s PLC Head said that the “quality of practice worksheets has gone up” because of PLC meetings. An English teacher in one focus group said that student reading improved in her

class because she started using a strategy where students were asked to pick chits to come up to the front of the class and perform a read aloud. This promoted student practice and allowed for meaningful feedback. Such strategies reflect evidence-based instruction as per the Framework for Teaching (Danielson 2013), where proficient lesson plans “include formative assessments during instruction” (p. 23), and the “teacher elicits evidence of student understanding” (p. 55) through classroom activities.

Unity and consistency in practice across classes

A teacher from School 1 expressed that, “before PLCs there were disparities in classes (but now) there’s more unity”. Another teacher from School 2 explained that, “now we are teaching in the same (way); before we didn’t know how others were teaching”. All members of both focus groups agreed. Also, School 2’s Grade 5 math PLC meeting minutes for 3rd November 2018 showed that the team took up the collaborative design of lesson plans for the topic of construction of angles. The teachers created a common lesson plan to be implemented across all Grade 5 math classes and included an introductory activity, which involved technology. Such activities may have increased consistency in classroom practice. According to the central Quality Assurance and Innovation Department team, the PLCs brought more uniformity in planning and assessment practices. Participating in such team decision-making processes that support consistency of practice is considered a reflection of proficiency under the “showing professionalism” measure of the Framework for Teaching (Danielson 2013).

Research question 3

Findings for the question—in what ways did participating in PLCs affect collaboration amongst teachers—revealed that the PLC may have fostered stronger bonds between team members as they were perceived by peers as more helpful and comfortable with one another. Further, the willingness of teachers to share knowledge of successful practice with one another, especially from more experienced to novice teachers, emerged as an important output of the PLCs. Finally, instances of collaborative problem solving were documented in PLC minutes, where teachers shared problems of practice and received suggestions from their peers which were then implemented successfully in the classroom.

Connectedness

A common theme that emerged during focus groups was that PLC meetings promoted stronger connections between team members. One teacher expressed that earlier team members would think, “where do I have the time to interact

(with others); but then with the PLCs the bonding has really evolved”. All other members of the focus group agreed, and this sentiment was echoed in other focus groups as well. All three principals, in their personal interviews, added that the PLCs have supported an increased sense of connectedness amongst teachers. One focus group participant expressed that “everybody has become helpful”, and that the PLCs have “brought teachers to a common platform where they can share their problems and innovative ideas; they love to share”. Another teacher said that, “earlier I was thinking no one is ready to help me out”. The Quality Assurance and Innovation Department team echoed these sentiments by saying that there has been a change from, “an ‘I’ concept to a ‘we’ concept; (teachers) are very comfortable with sharing failures which before they weren’t confident to share”.

Sharing practice

Focus groups revealed that the PLCs were a powerful space for novice teachers to learn and benefit from the knowledge and ideas shared by more experienced peers. One Principal said that, “now they (teachers) want to share; they are willingly sharing; (earlier, they) wanted to keep things up their sleeve but not anymore; we have seen drastic change since the time we have introduced PLCs”. The Quality Assurance and Innovation Department team explained that, “new teachers get access to senior teachers which they would not get otherwise” and through these interactions they gain valuable insights. Teacher focus groups echoed these sentiments, with one teacher expressing, “it is good for newcomers; (they) learn a lot, learn a lot”.

Also, instances of such sharing were found in PLC minutes. For example, School 2’s Grade 5 math PLC engaged in the collaborative design of lesson plans for a geometry concept. Experienced teachers of the group led the exercise. During this meeting, new teachers were exposed to examples of effective lesson planning. In another example, one teacher at School 1 on the 31st of January in the Grade 2 English PLC brought a video showing an activity she implemented in her class to teach students the concept of homophones while building their vocabulary. Other teachers expressed that they would like to implement this activity in their classrooms.

