Professional Development in Education

ISSN: 1941-5257 (Print) 1941-5265 (Online) Journal homepage: https://www.tandfonline.com/loi/rjie20

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To cite this article: Salleh Hairon, Jonathan Wee Pin Goh, Catherine Siew Kheng Chua & Li-yi Wang (2017) A research agenda for professional learning communities: moving forward, Professional Development in Education, 43:1, 72-86, DOI: 10.1080/19415257.2015.1055861

To link to this article: https://doi.org/10.1080/19415257.2015.1055861

Published online: 28 Jul 2015.

Professional Development in Education, 2017
Vol. 43, No. 1, 72–86, http://dx.doi.org/10.1080/19415257.2015.1055861

Routledge
Taylor & Francis Group

A research agenda for professional learning communities: moving forward

Salleh Hairon[a]*, Jonathan Wee Pin Goh[b], Catherine Siew Kheng Chua[a] and Li-yi Wang[b]

[a]*Policy and Leadership Studies, National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, 637616 Singapore;* [b]*Office of Education Research, National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, 637616 Singapore*

(*Received 16 December 2014; accepted 23 May 2015*)

Professional learning communities (PLCs) as a means of raising the teaching profession are becoming more attractive in education systems seeking to improve school improvement processes and outcomes. The main intention is to increase the individual and collective capacity of teachers so as to support school-wide capacity for teaching and learning. Although international research on PLCs is relatively extensive, covering about three decades, there are still gaps in its research base; specifically on the concept of community and the effects of PLCs. In this article, we propose a research agenda for PLC research that will afford substantive theorization on PLCs which will need to be drawn from robust empirical evidence. In the proposed research agenda for PLCs, we first argue that a PLC is a multi-dimensional construct comprising three inter-dependent dimensions of 'community', 'learning' and 'professional'. This precedential task is necessary before investigations on effects or impact (direct or indirect) of PLCs can be meaningfully and reliably carried out. We then propose a research framework for PLCs constituting three aspects: construct of PLCs; conditions–contexts of PLCs; and causalities of PLCs. Finally, we propose six aspects pertaining to methodological rigor to support PLC research.

Keywords: professional learning communities; research agenda; theorization of professional learning communities

Introduction

The professional learning community (PLC) is increasingly becoming attractive and fashionable in education systems seeking to improve school processes and outcomes. Education reformers and researchers view the PLC as a means to enhance teacher learning, competency and practice, leading to improvements in student learning. The PLC is said to hold considerable promise for capacity-building of teachers – individually and collectively, which supports school-wide capacity for promoting students' learning (Stoll *et al.* 2006). Although the claims on PLCs as having the power to improve student learning outcomes through enhancing teacher and organizational capacities remain generally non-contested, empirical studies supporting such claims are not well established. Furthermore, although international

*Corresponding author. Email: hairon.salleh@nie.edu.sg

research on PLCs is relatively extensive, covering about three decades, there are still gaps in its research base. One of which has to do with the theorization of the PLC concept or construct (Bolam *et al.* 2005, Stoll *et al.* 2006). Each of the three words comprising the PLC construct – 'professional', 'learning' and 'community' – is essentially a contestable concept (Watson 2014), making it a complex phenomenon (Sigurðardóttir 2010). This specific research gap perhaps explains why there is no agreed universal definition of the PLC.

This critique raises the second research gap in the research base of PLCs – that is, the lack of theorization on the causalities or effects of PLCs. The lack of substantive theorization of the PLC construct would inadvertently weaken attempts at establishing the effects of PLCs. Moreover, the empirical research base has yet to match the claims made on PLC effects, especially that of student outcomes. In their review of research on the impact of the PLC on teaching practice and student learning, Vescio *et al.* stressed that 'additional and rigorous research documenting the impact on teaching practice and student achievement is imperative' (2008, p. 89). There is therefore a clear need for more empirical studies in this aspect on the theorization of PLCs (Vescio *et al.* 2008, Lomos *et al*. 2011). Besides attention to direct effects on student outcomes, there is also the need to investigate the intermediary effects of PLCs linking to student outcomes, such as development in teacher knowledge and skills, teacher beliefs in professional development, and teacher practices (Vescio *et al.* 2008). Besides intermediary effects of PLCs, there is also the need to look at the effects on aspects of school improvement beyond the classroom (e.g. school culture, home–school relationships, teacher leadership development, and teaching and learning environment).

