

## Nurturing quality science learning and teaching: The impact of a reading group

### Abstract

Teachers are key to the delivery of quality science education experiences in Australian classrooms. In achieving this, there is a need for teachers to be better supported in thinking reflexively and critically about their practice. The Centre for [de-identified] at [de-identified] University took action to address this need by forming a reading group to encourage interested teachers of science from primary and secondary schools to meet regularly to discuss relevant journal articles and implications for their practice. This paper explores how forming a community of practice around a reading group impacted on participants' approaches to science learning and teaching.

### Introduction

In school staffrooms and shared office spaces across Australia, teachers talk. They discuss their students, they dissect their teaching and they share their ideas. They offer encouragement, they provide insights and they challenge each other to think differently. In these, usually informal, moments, much learning can take place. But all too often this opportunity to talk about teaching practice is reduced to a fleeting one. A fortuitous encounter in a corridor, a quick chat by the photocopier, a shout out for support over a sandwich. The chance for sustained and targeted discussion amongst teachers about what they do in their classrooms to support student learning how and why is all too rare (Nias, 2005). This is an unfortunate truth. But as the work of a teacher becomes more complex and demanding, there is an understandable need to prioritise where energy and effort is channelled and opportunities for *really* talking about learning and teaching tends to fall towards the bottom of the list. Although in this reality lies an incredible irony. A distinctive characteristic of an effective teacher is that they are reflective practitioner (Stronge, 2007). They take the time to review, analyse and evaluate their experiences in the classroom as way of improving the quality of their teaching and their students' learning. These teachers make their experiences and reflections public through shared conversations and active collaborations rather than keeping them as private thoughts as a way of increasing effectiveness (Darling-Hammond, 2008). What emerges from this is a tension – finding space for formally sharing professional thinking - that warrants concerted efforts to find ways of supporting this to happen. It was with this in mind that a group of science teacher educators from [de-identified], which we (the authors) were part of, started to explore what could be done to practically support their science education colleagues to not only think more deeply about the learning and teaching of science, but to give voice to their insights and provide an opportunity for collaboration and sharing. This paper shares our approach to this issue by articulating what we did and why.

### Literature Review

The phrase *community of practice* (CoP) emerged from Wenger's (1998) work nearly two decades ago, which examined the formation of groups of people engaged in a process of shared learning around an area of common interest. While he did not specifically focus on teachers as part of his research, it is a concept that is nonetheless fitting for the work that teachers engage in. Broadly, Wenger (2006) defines CoP as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (p. 1). For teachers, these

groupings can emerge from a variety of spaces, such as staff rooms, staff meetings, structured networks (e.g. professional associations) or personal friendships, each contributing in different ways to learning about and improving teaching practice.

Wenger (2006) determined that three characteristics must be evident for a CoP to exist:

1. Domain;
2. Community; and
3. Practice.

A shared *domain* of interest and expertise in a particular area defines the identity of those involved in a CoP. In pursuing their interest in a particular domain and strengthening that *community*, participants actively engage in activities and discussions to help each other, share information and develop relationships that promote learning. Over time and through sustained interactions, participants develop a shared *practice*, such as experiences, stories, tools, or ways of addressing issues. It is a combination of these three elements that constitutes a CoP. In school settings, it is relatively easy to identify what would constitute a domain (e.g. improvement of science learning and teaching) and a community (e.g. teachers of science), but less obvious, or perhaps more often the missing link in an education-focused CoP, is the practice, the activity that brings it altogether (e.g. what do teachers of science do to improve science learning and teaching?). It is this space that our research was interested in exploring – different notions of practice that can be used to form and inform a CoP.

In an education context, teachers participating in a CoP are encouraged to think about their broader purpose and practice in ways that support longer term goals associated with learning and teaching rather than being solely concerned with the specifics of day-to-day lessons (McLaughlin & Talbert, 2001). This may be due to, as Lieberman (2009) states, “participat[ion] in a learning community allowing teachers to develop or confirm a teacher identity that includes meeting the needs of students and learning from other teachers in order to do so” (p.4). This approach to developing teacher identity and practice enables those participating in a CoP to be more innovative as they are continually rethinking their practice based on how their students perform and how their own learning evolves (Vescio, Ross, & Adams, 2008).

Science education provides a particularly interesting context for exploring the role CoPs might have in engaging teachers of science in challenging their own notions of quality learning and teaching. Even though it was released over a decade ago, the Government report, *The Status and Quality of Teaching and Learning of Science in Australian Schools* (Goodrum, Hackling & Rennie, 2001), provided an informative yet disappointing picture of the state of science education in Australia that still, unfortunately, holds relevance today. In particular, the report uncovered the inadequacy of traditional teaching practices, for both primary and secondary phases of schooling, in regards to developing students’ understandings of science and of fostering positive dispositions towards science. This suggests that there is a significant need, as well as opportunity, to actively contribute to improvements in science education through the establishment of different ways of working, such as CoPs, to bring about positive impacts on science teaching practices and subsequently on students’ learning in science.