Collaborative problem solving

Focus groups revealed that PLCs allowed for collaborative problem solving. One teacher expressed that, “I am learning something new from somebody else; I may not be able to deal with a problem but then come to the PLC and with all others can find a solution”. All other participants of the focus group agreed. Another teacher explained that, “when I joined I came from a different background and dealing with little kids was difficult; I took a number line and the result

in the books was horrible; I came to the PLC and now my results are beautiful”. One teacher provided an example of a discussion in her PLC regarding estimation of sums, “it wasn’t in the curriculum earlier, so we discussed it in the PLC and the new ideas helped teachers tackle and deliver it better”.

Another teacher explained that earlier her students would resist essay-writing tasks, but then at the PLC, it was discussed that sentence starters could be given as scaffolds and this worked well in her class when she tried it. With the help of her peers in the PLC, the teacher was able to engage in reflection on teaching, which is considered a sign of proficient teaching where the practitioner “identifies specific ways in which a lesson might be improved” (Danielson 2013, p. 62). Examples of problem solving discussions were found in PLC minutes too. On the 30th of November 2018, one teacher in School 2’s Grade 4 math PLC shared cases of poor behaviour and children falling behind in her class. Members of the PLC suggested ideas and solutions, such as closer monitoring during class time, extra classes, and engaging parents. The teacher facing trouble found these suggestions helpful and implemented them in her classroom and saw positive results, as recorded in the subsequent PLC meeting minutes.

Discussion

Research shows that in order for PLCs to be effective, they must possess certain characteristics, including supportive leadership (Burns et al. 2018; Zheng et al. 2019), meetings focused on teaching and learning (Ronfeldt et al. 2015; Ismail et al. 2019), and discussions and instructional decisions being made using student data (Marsh et al. 2015; Voelkel and Chrispeels 2017). All three characteristics were found in the PLCs at School 1 and School 2. Leaders at both schools supported PLCs by creating meeting time for teachers within their weekly school working hours. Also, leaders ensured that each PLC had access to an appropriate meeting space, and had the necessary technology available to support efficient discussions and decision-making. Finally, leaders also attended and participated in meetings, while placing a school-wide priority or focus on the PLC initiative through repeated communications and encouragement. A random assessment of PLC agendas and minutes across both schools showed that all the meetings focused on matters pertaining to only teaching and learning. Also, PLC tracker data and meeting minutes showed that 90% of the meetings engaged participants in discussions over classroom practice data or student learning data.

Fidelity of implementation with regard to dosage showed that the number of meetings at School 1 was very close to what was planned at the outset, while the number of

meetings at School 2 was far less than planned. Yet, the average frequency of meetings at School 1 and School 2 fell within the dosage range of once a week (Brodie 2013; Ndunda et al. 2013; Williams 2013) to once in 6 weeks (Schechter 2010) found in prior literature. Teachers from both schools, however, expressed that based on their experience, any more or less than a frequency of once in 2 weeks was suboptimal. The duration of meetings at School 1 and School 2 was approximately 60 min each. This was slightly higher than the minimum amount of 40 to 50 min found in prior literature (Jones et al. 2013; Saunders et al. 20,019). There was almost unanimous consensus across participants at School 1 and School 2 that the duration implemented was just right at 60 min and that less or more would be suboptimal. Finally, it was found that participant attendance at meetings across both schools was high, averaging more than a 94% attendance rate.

In summary, with regard to implementation, the PLCs at School 1 and School 2 reflected key elements of successful design as per global research. The meeting agendas focused squarely on teaching and learning matters, and teaching and student data were used for discussion and decision making. Also, the frequency and duration of meetings fell within the range found in prior international studies. Finally, leadership support with key inputs like creating time in weekly teacher schedules for meetings and providing conducive physical spaces and technology for meetings was found, reflecting key characteristics of effective PLCs as per global research. In addition to this, the PLCs at School 1 and School 2 experienced a few inputs that were not previously found in research. First, participants engaged in workshops before the establishment of PLCs and then again after 6 months of operation. These sessions oriented participants to the concept of PLCs, helped them plan for their own PLCs given the unique affordances and constraints of their context, and build their understanding of data-driven decision-making practices. Second, leadership support to PLCs included occasional attendance by them at PLCs and also encouragement through official communications to the PLC teams.