The third research gap in the PLC research base is the lack of theorization on the conditions and contexts – correspondingly within and outside school factors, which enable and constrain PLC practices. It has been argued that contexts surrounding PLCs influence the way PLCs are enacted in schools. In their literature review, Bolam *et al.* (2005) found that although PLCs have common characteristics and adopt similar processes, the practical implications for developing PLCs can only be understood and worked out in the specific conditions of particular contexts. Based on the above explications of the three research gaps on the lack of theorization on the construct, condition and contexts, and causalities of PLCs, there is indeed more empirical work to be done in the PLC field of study. These three aspects pertaining to PLC theorization are intimately inter-related. Research studies seeking to determine the causalities or effects of PLCs would require more precise clarity in the definition of the construct of PLC, which we propose to be a multi-dimensional construct. The effects of PLCs on student outcomes are also affected or moderated by school conditions and contexts.

As more and more attention and investment of resources are placed on PLCs for school improvement and effectiveness, there is an urgent need to develop a research agenda and framework that is able to support the claims of PLCs on school improvement and effectiveness. The primary aim of this article is to propose a research agenda for future research work on PLCs. An upshot of which is to provide substantive theories drawn from robust empirical evidence so as to support appropriate critical developments in the policy and practice of PLCs in schools. In this article, the authors will first present a theoretical frame for research on PLCs followed by the articulation of the core research purposes and research questions emanating

from this theoretical frame. This is followed by a discussion on the methodological rigor in PLC research in view of the proposed core research purposes and questions.

Theoretical framework for professional learning community research

In our view, the theoretical frame for research on PLCs can be categorized into three core aspects of theorization: construct of PLCs; contexts–conditions of PLCs; and causalities (effects) of PLCs (see Figure 1). Equal investment in research is required in the building of the substantive theoretical base of the three core knowledge aspects of PLCs. Each of these core aspects of knowledge on PLCs is interdependently tied to one another. Investigating the causalities or effects of the PLC will first require substantive understanding on the construct of PLCs. Conversely, without the substantive understanding of the effects of PLCs (e.g. on student, teacher or organizational outcomes), the value in understanding the PLC construct is marginalized; especially in current school improvement discourse that recognizes the value of building teacher and organizational capacities to improve student learning outcomes. However, the link between PLCs and student learning outcomes is mediated or moderated by other factors within and outside school. As an illustration, PLCs promote the development of teacher knowledge, skills and beliefs followed by improvements in classroom teaching and learning, which then add value to student learning outcomes. The development of teacher knowledge, skills, beliefs and practice can be considered as mediating or intervening variables. However, the strength of these mediating or intervening variables could be moderated by other factors within or outside the school (e.g. school leadership, school culture, leadership at the district or county level, societal culture, etc.). These moderating variables also have the potential to moderate the relationships among the PLC dimensions – 'community', 'learning' and 'professional'. For example, it is plausible that the strength of the community affects the strength of learning in PLCs, such as a group of teachers learning together within a school. However, school culture could moderate the relationship between community and learning in PLCs. If the school culture is one that

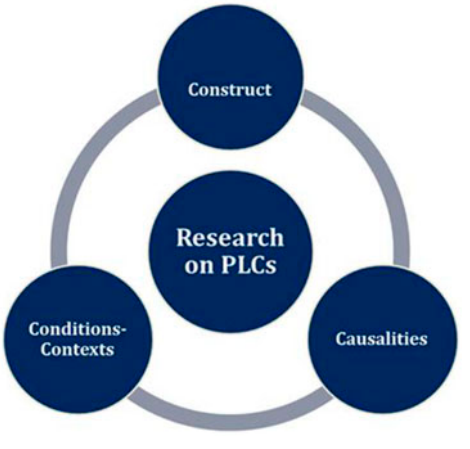

Figure 1. PLC research theoretical frame.

endears learning, the effect of community on learning in the PLC is further strengthened.

Construct of professional learning communities

We postulate that the PLC is a multi-dimensional construct consisting of three dimensions – 'community', 'learning' and 'professional'. The lack of attention given to the multi-dimensionality of the PLC construct perhaps explains why there is no agreed universal definition on the PLC (Stoll *et al.* 2006, Sigurðardóttir 2010) and the presence of multiple interpretations to its meaning (Stoll *et al.* 2003). We further postulate that the difficulty in arriving at a definition of the PLC that takes into consideration the interdependent relationship of these three dimensions could explain why attempts at reaching a broad consensus on the definition of a PLC seem to either water down the substantive essence of PLCs or further the renditions on aspects or characteristics of PLCs. As a case in point, the broad consensus that the PLC has to do with a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way (Stoll *et al.* 2006) relegates the concept of community to a mere group of people, simplifies the concept of learning (e.g. reflective, learning-oriented) and community (e.g. collaborative, inclusive), and lacks precision in determining what each of the three dimensions of the PLC really mean.

