Lesson study and the long-term impact on teacher professional community development

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Abstract

Purpose – The purpose of this paper is to investigate the long-term impact of participating in school-based lesson study on mathematics teachers' professional community.

Design/methodology/approach – A study was conducted with six mathematics teachers, from two post-primary schools in the Republic of Ireland, following up on their participation in school-based lesson study over the academic year 2012/13 (see Ni Shuilleabhain, 2016). Qualitative data were generated through one-to-one, semi-structured interviews with the participating teachers and analysed using an empirical framework for teacher community formation (Grossman *et al.*, 2001).

Findings – Analysis of the interview responses suggests that the mathematics teachers in both schools, Doone and Crannog, had developed a mature professional community during their participation in lesson study in 2012/13. Furthermore, the research finds that, in the absence of any other professional development intervention, both teacher communities have been sustained at this level six years later. These findings suggest that a lesson study may serve as a potential structure to foster the development of sustainable professional communities within subject-based teacher groups.

Originality/value – While a lesson study has been shown to support the development of teacher professional communities, previous research has not addressed the sustainability of the communities which emerge. This study, therefore, adds to the existing literature by investigating teachers' perceptions of the long-term impact of lesson study participation on their professional community.

Keywords Teacher professional community, Lesson study, Teacher learning, Professional development, Mathematics education

Paper type Research paper

Introduction

In recent years, teacher professional communities have been acknowledged as important structures for fostering teacher learning and capacity building in schools (Little, 2002; Stoll *et al.*, 2006; Vescio *et al.*, 2008). Many educators and researchers argue that such communities offer a distinct form of professional development since they are situated in the realities of the school (Sargent and Hannum, 2009) and can provide teachers with a collaborative structure within which to engage with curricula and policies (Dooner *et al.*, 2008). Moreover, empirical research has documented the capacity of teacher communities to support instructional improvement and school reform (Little, 2002), which, in turn, can have a positive impact on student learning and attainment (Dogan *et al.*, 2016; Grossman *et al.*, 2001; Vescio *et al.*, 2008).

Lesson study (LS) has emerged as a valuable model to support the development of teacher communities (Baricaua Gutierez, 2016; Chichibu and Kihara, 2013; Lewis *et al.*, 2009;

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Lieberman, 2009) as it provides a context for school-based collaboration and is rooted in both teacher and student learning (Lewis *et al.*, 2009). However, previous research has been limited to short-term studies in which data were collected and analysed directly after the introduction of LS (Lewis *et al.*, 2009). This research, therefore, aims to address the question "How do teachers perceive the long-term impact of participating in school-based LS on their teacher professional community?" by following up with six mathematics teachers who had participated in school-based LS in 2012/13 (see Ni Shuilleabhain, 2016).

Teacher professional community

The concept of teacher community has been widely referenced in recent years, and common characteristics of such communities have emerged. Westheimer (1999) contends that teacher communities are rooted in shared values and understandings, interdependence, mutual engagement, meaningful relationships and a concern for individual and minority views. Vescio *et al.* (2008) also suggest that such communities are based on the premise of improving student outcomes through teacher learning. Within the context of this research, we define a "teacher professional community" as a cohesive group of teachers who work collaboratively in an effort to improve both teacher practice and student learning (Grossman *et al.*, 2001; Stoll and Louis, 2007; Vescio *et al.*, 2008).