PLC literature shows that effective PLCs can influence student learning by increasing collaboration between teachers (Schaap and Brujin 2018; Williams 2013), increasing their unity of beliefs about teaching and learning (Tam 2015; Zhang and Sun 2019), and improving classroom practice (Dogan and Adams 2018; Dogan et al. 2016). All three effects were experienced in this study. Teachers and leaders at School 1 and School 2 reported a heightened sense of bonding and connectedness between team members. Teachers were helping each other with solving problems and were

found to openly share ideas and classroom practice with one another. This was not experienced earlier, as reported by teachers and leaders. Leaders reported an increase in consistency of teaching practices, lesson plans, and assessment practices, across participant classrooms. This too was not noticed before PLCs. Studies validate the effect of PLCs in encouraging teachers to synthesize their diverse prior knowledge and experiences and reach a unity in beliefs about teaching and learning within the team, consequently influencing their classroom practice (Chou 2011; Pella 2011; Tam 2015). Finally, participation in PLCs in School 1 and School 2 was found to have influenced the classroom practice of some teachers to evolve from teacher-centred instruction to evidence-based student-centred instructional activities that were perceived to be more interesting for students. This is an important finding because it shows that the PLCs helped teachers move far beyond simply lecturing students and asking them to copy notes from the black board—practices rife in the Indian schooling context that have been a cause of concern documented in reports and studies (Ministry of Human Resource Development 2018; Probe Team 1999; Singh and Sarkar 2012). Also, evidence-based classroom practice was found to increase, as seen in the increased use of effective teaching resources, group work strategies, and checking for understanding in the classroom.

Conclusions

There is a dearth of research on PLCs in the Indian context, with only one prior peer-reviewed study published by Padwad and Dixit (2008) more than a decade ago. The draft National Education Policy of India released in 2019 (Ministry of Human Resource Development 2018) and the subsequent National Education Policy released in 2020 list several shortcomings of current in-service professional development practices across the country. However, among the many reform suggestions, the National Education Policy of 2020 provides, no explicit mention or recommendation is made regarding the establishment of PLCs in schools. The draft National Education Policy in 2019 did make a passing mention to the idea of PLCs but the document did not define or explain what PLCs are, and it did not provide any guidance on how they should be established and implemented. In fact, no empirical literature from the Indian schooling context explains how successful PLCs must be established and maintained. By outlining the planning and implementation processes of PLCs at School 1 and School 2 in the ABC School

Network, it is hoped that public and private schools in India will feel better prepared to take steps towards the establishment of PLCs in their institutions. This study showed that in spite of the difference in school contexts between India and the western countries from where a majority of seminal PLC literature has emerged, School 1 and School 2 were able to implement and benefit from the key elements of successful PLCs found by international research.

The finding that participation in PLCs may have increased evidence-based teaching in the schools under study is important because classroom practice is known to be one of the most significant influences on student learning (Darling-Hammond et al. 2017; Hattie 2008; Hightower et al. 2011; Ministry of Human Resource Development 2018; National Council for Educational Research and Training in India 2011). Considering this, more research on PLCs is warranted, across diverse contexts of schooling in India. Such studies may wish to adopt experimental designs for causality, move beyond teacher perception to also include classroom observation data, and collect data over longer periods of time in order to include student performance as a key desired outcome variable.

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Compliance with ethical standards

Conflict of interest The education consultants that supported the implementation of PLCs at the schools under study are also the authors of this paper. The authors are employed by the The Acres Foundation Mumbai, India.

Annexure 1

PLC Agenda - Meeting # ___

Date:
Start time:
End Time:
Members absent (/):

Agenda Items:

1. Calming Activity/Mindfulness OR Icebreaker Game: 5 mins.
 - a. Mindfulness activities⁴
 - b. Icebreaker activities⁵
2. Circle-time reflections: 5 mins.
Purpose is to give every participant a chance to share a reflection from the past 1-2 weeks.
For facilitation, you may use a variation of the below protocol:
Circle Share (each person shares, going around in circle:
 - o I am feeling... (what's the overarching emotion you have been experiencing this week)
 - o One success I experienced this week...
3. Follow-up/ Action Taken Report: 5 mins
Purpose is to (i) keep all team members accountable for the commitments they have made at the previous meeting; (ii) ensure that decisions are not just discussed, but executed with ample monitoring and support; (iii) we are engaged in continuous cycles of inquiry. Secretary to look at minutes of previous meeting and add items here.