PLCs have also been interpreted as a 'professional community of learners' that enhances teacher, student and organizational learning, whereby:

> teachers in a school and its administrators continuously seek and share learning, and act on their learning. The goal of their actions is to enhance their effectiveness as professionals for the students' benefit; thus, this arrangement may also be termed communities of continuous inquiry and improvement. The notion, therefore, draws attention to the potential for a range of people, based inside and outside a school, to mutually enhance each other's and pupils' learning as well as school development. (Hord 1997, p. 1)

In our view, this is another illustration of the expansive approach to understanding PLC, whereby PLC is conceptualized within a school-level domain as opposed to a group-level domain. This further adds to the complexity of the PLC construct. It is therefore necessary to make explicit whether PLC is a group or organizational (school) level domain in defining the PLC construct. However, there is also the simplistic approach – that is, PLCs involve 'professionals coming together in a group – a community – to learn' (Hord 2008, p. 10). This simplistic definition of the PLC only attests the need to go back to the essence of a PLC with its attendant three dimensions.

In their literature review on PLCs, Bolam *et al.* (2005) arrived at five broad characteristics of PLCs: shared values and vision; collective responsibility; reflective professional inquiry; collaboration; and group as well as individual learning. On top of these five broad characteristics, they further extended these characteristics by adding three more: mutual trust, respect and support among staff members; inclusive membership – the community extending beyond teachers and school leaders to support staff, and it being a school-wide community rather than consisting of smaller groups of staff; and openness, networks and partnership – looking beyond the school for sources of learning and ideas (Bolam *et al.* 2005, Stoll *et al.* 2006). The amalgamation of these eight characteristics of PLCs forms what they termed an 'Effective

Professional Learning Community'. These characteristics are noticeably consistent with those espoused by the early proponents of PLCs such as Louis *et al*. (1996), Newmann *et al.* (1996), Hord (1997) and McLaughlin and Talbert (2001). These eight characteristics are also closely tied to the three dimensions of the PLC construct. The first characteristic emphasizes the importance of community where group members share common values and vision. The second emphasizes the importance of professionalism in so far as group members share collective responsibility for student learning. The third emphasizes the importance of teacher learning that involves a range of activities such as reflection and enquiry in which group members participate to improve teaching and learning. The fourth emphasizes the notion of community, where joint activities by group members are encouraged to accomplish group goals. The fifth emphasizes group members' learning group at the individual and group levels. The sixth, seventh and eighth characteristics are extended ideas on the concept of community.

Although understanding PLCs using characteristics is very helpful, the establishment of the PLC construct is still an unfinished project. Interestingly, Bolam *et al.* (2005) highlighted the importance of unpacking the concept of PLC, but only to extend the list of characteristics without really arriving at a more parsimonious substantive conceptual construct of PLC. First, there is the need to establish whether the PLC is a single or multi-dimensional construct. The list of characteristics and the professional–learning–community triplex strongly suggest that the PLC is a multi-dimensional construct. This assertion, however, has been recognized by Bolam *et al.* (2005). Second, there is the need to arrive at a more parsimonious, judicious and precise conceptualization of the multi-dimensional construct of PLCs. What does each of the three words in the professional–learning–community triplex mean? What is the definition of these three interdependent terms? Are shared values and vision the primary constitutive element of community? Are shared values and vision related to collective responsibility? Must the shared vision only pertain to student learning outcomes? Would reflective professional inquiry involve reflection or inquiry work (e.g. data collection and analysis), or both? What would inquiry involve? Would the inclusion of group members beyond the education profession such as parents and external school partners be contradictory to the word 'professional' used in the PLC terminology? Without clarifying these characteristics, and operationalizing them, the role of PLCs in contributing to continuous school improvement becomes implausible (Watson 2014).