It is not enough, however, to simply bring teachers together with a common enterprise to ensure the development of a community (see Rousseau, 2004). Research on the development of teacher professional communities shows that, within supportive structures, communities can undergo change over time and develop from a beginning to mature community through different stages. Van Es (2009) suggests a framework for the development of a teacher learning community in a video club which moves from a "beginning" to "high functioning" community as participants begin to collaborate to support each other's development. Dooner *et al.* (2008) use four developmental stages in analysing the collaborative dynamics involved in developing and sustaining a professional community. Similarly, Grossman *et al.* (2001) outline a framework for community formation across three stages of development: beginning, evolving and mature. This framework is further divided into four dimensions or aspects of teacher community: (1) Formation of group identity and norms for interaction, (2) navigating fault lines, (3) negotiating the essential tension, (4) communal responsibility for individual growth. The first dimension relates to the group's identity and their interactions. During the beginning stages of community development, members may identify with subgroups with a group leader taking sole responsibility for regulating the behaviour of the wider group. As a community develops, members begin to identify as a cohesive group and assume collective responsibility for their interactions and behaviour. The second dimension relates to how the group responds to conflict and differences. Initially, dissent and conflict may be suppressed, and genuine commonality between members may be lacking. Rather than strive for cohesion and agreement in all topics and decisions, however, members must learn to understand that there are differences in their beliefs, knowledge and practices and that these can become a source of learning (Grossman *et al.*, 2001; Rousseau, 2004). The third dimension relates to how teachers respond to the "essential tension" between student learning and teacher learning. While some teachers may solely focus on supporting either student learning or teacher learning, members in a mature professional community come to recognise the relationship between the two and actively use their own learning as a vehicle to support student learning. The fourth dimension is concerned with the group's sense of responsibility for each other's professional growth. Initially, learning may be seen as an individual responsibility, and thus members may not feel obligated to contribute to the discussions or share pertinent information. As a community matures, members develop a sense of responsibility for each other's professional development (see Grossman *et al.*, 2001, p. 94).

From each of these models, it is clear that the sustained inquiry of members of the community around their own practices, shared openly within the group without trepidation of the implications on one's knowledge or beliefs (Van Es, 2009), is an important element of developing a community. In addition, having a clear goal to work toward is a key feature in maintaining the dynamics of a group. These factors align with the objectives and mechanisms within a cycle of LS (Takahashi and McDougal, 2016).

Lesson study and teacher professional community

While different models and interventions that foster the development of teacher professional communities have been documented in the literature, empirical research has evidenced LS as a potential structure to support the formation of teacher community (Baricaua Gutierez, 2016; Chichibu and Kihara, 2013; Lewis *et al.*, 2009; Lieberman, 2009). LS is a well-documented model of professional development, whereby teachers work together to plan, teach, observe and reflect on a research lesson as part of a LS cycle, with the aim of improving instructional practices to positively impact student learning (Lewis and Hurd, 2011; Lewis *et al.*, 2006, 2009; Takahashi and McDougal, 2016).

Research on establishing teacher professional communities through LS has found that the shared goal of engaging in the LS cycle was an important part of these communities working successfully together (Chicibu and Kihara, 2013). In addition, LS encourages teachers to make their implicit knowledge, beliefs and practices explicit to other members of the group (Fujii, 2018; Lewis *et al.*, 2009) and provides teachers with opportunities to engage in collective decision-making, thereby developing a shared sense of responsibility for students' learning (Lawrence and Chong, 2010). Where LS communities have failed to engage in or complete a cycle, a lack of shared understanding of the purposes of members' own participation has been demonstrated as a contributory reason (Rousseau, 2004). Statistical analysis conducted by Chichibu and Kihara (2013) suggests that a lack of consistent collaboration of members of the group across all stages of the LS cycle led to less sustainable communities.

Research methodology

Participants

In this research, semi-structured interviews were conducted with mathematics teachers from two post-primary schools, Doone and Crannog (all names used are pseudonyms), in the Republic of Ireland (ROI). Participating teachers from both schools had engaged in school-based LS as part of a comparative study in 2012/13 (see Ni Shuilleabhain, 2016), with five mathematics teachers from Doone and seven from Crannog taking part in the LS cycles. This research had been conducted during the reform of the mathematics curriculum in the ROI, where LS was introduced to a number of schools to support them in the implementation of the revised curriculum (see Brosnan, 2014; Ni Shuilleabhain, 2018b). Although four of the original twelve LS participants had either taken up a new position or retired from their respective school since the original study, three teachers from each school volunteered to take part in this follow-up research. These participating teachers, one male and five females, had varying years of experience teaching mathematics: Kate, Lisa and Nora from Doone had 9, 13 and 41 years of teaching experience, respectively, with Nora working in the capacity as a remedial teacher. In Crannog, Eileen, Fiona and Walter had 9, 37 and 18 years of experience teaching mathematics.