Decision at Previous Meeting	Person Responsible for Execution	Status

4. One new thing I tried!: 10 mins.
This is an opportunity for team members to share new strategies and ideas they have used, so that others can use them too. The below table can be used to facilitate group discussion and record new learning:

I tried...	How did it work out?

5. Reflections on reading/ viewing/ listening material (OPTIONAL): 10 mins.

⁴ https://drive.google.com/file/d/1NCrKOp2P_6zIXAsSP-XopmE8yZMzzU2A/view?usp=sharing
⁵ <https://drive.google.com/open?id=1FXA-dRwZX9ygdNMLK57weWtSF28oK-p>

The PLC might want to take up a book or article that they group studies over 1-2 sessions. Together, it is decided how many pages, sections, etc. will be studied independently by the team members at home, and then at the next meeting, 10 minutes or so can be dedicated to reflecting on big-ideas from that reading. The below table can be used to record big ideas and think of how the new knowledge can be applied in action.

SEE <i>What did we see/ hear in this video/ reading?</i>	THINK <i>What do we think about what we saw/ heard? Why is that person saying/ doing that?</i>	WONDER <i>How can this be applied to our classrooms? Is it relevant to our practice?</i>

6. Matters for Reflection/Consultation: 25 mins.
 Discuss any of the following data points presented below using the see-think-wonder strategy: *Classroom video, observations of a specific child, parent communications, whole-class structures/ strategies, behavioural data, lesson plan, etc.* or any other teaching-learning data that you need feedback on

- In order to discuss the data effectively, follow the following steps:
1. The teacher who brings the data gives background on the data
 2. Other members of the PLC individually see/analyse the data
 3. The facilitator begins discussion and asks members to share 'I see'
 4. I see is followed up by I think/I wonder
 5. The teacher brought the data can respond to queries/wonders
 6. The teacher who brought the data concludes the conversation with 'Next Steps'

Data brought to the meeting:

'I SEE...' <i>What did the teachers do, what were students doing, etc. (only observable behaviours)</i>	'I THINK...' <i>WHY do you think this was done or these behaviours were displayed?</i>	'I WONDER...' <i>What questions do you have, what could have been done instead, etc. (suggestions, etc.)</i>

At the end of each meeting, copy-paste the agenda template on top to avoid scrolling down. By the end of it, your first meeting will be at the bottom of the document