In thinking about what could be done on a practical level to initiate such changes, the Centre of [de-identified] at [de-identified] University decided to establish a CoP around a reading group. A reading group became a vehicle for this initiative because the concept would be recognised as familiar, it was achievable in terms of resourcing and time commitments, provided a non-threatening environment and had the potential to be repeated in different contexts. In this instance, the *domain* was interested primary and secondary school teachers, academics and research students from a range of sectors connected with science education. The *community* revolved around the participants meeting once a month during the school term for an hour to discuss an article(s) set by the reading group facilitators (the first two authors of this paper). The chosen article(s) were related to an area of science learning and teaching that has been raised by a participant in the group as being of interest or in need of improvement. The *practice* of meeting regularly as a reading group encouraged the participants to share their interpretations of the set reading(s) and engage in discussion about how these ideas were or could be incorporated within their own science learning and teaching practices.

The formation of this CoP provided an opportunity to also document the experiences of those who participated in the reading group with this research component led by the third author of this paper. The intention of studying this experience was to examine the participants' perceptions of and insights into how being part of this unique experience impacted on their thinking and practice in relation to science education. The question driving this research was: What impact does a reading group have on the participants' approaches to science learning and teaching?

## **Method**

The study combined quantitative and qualitative modes of data collection as a way of providing a more complete picture of the phenomenon being examined – the impact of a reading group on participants' thinking about and practice in relation to science learning and teaching. In this case, quantitative data, in the form of questionnaire responses, were gathered to provide an overview of the reading group experience. Qualitative data were also gathered in the form of semi-structured interviews. This approach enabled trends in the participants' responses to be noted, but also allowed for an in-depth account of their perspectives to be developed (Creswell & Plano Clark, 2010).

This paper reports only on the qualitative component of this research by exploring the perceptions of three reading group participants as shared through individual interviews. By focusing on their experiences, it is hoped some insights will be provided into what value forming a community of practice around an activity like a reading group can have on the ways science education is considered and practiced.

## **Participants**

At the time of this study, the reading group had a regular attendance of approximately 10 drawing from a pool of 30 science teachers, teacher educators and research students. All participants were invited to take part in this research with 14 responding to the online anonymous questionnaire

and three subsequently taking part in an individual interview. The three interviewees – Fleur, Mingfei and Rana – were involved in science education either as a teacher (Fleur – early career secondary school teacher) or as a research student (Mingfei: international student; Rana: local student; both completing PhDs). While this sample is not representative as the voices of primary school teachers and academics are absent, it does start to shed light on the impact of participating in a reading group in terms of the ways these participants thought about science education.

### **Data collection**

Semi-structured interviews were conducted to elicit specific examples of how the participants transferred what they experienced in the reading group into their science education practices as well as document how the reading group acted as a CoP to nurture notions of quality science learning and teaching.

With these purposes in mind, it seemed that a semi-structured interview format was the most practical and functional way of collecting this evidence (Stake, 2000). A research assistant, the third author of this paper, conducted the interviews as a way of reducing any concerns relating to a possible power imbalance between the facilitators of the reading group (instigators of this research) and the participants. A convenient interview time and location was arranged with three participants. Interviews were approximately 45 minutes in length and were digitally recorded to enable transcription.

### **Data analysis**

Five characteristics identified by Lieberman (2009), resulting from his own research into the characteristics of successful CoPs involving teachers, were used as a framework for examining the interview data from the study. Extrapolated from these characteristics were the following ideas:

- *Participation;*  
The impact of participating and interacting with/as a group
- *Collegial support;*  
Ability to share ideas/tensions with other teachers
- *Professional development;*  
Support for improved learning and teaching in science;
- *Space for discussion; and*  
Opportunities for discussions about act and art of science learning and teaching
- *Time for thinking.*  
Opportunities to think more deeply about bigger issues in science learning and teaching.

In analysing our data, we searched for confirming and disconfirming evidence of the impact of these five key ideas. After reading and re-reading the interview transcripts a number of times, quotes were identified that provided evidence for these themes as well as for themes that were unique to the participants of this CoP.

### **Findings and Discussion**

The findings of this research are presented around the five themes identified in Lieberman's (2009) work characterizing successful CoPs: participation, collegial support, professional development, space for discussion and time for thinking. Within each theme, the three participants' perspectives about the role of a CoP, formed around a reading group, are shared. Supporting quotes are drawn from the individual interview transcripts for each participant.