These questions point towards the third proposition. That is, the need to establish methodological rigor in understanding the PLC construct, along with its attendant relationships with the conditions and contexts of PLCs and with the outcomes of PLCs such as teacher and organizational capacities (e.g. school culture, supporting structures, etc.), teacher practice and student learning outcomes. This would indeed require proper operationalizations of the PLC multi-dimensional construct to aid in its theoretical analysis. Constructs are human abstractions containing the essence of observed phenomena. They are derived by the merging of theoretical and operational analyses. While much has been written on the theoretical analysis of PLCs, more work is needed in the operational analysis of PLCs. Enhancing the operational analysis would value add to the theoretical analyses of the PLC construct. Research work must therefore involve the dialectical work of theoretical and operational analyses in the PLC construct. Although the term operationalization has been proposed, this does not imply that arriving at a more substantive conceptual construct

of PLC is the precinct of quantitative research. Qualitative research likewise requires trustworthy interpretation and understanding of the PLC phenomenon through observations, interviews or artifact analyses, which are equivalent to the 'operations' of PLCs.

In a nutshell, future research studies on PLCs need to do a better job in the substantive theorization of the three dimensions of the PLC construct comprising 'community', 'learning' and 'professional'. As an example, the word community has become an obligatory appendage to every educational innovation such as 'communities of learners', 'discourse communities', 'teacher community' and 'communities of practice' (Grossman *et al.* 2001), and extends to others including 'professional community', 'team-based community', 'argue-based learning community', 'intellectual community', 'learning community' and 'professional learning community'. Although the borrowing of the term 'community' from sociology, anthropology or psychology can be problematic, it can still benefit the theorization of the concept on community (for example, Tönnies 1887, McMillan and Chavis 1986, Durkheim 1897, 1911, Wenger 1998, McMillan 2011). Likewise, the dimension on learning could draw from the rich knowledge base on teacher learning and professional development, and learning theories in general, including models that are closely related to learning communities such as lesson study or action research. The central question to ask is 'How do teachers learn?' (Hammerness *et al.* 2005). Finally, the question to ask is 'What do professionals do?' in order to answer the question 'What does professional mean?' Is it synonymous with the concept of professionalism such as that espoused by Bottery (1994) comprising altruism, competency and autonomy? Does this dimension speak of the commitment to students learning which is at the heart of the teaching profession? Or has it got to do with trust among professionals?

Conditions–contexts of professional learning communities

While the notion of context has been observed to affect how PLCs are enacted – giving it shades of interpretation in different contexts (Bolam *et al.* 2005, Stoll *et al.* 2006) – systematic and coherent studies investigating the relationship between the context and construct of PLCs have much room for investigation. In their literature review, Bolam *et al.* (2005) identified four operational processes that support the eight characteristics of effective PLCs: leadership and management; optimizing resources and structures; promoting individual and collective professional learning; and explicit promotion and sustaining of an effective PLC. These operational processes can be considered as contexts supporting the enactment of PLCs. Likewise, Hipp and Huffman (2009) recognized the importance of supportive conditions in terms of relationships and structures in supporting PLCs. In our analysis, we observed that contexts in the generic term can be differentiated at two levels – within and outside school. The former can be termed as conditions, and the latter as contexts. Examples of the former include school culture, structures (e.g. timetabling, organizational structure, etc.), leadership and resources. Examples of the latter include district and system factors such as district/system culture, leadership, resources and policies, and societal factors such as societal and national culture and national policies. The supporting conditions and contexts can thus exist at different levels. In other words, the PLC phenomenon can exist or be nested within a wider phenomenon, which is then nested within another wider phenomenon. Hence, a

PLC is shaped by the context of the school, the school is shaped by the context of the district (or county), the district is shaped by the context of the education system, and the education system is shaped by the context of the national system. In this regard, it is therefore understandable that literature on PLCs highlights ambiguities in the ways in which PLCs are established, developed, sustained and institutionalized (Bolam *et al.* 2005).