References

- Ahn, J. (2017). Taking a step to identify how to create professional learning communities-report of a case study of a Korean Public High School on how to create and sustain a school-based teacher professional learning community. *International Education Studies*, 10(1), 82–92. <https://doi.org/10.5539/ies.v10n1p82>.
- Akiba, M., & Liang, G. (2016). Effects of teacher professional learning activities on student achievement growth. *The Journal of Educational Research*, 109(1), 99–110. <https://doi.org/10.1080/00220671.2014.924470>.
- Brodie, K. (2013). The power of professional learning communities. *Education as Change*, 17(1), 5–18. <https://doi.org/10.1080/16823206.2013.773929>.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32–42.
- Burns, M. K., Naughton, M. R., Preast, J. L., Wang, Z., Gordon, R. L., Robb, V., & Smith, M. L. (2018). Factors of professional learning community implementation and effect on student achievement. *Journal of Educational and Psychological Consultation*, 28(4), 394–412. <https://doi.org/10.1080/10474412.2017.1385396>.
- Chou, C. H. (2011). Teachers' PD: Investigating teachers' learning to do action research in a professional learning community. *The Asia-Pacific Education Researcher*, 20(3), 421–437.
- Cobb, P., & Bowers, J. (1999). Cognitive and situated learning perspectives in theory and practice. *Educational Researcher*, 28(2), 4–15. <https://doi.org/10.3102/0013189X028002004>.
- Coburn, C. E. (2001). Collective sensemaking about reading: How teachers mediate reading policy in their professional communities. *Educational Evaluation and Policy Analysis*, 23(2), 145–170.
- Coburn, C. E., & Russell, J. L. (2008). District policy and teachers' social networks. *Educational Evaluation and Policy Analysis*, 30(3), 203–235. <https://doi.org/10.1080/00220671.2014.924470>.
- Corcoran, T., & Goertz, M. (1995). Instructional capacity and high performance schools. *Educational Researcher*, 24(9), 27–31. <https://doi.org/10.3102/0013189X024009027>.
- Damjanovic, V., & Blank, J. (2018). Building a professional learning community: Teachers' documentation of and reflections on Preschoolers' work. *Early Childhood Education Journal*, 46(5), 567–575. <https://doi.org/10.1007/s10643-017-0888-0>.
- Danielson, C. (1996). *Enhancing professional practice: A FFT Alexandria*. VA: ASCD.
- Danielson, C. (2013). *The 2013 FFT Evaluation Instrument*. The Danielson Group. Retrieved from <https://danielsongroup.org/downloads/2013-framework-teaching-evaluation-instrument>
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Palo Alto, CA: Learning Policy Institute.
- Das, A. K., Gichuru, M., & Singh, A. (2013). Implementing inclusive education in Delhi, India: Regular school teachers' preferences for professional development delivery modes. *Professional Development in Education*, 39(5), 698–711. <https://doi.org/10.1080/19415257.2012.747979>.
- Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181–199. <https://doi.org/10.3102/0013189X08331140>.
- Doğan, S., & Adams, A. (2018). Effect of professional learning communities on teachers and students: reporting updated results and raising questions about research design. *School Effectiveness and School Improvement*, 29(4), 634–659. <https://doi.org/10.1080/09243453.2018.1500921>.
- Dogan, S., Pringle, R., & Mesa, J. (2016). The impacts of professional learning communities on science teachers' knowledge, practice and student learning: A review. *Professional Development in Education*, 42(4), 569–588. <https://doi.org/10.1080/19415257.2015.1065899>.