Data collection and qualitative analysis

Data for this study were gathered through one-to-one, semi-structured interviews with participating teachers, which were conducted more than six years after their initial participation in LS. The interview questions examined the teachers' recollections of their

experiences of professional development and teacher community before participating in LS, their reflections on their participation in numerous cycles of LS over the 2012/13 academic year and their post-LS experiences. These questions were structured according to the four dimensions outlined in Grossman *et al.*'s (2001, p. 94) framework for teacher community (see literature review) for each time period outlined above [1]. For example:

> Did you feel there were any subgroups or smaller groupings within the larger lesson study group? Did this change over the course of the lesson study cycles? [Questions relating to LS 2012/13]

> Do you feel a sense of responsibility for your colleagues' learning as a group of mathematics teachers? [Question relating to Post-LS]

The dimensions in Grossman *et al.*'s (2001) framework will henceforth be labelled D1, D2, D3, and D4 for ease of reading:

D1. Formation of group identity and norms for interaction

D2. Navigating fault lines

D3. Negotiating the essential tension

D4. Communal responsibility for individual growth

Each dimension consists of descriptors for each stage of community development (beginning, evolving or mature), thus indicating the minimum level of capability for each. In D1, the first row of descriptors relates to the group's identity, the second row relates to how they value the contributions of individual members, the third row to responsibility for regulating group behaviour and the fourth row to the group's interactional norms. As an example, the first row relating to the group's identity has the following descriptors: "Identification with subgroups" [beginning]; "Pseudocommunity (false sense of unity: suppression of conflict)" [evolving]; "Identification with whole group" [mature] (p. 94).

For D2, the first and second row of descriptors relate to differences and conflict, respectively; for D3, the row of descriptors relates to the essential tension between student and teacher learning and finally, for D4, the first and second row relate to responsibility for colleagues' learning and group contributions. As for D1, each row has descriptors for what constitutes beginning, evolving and mature behaviour levels of formation. There were thus 12, six, three and six descriptors under D1, D2, D3 and D4, and these 27 descriptors were used as codes in the analysis.

The audio files were transcribed and analysed utilising NVivo software, in accordance with the framework above. The transcribed interviews were each divided into units of analysis, defined as a participant's response to a question or follow-on question. The time periods addressing teachers' participation in LS (LS 2012/13) and the time after their participation in LS (Post-LS) were each coded using the 27 descriptors from the framework. A unit of analysis could be assigned more than one code. The first author initially coded several interview excerpts, and this was cross-checked with coding from the third author to investigate inter-rater reliability. Once coding was agreed upon, each of the transcribed interviews was coded utilising the framework outlined above.

Following the analysis, hierarchy charts were created in NVivo for LS 2012/13 and post-LS according to the combined number of coding references for each stage of community development for the respective period of time in each school (see Figures 1–4). These charts, along with participants' responses to the interview questions, were subsequently examined to identify whether any emerging professional communities were sustained in the period following LS. Similar charts were not created for pre-LS since there was no evidence of a professional community in either school prior to the teachers'