### *Participation*

To reap the benefits of a CoP, active participation and interaction is necessary (Lieberman, 2009). Emerging from the interviews with our three participants – Fleur, Mingfei and Rana – were ideas about the value of participating in a reading group to enhance science education, but this was traded off with the commitment that these interactions require. Fleur valued the reading group experience because as an early career teacher she identified she still had “lots to learn so being involved in the reading group [was] a really good experience” and the “welcoming environment” enabled her to gain the professional learning that she needed. While Mingfei, an international student, sometimes found “the context [of the discussions] not easy to understand”, he did identify that the “[focal] readings [had] some impact for [his] thesis writing” and that he appreciated the opportunity for “new students to share their various experiences with participants in this group”. Rana summed up her experiences in the following way: “Great impact, very positive, still willing to go”. For all three participants, being able to commit to attending the reading group sessions did prove problematic. Dedicating the time to attend was difficult (Rana: “Weekdays are a bit hard for me, weekends are always a good option”), timing was an issue (Fleur: “Falls at same time as our staff meetings, which are very valuable”) and finding the space in a demanding schedule was not easy (Mingfei: “I’m busy doing other writing or reading”). This tension is explored in Cole's (1997) work, which examines the conditions that impede teachers' engagement with reflective practice. She refers to working conditions imposed on teachers (e.g. school structures, government systems) and the resultant psychological states (e.g. anxiety, meaninglessness) as making it difficult to engage in reflective practices. While our participants do necessarily not identify their experiences in such ways, it is evident that their commitment to their day-to-day work takes priority over opportunities for professional growth, even when their participation in the reading group results in such positive learning experiences.

### *Collegial support*

Lieberman's (2009) explanation of collegial support referenced the ability of a CoP to provide a forum for the sharing of ideas and tensions with other participants. In this instance, the reading group provided a regular opportunity (monthly in school term time for one hour) for interested science teachers, educators and researchers to meet and have their discussion framed by, but not restricted to, the focal topic and journal article(s). All three participants acknowledged the value of being able to not only share their opinions and approaches to different aspects of science education, but to listen and learn from the experiences of others. For example, Fleur valued “discussing things with more experienced teachers” and Mingfei reiterated the importance of engaging in discussion with a variety of colleagues such as “teachers, the researchers, the higher degrees by research students [because] I think it's a very good combination to share knowledge and practice”. Rana summed up her experience by stating “it is good to know that people are

working hard to make science interesting for students". These perspectives, while not surprising, highlight that the reading group exposed participants to perspectives and approaches to science education that they may not have usually had the opportunity to engage with. The impacts of such encouragement from colleagues should not be underestimated with a more surprising outcome of this work, again shared by all three participants, being the opportunity the reading group created to engage in supportive professional discussions with colleagues beyond the initial meeting. The far-reaching impact of this experience is captured in the following quote from Fleur:

Because two other staff members [from my school] go to the reading group and we often talk about things as a Faculty and try and implement different things as a school. I think it's really good to see what they've taken away as well and it's kind of like a catalyst for discussing what we are doing in our classrooms and what else we could be doing.

This evidence suggests that collegial support in a CoP may have two functions in enhancing science learning and teaching. The first function is exposure to new ideas and approaches from the wider group of participants, while the second function involves sub-groups of participants – those who work together or have regular contact outside of the CoP – taking ideas and engaging in further sense making activities to account for their context (McLaughlin & Talbert, 2006).

#### *Professional development*

The role of a CoP is more than just encouraging participation; it is to support deeper thinking and reflection. In this instance, a reading group was established to improve science learning and teaching. For two participants – Fleur and Mingfei – the reading group offered personal learning experiences as well as the opportunity to learn from experienced others. The personal learning that took place was in connection to being exposed to readings that explored a variety of areas, issues and topics in science education. Fleur summed up her personal learning experience by stating that "being part of the reading group has allowed me to further develop my understanding of different parts of science." While the readings themselves assisted with this, it seems that the more significant experience was the opportunity to listen and learn from experienced science teachers and science education academics. Darling-Hammond's (2008) research further highlights the valuable role that the co-construction of knowledge can have on negotiating the theory-practice gap in meaningful ways. The presence of others in this CoP was identified by Mingfei as making him "want to listen more and more to the experts as this makes [the experience] more interesting and helps in making more sense of the reading". Experience brings additional insights, it also brings confidence, as captured in the following quote from Fleur.