- DuFour, R. (2004). What is a "professional learning community"? *Educational Leadership*, 61(8), 6–11.
- DuFour, R., & DuFour, R. (2013). *Learning by doing: A handbook for Professional Learning Communities at Work*. Bloomington, IN: Solution Tree Press.
- DuFour, R., & Eaker, R. (2005). *PLCs at Work TM: Best Practices for Enhancing Students Achievement*. Bloomington, IN: Solution Tree Press.
- Dusenbury, L., Brannigan, R., Falco, M., & Hansen, W. B. (2003). A review of research on fidelity of implementation: Implications for drug abuse prevention in school settings. *Health Education Research*, 18, 237–256. <https://doi.org/10.1093/her/18.2.237>.
- Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (pp. 119–161). New York: Macmillan.
- Gee, J. P. (2008). A sociocultural perspective on opportunity to learn. In P. A. Moss, D. C. Pullin, J. P. Gee, E. H. Haertel, & L. J. Young (Eds.), *Assessment, equity, and opportunity to learn* (pp. 76–108). Cambridge: Cambridge University Press.
- Gersten, R., Dimino, J., Jayanthi, M., Kim, J. S., & Santoro, L. E. (2010). Teacher study group impact of the PD model on reading instruction and student outcomes in first Grade classrooms. *American Educational Research Journal*, 47(3), 694–739. <https://doi.org/10.3102/0002831209361208>.
- Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.
- Hightower, A. M., Delgado, R. C., Lloyd, S. C., Wittenstein, R., Sellers, K., & Swanson, C. B. (2011). *Improving student learning by supporting quality teaching*. Retrieved from http://www.edweek.org/media/eperc_qualityteaching_12.11.pdf
- Hord, S. M. (1997). *PLCs: Communities of continuous inquiry and improvement*. Austin, TX: Southwest Educational Development Laboratory.
- Ismail, S. N., Abdullah, Z., & Mustapha, R. (2019). The practice of professional learning community in trust schools, transformation schools and high performing schools in Selangor Malaysia. *International Journal of Advanced Science and Technology*, 28(16), 1853–1868.
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods. *Journal of Mixed Methods Research*, 1(2), 112–133. <https://doi.org/10.1177/1558689806298224>.
- Jones, M. G., Gardner, G. E., Robertson, L., & Robert, S. (2013). Science professional learning communities: Beyond a singular view of teacher professional development. *International Journal of Science Education*, 35(10), 1756–1774. <https://doi.org/10.1080/09500693.2013.791957>.
- Knight, P. (2002). A systemic approach to PD: Learning as practice. *Teaching and Teacher Education*, 18(3), 229–241. [https://doi.org/10.1016/S0742-051X\(01\)00066-X](https://doi.org/10.1016/S0742-051X(01)00066-X).
- Langley, G. J., Moen, R., Nolan, K. M., Nolan, T. W., Norman, C. L., & Provost, L. P. (2009). *The improvement guide: A practical approach to enhancing organizational performance*. San Francisco, CA: Jossey-Bass.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Leech, N. L., & Onquegbuzie, A. J. (2006). A typology of mixed methods research designs. *Quality & Quantity: International Journal of Methodology*, 43(2), 265–275. <https://doi.org/10.1007/s11135-007-9105-3>.
- Lewis, C. (2015). What is improvement science? Do we need it in education? *Educational Researcher*, 44(1), 54–61. <https://doi.org/10.3102/0013189X15570388>.
- Louis, K. S., Leithwood, K., Wahlstrom, K. L., Anderson, S. E., Michlin, M., & Mascal, B. (2010). *Learning from leadership:*