Although several writers on PLCs specify several essential or generic characteristics within the school level (for example, Bolam *et al.* 2005), far less attention has been devoted to how PLCs are conceptualized and implemented at the school and district (or county) levels within different societal cultures and school systems (Bolam *et al.* 2005, Vescio *et al.* 2008, Wells 2008). Besides the relative lack of in-depth research on the roles of teachers and others at different systemic levels in enabling PLCs to function successfully (Hipp *et al.* 2008), it is yet to be fully understood how PLCs are differently enacted from one culture to another. For example, it would be interesting to understand how PLCs are enacted in Asian hierarchical and high power-distance societies (Hofstede 2001). The neglect of empirical research on PLCs is particularly acute in Asian settings (Sargent and Hannum 2009, Wong 2010a, 2010b, Hairon and Dimmock 2012, Wang 2014). The importance of conditions and contexts shaping the definition and developmental practices and processes of PLCs has been highlighted previously (Stoll and Louis 2007). There is therefore a strong case for strengthening the present knowledge base with regard to establishing and sustaining PLCs in different social and cultural contexts, and how teachers, school leaders and policy-makers translate and transfer the concept to practice in their own contextual settings. Future researchers investigating PLCs should therefore be cognizant of how PLCs are shaped – enabled or constrained, by the internal school conditions and external school contexts at their multiple levels.

The importance of conditions and contexts of PLCs also perhaps explains why the PLC construct can be understood to exist at the group or school levels. The latter could be a misnomer, especially when supporting structures within the school are understood as part of a PLC construct when in reality they are contextual constructs. Supportive school culture or leadership may not be constitutive elements of the PLC construct, especially if the PLC is defined as a group-level domain. However, leadership could also exist within PLC settings simply because leadership does not exist only at the principal or middle manager levels. Hipp and Huffman's (2009) aspect on 'shared leadership' is recognition of leadership existing within PLCs – that is, inherently present among teachers working and learning in their learning communities. In fact, leadership has been considered to be a critical factor in supporting PLCs (Huffman and Jacobson 2003, Thomson *et al.* 2004, Hipp and Huffman 2009, 2010). Furthermore, based on her six-year participation observation study, Wood (2011) observed that the obstacles to PLC success have to do with difficulties internal to participants' relationships among themselves and demands placed by school administrators. Hence, leadership can exist outside and within PLCs, and correspondingly PLCs can exist at the school-level or group-level domains. For group-level PLCs, the role of teacher leadership cannot be overlooked, and is highly critical in that the theorization of the PLC construct as leadership cannot be taken out of the theorization on the community aspect or dimension of PLCs. Teachers are indeed catalysts for change and development towards a commitment to shared collaborative learning in a community (Harris 2005).

In general, the theorization of teacher leadership in PLCs has indeed been neglected. This is partly due to the weak empirical base on the effects of teacher leadership as a discipline (York-Barr and Duke 2004). The definition by York-Barr and Duke on teacher leadership as 'the process by which teachers, individually or collectively, influence their colleagues, principals, and other members of school communities to improve teaching and learning practices with the aim of increased student learning and achievement' (2004, pp. 287–288) is understandingly convincing bearing in mind that instructional leadership is most effective when it is closest to classroom teaching and learning. The crucial role of leadership within PLCs (e.g. teacher leadership) or outside PLCs (e.g. middle, senior and district/county leadership) is also consistent with the claim that leadership (quality leaders) is second only to classroom teaching (quality teachers) as an influence on student learning outcomes (Leithwood *et al.* 2006). Hence, it is therefore understandable that PLCs are to develop teacher knowledge, skills and beliefs so as to improve teacher practice supported by strong leadership at the school and PLC levels.

Causalities of professional learning communities

The accomplishment of the substantive theorization of the PLC construct and conditions and contexts of PLCs would set a robust foundation for the theorization of the causalities or effects of PLCs. There are increasing signs of this interest recently (Vescio *et al.* 2008, Sigurðardóttir 2010, Lomos *et al.* 2011). In our view, this augurs well for furthering the theorization of the PLC construct because it compels researchers to arrive at a substantive and precise definition of the multi-dimensional PLC construct. Notwithstanding the international claims on the positive effects of PLCs on teacher professional development, instructional practices, student learning outcomes and school improvement, the empirical evidence to corroborate these claims is relatively disproportionate. In their review of 11 research studies on PLCs, *Vescio et al.* alluded to the fact that the impact of PLCs on teacher practice and student learning are primarily perception in nature with 'some limited evidence that the impact is measurable beyond teacher perceptions' (2008, p. 88). This does not, however, rule out the idea that PLCs have potential to improve teacher practice and student learning outcomes. Vescio *et al.* (2008) stated that the collective results of the few relevant studies do support the claim that PLCs have impact on the learning outcomes of students.