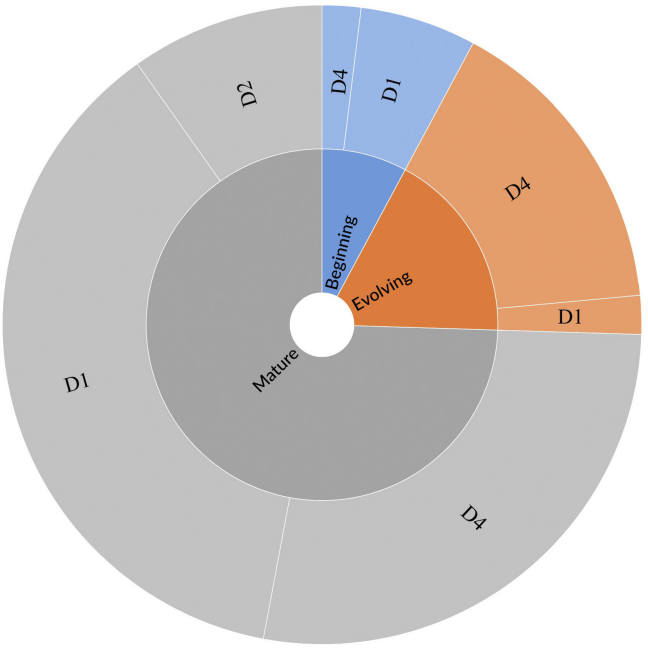

Figure 1.
Teacher community development in Crannog during LS 2012/13

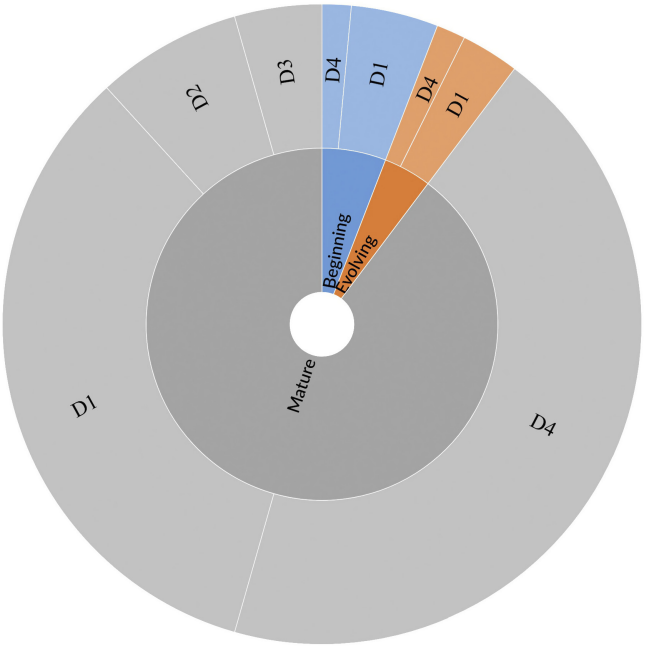

Figure 2.
Post-LS teacher community development in Crannog

Figure 3.
Teacher community development in Doone during LS 2012/13

Figure 4.
Post-LS teacher community development in Doone

participation in LS, according to teachers' interview responses; something which may be expected in the Irish educational context where teacher professional development is not officially recognised or acknowledged and where, until recently, teacher collaboration has not been cultivated as a valuable environment for teacher learning (Ni Shuilleabhain and Seery, 2018a).

It is worth noting that the findings outlined below relate only to the three responding teachers from each school from the original 12 and without the opportunity to contrast with the practice of other teachers in the respective schools.

Findings

From the analysis of the interview responses, and recognising that interviewees did not include all of the teachers involved in the initial research, it is clear that participating teachers in both schools perceived their involvement in LS to be an enriching and worthwhile experience which had a long-term positive impact on their relationship with colleagues. While teachers in both schools did not have an established professional community prior to their involvement in LS, both groups were, according to their interview responses, predominately in the mature stage of community development during LS in 2012/13. Furthermore, the research finds that, more than six years later, and in the absence of any other professional development intervention, the community has been sustained in Doone and further strengthened in Crannog. These findings are reported for each school below.

Crannog

Pre-LS

Before participating in LS, the mathematics teachers in Crannog did not engage with each other in the context of a professional community. While they were a collaborative department, their conversations were ad-hoc, and their department meetings were mainly concerned with administration rather than teaching and learning. Any sharing of resources was also based on chance conversations, and they would not have openly discussed or provided feedback on the resources that were shared. Nevertheless, the teachers reported a collegial atmosphere within the department prior to LS.