Other more experienced teachers at the reading group are quite experienced in physics and they've talked about practical tasks they've done and because I'm not so experienced in physics, I almost am scared sometimes to do practical tasks with the students because I don't feel that confident. So talking to them about it has made me feel more confident to try things they've suggested.

### *Space for discussion*

The space for discussion provided by CoPs emerged as a theme from Lieberman's (2009) work which can be translated into this context as providing participants with opportunities to discuss the act and art of science learning and teaching. For each of the participants in this study, this space supported their professional learning in different ways. For Fleur, the reading group provided her with the chance to listen to the ideas and discussions of more experienced teachers, which was a significant opportunity and as valuable for her as participating in the discussions.

I don't feel overly intimidated or anything by other members but I do kind of not get as involved as other people in the discussions, just because I don't feel I have experience in areas that they might be discussing and I just want to listen and learn from their experiences

Similarly to Fleur, Mingfei identified experiences that were valuable to him as an international research student. For him, the reading group discussions provided insights into science education in Australian schools, something that he is not easily able to experience first-hand. The inclusion of visual resources in these sessions was also an important way to support and provide access to the discussion as " ... [it] was more interesting and stimulating when we reflected on some real classroom teaching practices from videos or relevant movie clips". Just as visuals supported discussion around good approaches to or practices in science learning and teaching, Fleur and Rana both acknowledged the role that the reading aspect of this CoP, through the provision of a relevant journal article or book chapter, in further stimulating discussions. Rana identified that not completing the reading did not hold her back from participating, but it meant that she did so without the same depth of understanding. Fleur commented that engaging with the reading and following up with discussion assisted in broadening her science education knowledge. While the actual act of reading is important for professional growth, the role of discussion should not be underestimated as a means for sense making (Jones & Ryan, 2014). Providing space for formal discussion, such as around a common reading, is valuable but equally creating opportunities for informal sharing of ideas should be encouraged too (Jones & Ryan, 2014).

### *Time for thinking*

Lieberman (2009) identified that a CoP should provide participants with opportunities to think more deeply about a particular issue or concern, in this instance science education. Two participants – Fleur and Mingfei – spoke in detail about the reflective space and stimulus that the reading group provided them with, particularly in relation to their own work as a teacher and a researcher respectively. The following quote sums up how participation in the reading group supported Fleur in reflecting on her learning and impacted on her teaching in meaningful ways.

I've only been to a handful of the reading groups but I often think about it for a long time afterwards; about what we've talked about and what I'm doing and am I doing what I should be doing in the classroom or how I can change things to make sure that my teaching is more effective and that student learning is enhanced as well. I really try to incorporate

things and use other people's suggestions that come up in discussions as well as the findings from different papers to inform what I do.

Using a reading group as an approach to working in a CoP not only provided dedicated time for thinking, but it also provided food for that thought as the provided reading acted as a tool to promote reflective thinking. While this is evident in Fleur's statement above, she also added that the reading component of the CoP has "been a really good thing to make me stop, read some science education literature and keep up to date with what's going on, the new trends and keep up to date in that way". Mingfei found that the "[reading group] discussion was stimulating, interesting and often relevant to my interest and the topic I am researching". But more useful for him was that the readings could be used to inform his thinking or researching at different times. "I'm researching children's learning about science, so sometimes I go back to the folder [I created] to have a look at the readings to connect the readings with my work". Reading has often been connected with the collection of new knowledge and information (Kwakman, 2003). It provides teachers with the opportunity to stay up to date in a variety of areas, such as teaching methods, pedagogical approaches and societal developments (Kwakman, 2003). While it is the responsibility of the individual to develop their own professional knowledge base, initiatives like reading groups, which provide the space to read and think, actively support teacher improvement.

### **Implications and Conclusions**

While improvements can be made, a CoP has been established that supports teachers, research students and academics involved in science education to think and practice differently. In response to our research question, the impact of the reading group was mostly connected with exposure to new ideas and the chance to participate in discussion with a range of science educators. Learning from this CoP was not restricted to physical attendance at a session because access to the reading group resources was also seen as valuable support for professional learning. Regardless of how this CoP was engaged with, the strength of this approach to professional growth lay in the development of a shared language and understanding about what quality science education looks like.

Using a reading group format to form a CoP has turned out to be a low cost and time effective way of starting conversations amongst teachers, academics and research students that requires minimal investment on behalf of the participants for a substantial gain. This approach to professional learning can be transferred to different contexts with minimal effort as key components include a space to gather in (real or virtual) and accessible readings that provoke further thinking about what constitutes quality learning and teaching in the area in question. More than anything, an effective CoP relies on people's willingness to contribute and reflect. You do not have to have read the paper to attend a session, but you do need to be willing to engage in relevant and authentic conversations.

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