The notion of teachers learning together or of organizational learning to directly or indirectly improve student learning outcomes had also been observed (for example, Silins and Mulford 2004, Mulford 2007, 2008). Sigurðardóttir's (2010) mixed-method study using correlation and experimental designs based on three sample schools within a school district corroborated the hypothesis that PLCs do impact on pupils' academic outcomes using nine characteristics or variables of PLCs. The mixed-method study had also corroborated the hypothesis that there is significant relationship between the school level of effectiveness and the PLC. The meta-analysis study conducted by Lomos *et al.* (2011) sheds further light to support the claims on PLCs impacting student learning outcomes, albeit with a small effect size ($d = 0.25$, $p < 0.05$). Their study made use of cited research studies from 1982 to 2009 relating to a generic term on learning communities in secondary/high school student achievement, which resulted in the identification of five studies. Notwithstanding the study limitations (e.g. small number of studies, small number of

countries – USA, England and the Netherlands – and differing conceptual and methodological approaches), the authors postulated that their study was a promising start in linking the effect of PLCs on student learning outcomes.

Nevertheless, the authors raised a string of recommendations for future work investigating the impact of PLCs: clearer conceptualization of the PLC; empirical validation of PLC key dimensions; methodological rigor; and recognition of indirect causal mechanisms. In this regard, Lomos *et al.* (2011) alluded to the intimate linkages between the construct, contexts and conditions, and causalities of PLCs as centrally argued in our proposition. Future research studies on PLCs will therefore need to invest more in tackling the biggest challenge of testing the hypothesis that PLCs have a positive impact on student learning outcomes through their impact on the development of teacher knowledge, skills, beliefs and practice (Figure 2). PLCs, like other teacher professional development platforms or models, must bring about the development of teacher knowledge, skills, beliefs and practice (Guskey 2002, Darling-Hammond *et al.* 2009). In addition to this, we also propose that for PLCs to truly bring about change and improvement in teacher practice, there must be the development of teacher knowledge in five aspects: curriculum content; pedagogy (theory of teaching); instruction (practice of teaching); assessment; and student learning.

Beyond this linear process (Figure 2), more empirical work is also needed to investigate intermediary effects of PLCs on school improvement processes that positively influence teacher knowledge, skills, beliefs and practice such as school culture, school structures, school leadership, teacher motivation, teacher commitment, teacher beliefs and teacher self-efficacy. For example, the enactment of PLCs could have an unintended influence on developing a learning culture or a culture of improvement which could possibly influence improvements in teacher practice. Also, PLCs could have an unintended effect on teacher commitment which has a knock-on effect on improvements in teacher practice. These within-school conditions potentially moderate the linkages between PLCs and student learning outcomes. Concomitantly, future research studies need to investigate outside-school contexts that potentially moderate these linkages. Broadly speaking, they could include partnerships with parents and external organizations, and district and system leadership and policies. For example, district superintendents' leadership and resource support in providing consultants to aid teacher learning in PLCs could make a huge difference in how teachers learn within PLCs, hence impacting on their

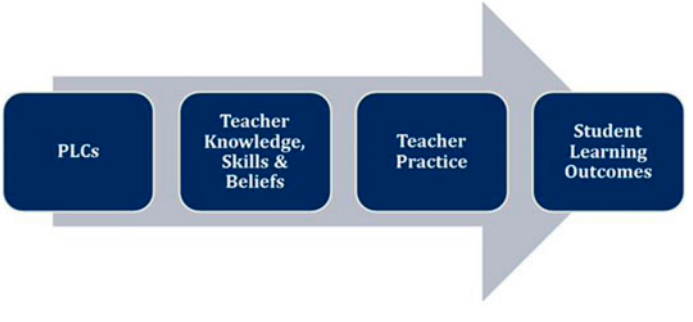

Figure 2. Impact of the PLC.

growth in knowledge about teaching. The wider national forces such as the political, economic, socio-cultural and technological factors could also have an impact on how PLCs are enacted.

Taking into consideration the above discussion, we propose a conceptual framework for future research on PLCs which takes into consideration the three research aspects: construct of PLCs; conditions–contexts of PLCs; and causalities of PLCs. Correspondingly, the research agenda serves to fulfill three main purposes. Firstly, it is to establish the substantive essence or construct of PLCs. Even though it has been argued earlier that the PLC construct is multi-dimensional, consisting of 'community', 'learning' and 'professional', what is still lacking is empirical work to establish each of these PLC dimension in an interdependent way. Secondly, it is to establish the relationship between the within-school conditions and outside-school contexts influencing PLCs. We postulate that coherent leadership support is needed in terms of direction, framework and resources encompassing teacher, middle, school and district leadership. It would play a significant role in bringing about successful development in teacher knowledge, skills and beliefs, which will positively impact teacher practice and student learning. Thirdly, it is to establish the outcomes of PLCs in the school improvement processes. In this regard, we propose that future research studies take the path least trodden to determine the direct and indirect relationships between PLCs and student learning outcomes. The broad research questions that the research agenda presents are: what is the construct of PLCs; what are the conditions and contexts influencing PLCs; and what are the effects of PLCs on school improvement processes and outcomes?