LS 2012/13

Analysis of the interview responses relating to LS 2012/13 suggests that the mathematics teachers in Crannog had developed a mature professional community through their participation in LS. The chart in Figure 1 represents the combined number of coding references from each teacher interview in Crannog for each stage of development from "beginning" to "mature", with the outer layer representing the different dimensions referenced under each stage. As indicated in Figure 1, the most prevalent stage of development for LS 2012/13 was mature, with codes within the beginning and evolving stages present in smaller proportions. It is worth noting, however, that there was no evidence of D3 (negotiating the essential tension) in teachers' perceptions of teacher professional community in their school during LS.

Most prominent among the dimensions highlighted in teachers' interviews are D1 and D4. With regards to D1, it was apparent that the mathematics teachers in Crannog were identified as a cohesive group during LS, as indicated by Eileen's recollection that "[LS] made us all work together as a really good team". The teachers also acknowledged a shared sense of responsibility for the LS work, and they valued each other's contributions, which is consistent with the features of a mature community (Grossman *et al.*, 2001). Although references to the beginning stage of development were also evident under D1, these were primarily due to the

presence of informal subgroups within the larger LS group and, in the main, the teachers identified as a cohesive group throughout LS:

> Interviewer: Did you feel that there were any sub-groups or smaller groupings within the larger lesson study group?
>
> Fiona: A little bit to some extent but that's the nature of people but I think when we were actually in the [LS] group it was not evident.

In relation to D4, the teachers acknowledged the responsibilities of group membership such as contributing to discussions, asking questions and sharing ideas (coded as features of a mature community). While Eileen admitted that she initially held back during the LS meetings since she was a newly qualified teacher at the time and did not feel as competent as her colleagues, she grew to participate equally as the group matured. There were also reports of teachers recognising their colleagues as a resource for their own learning (evolving), in addition to actively supporting their colleagues' professional growth (mature).

Post-LS

Based on teachers' interviews, the data suggest that the community which emerged in Crannog has further strengthened following their participation in LS. As evidenced in Figure 2, the majority of the coding references relating to their post-LS experiences aligned with the mature stage of development (Grossman *et al.*, 2001). It is also worth noting that codes associated with D3 were evident in the responses relating to post-LS, where they had not been before.

In relation to D1, it became clear that, despite no longer engaging in LS, teachers in Crannog continue to be identified as a cohesive group with new members seamlessly integrating into the culture of shared learning and collaboration, which has been established since LS (mature):

> I think that [LS] strengthened our kind of pulling together and working things out as a department. Walter

Moreover, the mathematics department has developed new interactional norms in recent years (mature). For example, they now meet on a weekly basis to discuss teaching and learning practices, with matters pertaining to administration more commonly discussed using an online communication platform. It is worth noting that school leadership was an important aspect in teachers initially participating in LS (Ni Shuilleabhain, 2016) and, according to the participating teachers, played a key role in encouraging and supporting the mathematics and other subject departments to meet regularly:

> We would have been one of the first departments to have met as a subject every week and then all the departments in the school meet as a subject every week. So, I think our participation in lesson study did sort of spawn off a number of benefits for the whole school as well. Walter

In reference to D4, the teachers noted in their interviews that LS formalised the sharing of ideas and opinions, which has since become a common practice within their community:

> We are now so willing to work together and share things with each other. Eileen

Moreover, they have come to share a sense of commitment to each other's professional growth, thus representing a shift from the evolving to mature stage of community development (Grossman *et al.*, 2001). Although references to the beginning and evolving stages of development were, again, evident in teachers' reflections of their post-LS experiences, these were primarily attributed to the presence of a few informal subgroups due to the proximity of classrooms and the open discussion of additional interactional norms, such as introducing peer observation and

further engagement in LS. In particular, they feel that LS is a useful model of teacher professional development, which should be encouraged more within the Irish education system:

> I think if schools were encouraged to do lesson study and were given time to encourage teachers to do that and count it towards their professional development and then was sort of marked as such, I think it would be very beneficial. I would like to see lesson study rolled out. Walter

Doone

Pre-LS

Before participating in LS, the mathematics teachers in Doone had no established culture of collaboration nor did they meet as a department to discuss teaching and learning practices. Indeed, this was documented as a reason for their initial participation in LS as the teachers wanted to be supported in working together during a time of curriculum reform (see Ni Shuilleabhain and Seery, 2018a).