- Investigating the links to improved student learning* (Vol. 42). New York: Wallace Foundation.
- Luyten, H., & Bazo, M. (2019). Transformational leadership, professional learning communities, teacher learning and learner centred teaching practices: Evidence on their interrelations in Mozambican primary education. *Studies in Educational Evaluation*, 60, 14–31. <https://doi.org/10.1016/j.stueduc.2018.11.002>.
- Marsh, J. A., Bertrand, M., & Hugué, A. (2015). Using data to alter instructional practice: The mediating role of coaches and PLCs. *Teachers College Record*, 117(4), 1–40.
- McDonald, J. P., Mohr, N., Dichter, A., & McDonald, E. C. (2013). *The power of protocols: An educator's guide to better practice* (3rd ed.). New York: Teachers College Press.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Thousand Oaks, CA: Sage.
- Ministry of Human Resource Development. (2014). *Education for all: Towards quality with equity, India*. New Delhi, India: National University of Educational Planning and Administration. Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/upload_document/EFA-Review-Report-final.pdf
- Ministry of Human Resource Development. (2018). *Draft national education policy 2019*. New Delhi, India: Committee for Draft National Education Policy. Retrieved from https://mhrd.gov.in/sites/upload_files/mhrd/files/Draft_NEP_2019_EN_Revised.pdf
- Ministry of Human Resource Development. (2020). *National education policy 2020*. New Delhi, India: Government of India. Retrieved from https://www.mhrd.gov.in/sites/upload_files/mhrd/files/nep/NEP_Final_English.pdf
- Mu, G. M., Liang, W., Lu, L., & Huang, D. (2018). Building pedagogical content knowledge within professional learning communities: An approach to counteracting regional education inequality. *Teaching and Teacher Education*, 73, 24–34. <https://doi.org/10.1016/j.tate.2018.03.006>.
- National Council for Educational Research and Training. (2011). *What do they know? A summary of India's national achievement survey, class V, cycle 3*. New Delhi, India: National Council of Educational Research and Training. Retrieved from [http://www.ncert.nic.in/departments/nie/esd/pdf/NAS_Class_V_\(Cycle%204\)_Summary_Report_National.pdf](http://www.ncert.nic.in/departments/nie/esd/pdf/NAS_Class_V_(Cycle%204)_Summary_Report_National.pdf).
- Ndunda, M., Van Sickle, M., Perry, L., & Capelloni, A. (2017). University–urban high school partnership: math and science professional learning communities. *School Science & Mathematics*, 117(3/4), 137–145. <https://doi.org/10.1111/ssm.12215>.
- Nelson, M. C., Cordray, D. S., Hulleman, C. S., Darrow, C. L., & Sommer, E. C. (2012). A procedure for assessing intervention fidelity in experiments testing educational and behavioral interventions. *The Journal of Behavioral Health Services & Research*, 39, 374–396. <https://doi.org/10.1007/s11414-012-9295-x>.
- Padwad, A., & Dixit, K. K. (2008). Impact of professional learning community participation on teachers' thinking about classroom problems. *Test-Ej*, 12(3), 1–11.
- Pella, S. (2011). A situative perspective on developing writing pedagogy in a teacher professional learning community. *Teacher Education Quarterly*, 38(1), 107–125.
- Probe Team. (1999). *Public report on basic education in India*. New Delhi: Oxford University Press.
- Riley, K. (2015). Enacting critical literacy in English classrooms: How a teacher learning community supported critical inquiry. *Journal of Adolescent & Adult Literacy*, 58(5), 417–425.
- Ronfeldt, M., Farmer, S. O., McQueen, K., & Grissom, J. A. (2015). Teacher collaboration in instructional teams and student achievement. *American Educational Research Journal*, 52(3), 475–514. <https://doi.org/10.3102/0002831215585562>.
- Rossman, G. B., & Rallis, S. F. (2011). *Learning in the field: An introduction to qualitative research* (4th ed.). New York: Sage.
- Saunders, W., Goldenberg, C., & Gallimore, R. (2009). Increasing achievement by focusing grade-level teams on improving classroom learning: A prospective, quasi-experimental study of title I schools. *American Educational Research Journal*, 46(4), 1006–1033. <https://doi.org/10.2307/40284745>.
- Schaap, H., & de Bruijn, E. (2018). Elements affecting the development of professional learning communities in schools. *Learning Environments Research*, 21(1), 109–134. <https://doi.org/10.1007/s10984-017-9244-y>.
- Schechter, C. (2010). Learning from success as leverage for a professional learning community: Exploring an alternative perspective of school improvement process. *Teachers College Record*, 112(1), 182–224.
- Shadish, W., Cook, T., & Campbell, D. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA: Houghton Mifflin.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63–75. <https://doi.org/10.3233/EFI-2004-22201>.
- Singh, R., & Sarkar, R. (2012). *Teaching quality counts: How student outcomes relate to quality of teaching in private and public schools in India*. Oxford: Young Lives.
- Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006). Professional learning communities: A review of the literature. *Journal of Educational Change*, 7(4), 221–258. <https://doi.org/10.1007/s10833-006-0001-8>.
- Svinicki, M. D. (1999). New directions in learning and motivation. *New Directions for Learning and Teaching*, 1999(80), 5–27. <https://doi.org/10.1002/tl.8001>.
- Tam, A. C. F. (2015). The role of a professional learning community in teacher change: A perspective from beliefs and practices. *Teachers and Teaching*, 21(1), 22–43. <https://doi.org/10.1080/13540602.2014.928122>.
- Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research*, 1(1), 77–100. <https://doi.org/10.1177/2345678906292430>.
- Timperley, H. S. (2005). Instructional leadership challenges: The case of using student achievement information for instructional improvement. *Leadership and Policy in Schools*, 4(1), 3–22. <https://doi.org/10.1080/15700760590924591>.
- Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of PLCs on teaching practice and student learning. *Teaching and Teacher Education*, 24(1), 80–91. <https://doi.org/10.1016/j.tate.2007.01.004>.
- Voelkel, R. H., Jr., & Chrispeels, J. H. (2017). Understanding the link between professional learning communities and teacher collective efficacy. *School Effectiveness and School Improvement*, 28(4), 505–526. <https://doi.org/10.1080/09243453.2017.1299015>.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Williams, D. J. (2013). Urban education and professional learning communities. *Delta Kappa Gamma Bulletin*, 79(2), 31–39.
- Zhang, J., & Sun, Y. (2019). Investigating the effects of professional learning communities on teacher commitment in China. *Educational Studies*. <https://doi.org/10.1080/03055698.2019.1651695>.
- Zheng, X., Yin, H., & Li, Z. (2019). Exploring the relationships among instructional leadership, professional learning communities and teacher self-efficacy in China. *Educational Management Administration & Leadership*, 47(6), 843–859. <https://doi.org/10.1177/1741143218764176>.

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