Methodological rigor in professional learning community research

Based on the conceptual framework for PLC research presented above, it is recommended that a mixed-method research program is first required in order to realize the three main purposes. A mixed-method research program would be able to complement the strengths and limitations of both quantitative and qualitative research methods. Secondly, the conceptual research framework needs to adopt longitudinal studies regardless of whether it is quantitative or qualitative in its approaches (Vescio *et al.* 2008). For example, a qualitative research study investigating the constitutive dimensions of the PLC construct through in-depth observation, interviews and artifacts analyses requires sufficient time to capture the essence of the PLC phenomenon. A quantitative study investigating the effects of PLCs on student, teacher or organizational outcomes requires sufficient time to determine the significance of impact with a fair degree of confidence. In other words, longitudinal research studies are indispensable in measuring changes in student growth and other class-level (e.g. teacher, PLCs, etc.) or school-level (e.g. school leadership, culture, etc.) effects.

Thirdly, the conceptual research framework requires data to be collected from minimally large samples. Without going into too much relentless debate on what constitutes a minimum sample size assuming that appropriate sampling strategies have been used, it is sufficient to assert that the larger the number, the more confident we are of the findings. However, resource limitation plays a large part in the determination of sample size. Schools, on the other hand, are equally aware of the commitment and extra man-hours needed in working with researchers. The need to obtain a minimally large sample size thus becomes an essential task for researchers. This is where the strength of mixed-method approaches to research in PLC is further

warranted. While the quantitative aspect of the research study could gather perception data from large samples on the PLC construct, conditions and contexts of PLCs, and causalities of PLCs in a relatively quick manner, the qualitative aspect could gather reported and observational data from smaller samples over a more intensive period of time to interpret the fine-grained details of PLC enactment.

Fourthly, the conceptual research framework needs robust research designs. For qualitative research, we propose the use of an ethnographic research design where intimate, intensive and prolonged fieldwork allows the collection of multiple data from observation, interviews and artifacts. In terms of data analysis, qualitative research has the luxury of a range of data analysis tools to generate findings appropriate for the research purpose/s (e.g. discourse analysis, conversation analysis, content analysis, etc.). For quantitative research, we propose the use of experimental research designs including its variant versions (e.g. quasi-experiments, one-group pre-test–post-test, post-test only, etc.), and non-experimental associative research designs (e.g. correlation and regression). The proposition for the reduced versions of experimental research designs such as quasi-experiment and one-group pre-test–post-test designs is a response to a main weakness of experimental design – that is, difficulty in controlling for variables. The proposition for non-experimental associative research designs is also a response to this. It has been argued that when experiments are not possible due to policy contexts, 'well-designed correlational or descriptive studies or longitudinal studies may be sufficient' (Creemers *et al.* 2010, p. 111). In this regard, the use of structural equation modeling and multilevel modeling or hierarchical linear modeling statistical techniques has gained popularity and credence in educational research. While structural equation modeling tests estimates of a set of relationships between multiple factors or variables, hierarchical linear modeling tests estimates of relationships between factors or variables taking into account their existence in higher levels – that is, a factor or variable is nested within another higher level variable, also termed multistage nested designs. For example, student-level variables (e.g. gender, socio-economic status) are nested within teacher-level variables (e.g. teacher knowledge, skills and beliefs), teacher-level variables are nested within school-level variables (e.g. leadership qualities, public or private school, small or large school size), and school-level variables are nested within system-level variables (e.g. district/regional/state leadership, policies, support). The importance of multilevel designs is warranted bearing in mind that school effects consist of direct and indirect effects and are a multilevel phenomenon including primarily student, classroom and school-level process variables contributing to student outcomes (Creemers and Kyriakides 2006, De Maeyer *et al.* 2007). As stated earlier, the effects of PLCs on student learning outcomes are mediated or moderated by other variables, including antecedent variables (e.g. societal culture, political system, etc.). A mixture of both statistical analyses known as multilevel structural equation modeling has also grown in popularity in the last decade (De Maeyer *et al.* 2007, Creemers and Kyriakides 2010, Preacher *et al*. 2011). For the case of PLC research, Lomos *et al.* (2011) rightly proposed that research in PLCs should use statistical modeling techniques, specifically that of multilevel analyses, to further deepen the knowledge base on PLCs.