LS 2012/13

Despite their limited engagement with one another prior to LS, there is evidence to suggest that the teachers in Doone had developed a predominately mature teacher professional community during LS in 2012/13, again demonstrating that participation in LS supported teachers in establishing strong professional relationships with one another (see Figure 3). The chart in Figure 3 shows the combined number of coding references for each stage of development across the dimensions of formation of teacher community (Grossman *et al.*, 2001) for Doone. While there was a higher proportion of responses within the beginning and evolving stages of teacher community when compared to Crannog, the most prevalent stage of development was nonetheless mature, based on the teachers' interview responses. It is worth noting that there was, again, no evidence of D3 in the context of teachers' participation in LS.

With respect to D1, the participating teachers recall having a strong sense of unity as a group, and they felt there was communal responsibility for the LS work (features of a mature community):

> When we were delivering the lesson there was no sense of "This is my lesson"; it was a case of "This is our lesson". Kate

Moreover, the teachers acknowledged the unique contributions of individual members and were aware of the need to regulate interactions between group members, such as keeping everyone on task during the LS meetings and ensuring everyone's voice was heard (elements of an evolving community). While coding references within the beginning stages of development were also evident under D1, these were, again, mainly attributed to the presence of informal subgroups within the larger LS group. However, similar to Crannog, the teachers considered these subgroups as a natural element of working in a school:

> There would have been no sense of exclusion to anyone, it was just natural kind of combinations. Nora

In relation to D4, the teachers acknowledged their colleagues as a resource for learning (evolving) and recognised the responsibilities of participation in a learning community, such as contributing to the conversations, sharing their learning and providing feedback on ideas (mature).

Post-LS

Analysis of the responses relating to the teachers' post-LS experiences suggests that the community in Doone has been sustained in the years following their participation in LS (see Figure 4).

With regard to D1, the teachers continue to identify as a cohesive group and there is "very good overall co-operation" (Nora) within the mathematics department (mature). The teachers have also begun to discuss the development of new interactional norms, such as setting up weekly meetings to discuss teaching and learning. However, while the teachers in Doone received support from school management during LS, they have not been given time allocations since then due to timetabling issues. This has subsequently acted as a barrier to continued engagement as a group:

> None of us are scheduled at the same time for a period one day of the week that we can all actually meet together. So that is a problem. Lisa

As a result, the teachers have begun to collaborate in smaller subgroups, thus contributing to an increase in coding references within the beginning stage of development when compared to LS 2012/13 (see Figure 4). Nevertheless, they still identify as a cohesive group (mature) and value the opportunity to discuss teaching and learning with each other.

In terms of D4, the teachers continue to recognise their colleagues as a resource for learning and accept the responsibility of membership within a community such as contributing to the discussions and seeking clarification on ideas (elements of an evolving and mature community respectively). As acknowledged by the teachers, their participation in LS "has been responsible for more vitality in the maths department" (Nora) and "it really did make us realise the value of sitting down together and discussing teaching" (Kate).

Discussion and conclusion

This study investigates teachers' longitudinal perceptions of the development, or lack thereof, of their learning communities following their participation in school-based LS over one academic year. Through semi-structured interviews with six teachers from two schools, teachers' opinions and beliefs regarding their and their colleagues' collaborative practices following their participation in LS were recorded. These qualitative responses were analysed utilising a framework of the development of teacher community from Grossman *et al.* (2001) and reported on regarding each teacher community's stage of development (beginning, evolving or mature).