Fifthly, with regard to measuring the changes of growth in student outcomes so as to corroborate growth in student learning, we are proposing the use of Item Response Theory (IRT) such as the Rasch Modeling to generate sharper resolutions to the measurement estimates in both academic and non-academic terms (e.g. twenty-first

century skills). It has been argued that in using multilevel analysis, differences between schools and individuals can be blurred due to measurement errors leading to spurious results, and most measurements in educational research are subject to error (Fox 2004). The Rasch Model is a probabilistic model which assumes that raw scores (e.g. Likert scales) are sufficient statistics for the determination of measures but converts them into linear units of measurement called 'Logits' or 'Log-Odds Unit'. The core assumption is that non-linear raw scores, which are more ordinal than interval in nature, result in spurious correlations while linear measures result in correlations that are closer to their 'true' values, or are specifically termed 'measures'. The Rasch Model is said to do extremely well at 'constructing linearity out of ordinality and at aiding the identification of the core construct inside a fog of collinearity' (Schumacker and Linacre 1996, p. 470). In a nutshell, the Rasch Model, or IRT in general, seeks to estimate a person's intrinsic ability – or latent trait – in a particular domain (e.g. mathematics ability) based on his or her responses to items (e.g. mathematics test questions) of the particular domain by converting raw scores which are considered ordinal to linear measures. Measures are therefore closer estimates to the intended trait to be measured. Besides measuring growth of student outcomes, IRT can also be applied to other observed data containing latent traits (e.g. teacher knowledge, skills and beliefs, and leader's practices, students' attitude and perception, etc.).

Finally, the conceptual research framework could benefit by including an intervention component. The reasons for this are threefold. First, intervention studies somewhat compel researchers to be robust in their theoretical framework prior to the study. The need to intervene also suggests the need for robust conceptual and theoretical frameworks. It has been noted that there is the need for greater use of theory in school effectiveness research. Scheerens (2013) cited that out of 109 international school effectiveness studies, only six could be seen as theory driven. Second, it encourages the take-up rate of schools in granting access to researchers. Schools see greater value in researchers coming in to value-add to students' educational experiences. Third, intervention studies have direct and immediate benefits to schools. It is also worth mentioning that the design experiment could be considered an innovative method for intervention in the research framework for PLCs. Although it is a relatively new concept in research methods which began in 1992 (Brown 1992) and is more popular in the field of learning sciences, its potential advantage lies in its ideal to combine explanation (research) and guidance of practice (development) – the intervention, with the primary purpose of improving teaching and learning, which is central to PLCs. In the design experiment, the intervention evolves as problems surface in the implementation of the intervention through research data collection. Also, it is generally acceptable for researchers to play the practitioners' role in the implementation of the intervention, and teachers to play the researchers' role in data collection and analysis all with the primary intention of improving the intervention over time. In this regard, the design experiment shares a slight tinge of the critical social science paradigm which has to do with the betterment of social life – in this case, improving the intervention through the blurring of roles between researchers and practitioners so as to improve teacher practice and student learning.

Conclusion

In this article we have presented the rationale for a conceptual framework for PLC research with particular emphasis on its great potential to guide future research

efforts in the development of the knowledge base of PLCs; and in so doing, provide some guide for educational policy-makers and practitioners in the formulation of policies and practices that help to create, develop and sustain PLCs that can successfully impact teaching and learning in schools. In our framework, we propose that future research work should invest in three inter-dependent aspects: construct of PLCs; conditions–contexts of PLCs; and causalities of PLCs. We also propose that methodological rigor be applied to future research efforts on PLCs with the following research design characteristics: mixed-method; longitudinal; large scale; ethnographic, experimental, and multilevel designs; IRT models; and intervention. We hope that the proposed research agenda detailed in this paper would encourage further reflection and discussion among members of the international research community, policy-makers and practitioners interested in PLCs or teacher learning communities in general.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was funded by the Educational Research Funding Programme, Office of Education Research, National Institute of Education, Nanyang Technological University [grant number OER 14/12 HS].

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