Findings from this research demonstrate that teachers' participation in LS facilitated the maturation of teacher professional communities in both sites and that this level of community development has been maintained more than six years later despite teachers no longer participating in LS. This research represents an important finding in highlighting LS as a potential way of effectively establishing teacher professional communities within subject-based teacher groups and as a valid and valuable way of developing such communities. As teacher communities have been shown to be a key feature of enabling and strengthening educational reform (Dogan *et al.*, 2016; Dooner *et al.*, 2008; Vescio *et al.*, 2008), this research suggests that LS may be utilised as a worthwhile and important practice in this regard.

As demonstrated in this paper, according to teachers' analysis of their experiences, LS facilitated teacher community to go from a beginning phase in both Doone and Crannog to mature during the academic year. Through teachers' collaborative work in successive cycles of LS, they began to share more with one another with regard to their classroom practices, ensure everyone's voice was heard and develop a sense of communal responsibility with regard to their own and each other's learning as part of the LS process. In their responses, the participating teachers noted the importance of their school's commitment in ensuring all members of the LS community could participate in the LS cycles throughout the year, resonating with Chicibu and Kihara' research (2013). Such support from school leadership is key in allowing such LS communities to establish and develop throughout the year (Fullan, 2003; Stoll *et al.*, 2006).

It is worth noting, however, that LS was not continued in either school following the original study in 2012/13. While the teachers in both schools received support from school leadership during the LS cycles, neither school has participated in formal LS since the initial study. This may be expected in the Irish educational context where there is no substitution or supervision available to facilitate LS and where teachers do not receive acknowledgement or reward for participating in LS. While teachers in Crannog continue to meet each week for teaching and learning purposes, the teachers in Doone have not received continued support following LS. However, given that our findings suggest that both communities have been sustained, despite a lack of ongoing organisational support in Doone, suggests that time and resources, although important, are not the sole enablers of community development (Grossman *et al.*, 2001). Rather, our findings indicate that efforts to sustain a teacher professional community may also rely on the development of shared goals and values (Westheimer, 1999), positive attitude towards self-development and strong working relationships (Stoll *et al.*, 2006).

We recognise the limitations of this research in that only six of the initial twelve teachers participated in this follow-up study and therefore do not relate to all teachers who participated in the original research. We acknowledge, however, that many of the interview questions and responses related to the teachers' collective experience as a community and their interactions with other members within the community. While four former members of the initial twelve LS participants have either changed role or retired from their respective school since the original research, the communities have, according to the teachers' responses, been sustained with new members being assimilated into the culture of shared learning which has been established since LS. We also did not have the opportunity to ascertain the veracity of the participating teachers' comments with other members of the school and recognise the limitation of establishing teachers' beliefs and opinions with regard to the teacher communities they may or may not belong to, as opposed to investigating the features of the teacher communities in both schools. We argue, however, that establishing features of a teacher professional community is a complex and long-term process which would, unfortunately, not have been possible with the resources at our disposal. We also argue that as teachers play such a key role in establishing, developing and evolving teacher community, investigating their experiences and beliefs around the communities they participate in is a valuable way of assessing the stages of development of the communities they may or may not feel part of.

LS has been established as an important model for teacher learning and a valuable context for school-based professional development (Lewis and Perry, 2017; Takahashi and McDougal, 2016). While research has already pointed to the value of LS in cultivating teacher professional communities (Baricaua Gutierez, 2016; Chichibu and Kihara, 2013; Lewis *et al.*, 2009; Lieberman, 2009), this study contributes to the literature on LS by providing evidence of its potential to establish and develop school-based teacher communities within subject-specific groups of teachers. In addition, it provides evidence of the sustained impact of teachers' participation in LS over one academic year. It is hoped that this research will contribute to the continuing research on LS as a valuable form of teacher education.

Note

1. Due to copyright, the framework could not be reproduced in this article. Please refer to Grossman *et al.* (2001, p. 94) for a summary of the framework.

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