



Discourse communities: A framework from which to consider professional development for rural teachers of science and mathematics

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ABSTRACT

This paper explores aspects of professional development for teachers of science and mathematics in schools in rural Australia. The study identified a range of issues including tensions between government, school and individual professional learning priorities and their respective responsibilities; the shaping of professional development by rurality; and issues of generic versus subject-specific professional learning. The paper will focus on the needs of teachers, particularly secondary teachers, for subject-specific professional development and the capacity of different professional development approaches for satisfying these needs. The notion of discourse communities is proposed as a framework for considering this issue.

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1. Introduction

Educational provision in rural communities, for both teachers and students, has been the subject of concern for many years in many countries. For instance, a recent Australian conference on rural education attracted delegates from Asia, America, Africa and Europe all with stories of challenges to rural communities (Im, 2009; Khupe, Keane, & Cameron, 2009; Mulcahy, 2009; Solstad, 2009). Recent studies (e.g. Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006; Lyons, 2006) have demonstrated a range of equity issues associated with rural education. In Australia, the nationally funded project Science, ICT and Mathematics Education in Rural and Regional Australia (SiMERR) committed to improving educational standards for rural Australians. The current study was undertaken as a SiMERR initiative. The study explored professional development provision experienced by teachers of science and mathematics in rural schools in Victoria, Australia, and the extent to which these matched their needs. The study, while local and specific in context, has the potential to address questions of broad

interest in the area of teacher professional development in rural schools and more generally.

2. The literature

2.1. The nature of successful approaches to teacher professional learning

In the area of teacher learning there has been a long standing advocacy of professional development models that involve collaboration between professionals in improving practice (Hall & Hord, 2001; Joyce & Showers, 1995). These professional learning communities (PLCs) can operate at a whole-school level and encompass fundamental discussions on purposes, values and beliefs (Hill & Crevola, 1999), at the level of the departmental team (Tytler, 2007, 2009), or with smaller groups of teachers engaged in refining their practice, as with the Japanese lesson study model (Isoda, Miyakawa, Stephens, & Ohara, 2006) or the related Learning Study model (Keung, 2009). These approaches draw on the notions of communities of practice (Lave & Wenger, 1991; Wenger, 1998), which involve the negotiation of knowledge and values towards achieving a shared purpose.

In Australia, as elsewhere, research has been conducted into factors characterising successful professional development

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programs (Ingvarson, Meiers, & Beavis, 2005; Meiers, 2008). Meiers' findings concerning factors leading to successful professional development programs in individual schools are broadly consistent with the PLC models described above, emphasising commitment over an extended period of time, leadership and mentoring, access to expertise, and links between learning and curriculum renewal.

The difference between these learning community based models, and more traditional delivery models of teacher professional development, is reflected in the distinction between teacher professional learning, a term now preferred in writing in this area, and professional development (PD). Berry, Loughran, Smith, and Lindsay (2009) characterise professional learning as involving 'the sharing of insights about teaching and learning between teachers in order to gain a sense of professional control and ownership over their learning' (p. 578) as distinct from the supply of pre-packaged knowledge to teachers underpinning traditional notions of professional development. While acknowledging these distinctions, in this paper we will retain the term 'professional development' (PD) as indicating the structures under which teacher professional learning is provided, be they externally delivered, school based, or personally arranged. For the sake of simplicity, we will use the same term for the process of teacher learning/development associated with these structures.

2.2. *Shifting the focus to individual teacher needs*

Many reports have focussed on the context and nature of the PD experience while paying less attention to the variety of needs of teachers involved in the PD programs and the diversity of their experiences. Other studies have looked at issues for specific groups of teachers. For example, Tytler, Smith, Grover, and Brown, (1999) drew upon data from two substantial primary teacher PD projects to argue that teachers' PD needs are influenced by the nature of the subject, and follow a developmental trajectory.

This paper focuses on issues of diversity in the PD needs of teachers and the relevant mix of generic versus subject-specific professional learning provision. For example, subject-specific mentors have been shown to be more effective in US science teacher induction programs due to the specific support they can give for instruction, running practical activities, planning, and incorporating "science as inquiry" and the "nature of science" into their teaching (Luft, 2008). Grossman, Stodolsky, and Knapp (2004) highlight the importance of providing external sources of subject-matter expertise in supporting teachers to incorporate reform ideals into their practice.

2.3. *The role of subjects in defining teachers' work and identity*

Secondary school teachers usually refer to themselves as teachers of specific subject areas and tend to separate themselves from other subject communities (Goodson, 1993).

Departments act as more than administrative units (Siskin, 1994); they also serve as the primary site for social interaction, professional identity and community, they represent strong boundaries dividing the school, and they influence decisions and shape the actions of individual teachers. Stodolsky and Grossman (1995) claim that the content provides the context for the secondary teacher, not just in terms of the subject matter to be taught, but in the ways teachers think about learning, assessment, and their roles as teachers (see also Grossman & Stodolsky, 1995; Siskin, 1994; Stodolsky, 1988). The subject, the subject matter, and personal histories in relation to the subject, are defining elements of teachers' practice and teachers' identity.

Pedagogical content knowledge (PCK: Loughran, Berry, & Mulhall, 2006; Shulman, 1986), emphasises the inextricable link

between teachers' knowledge of pedagogy and content. Morine-Dershimer and Kent (1999) argue that, in reality, "it is literally impossible for a teacher to implement pedagogical knowledge in the absence of content" (p. 42).

Teachers' subject culture affiliations can strongly influence how they teach, their perceptions of their roles, and how they see themselves as teachers. The subject therefore becomes a primary site for teachers' PD needs. This research explores how these issues of generic versus subject-specific teacher knowledge play out in the context of rural schools.

2.4. *The particular needs of rural teachers*

International research has identified a range of equity issues for rural teachers, students and schools associated with isolation, size, and socio-economic factors (Lyons, Choi, & McPhan, 2009). There are problems in attracting and retaining teachers in rural areas (Lock et al., 2009). Recently, a SiMERR National Survey (Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006) gathered data from teachers, parents and carers across all states and territories of Australia relating to Science, Information Communication & Technology (ICT) and Mathematics Education in rural areas. The Survey included a section on PD of teachers. The findings for teachers in rural schools were somewhat different for the three subject discipline areas but the common themes included the sense of professional isolation of teachers, their perception of a need for more professional development time release, and the particular disadvantage felt by teachers in remote schools.

The contextual particularities of these issues and potential solutions were not, however, explored fully. The current research extends the survey in relation to PD provision by looking more closely at the range of approaches to PD in science and mathematics for rural schools and teachers, and teachers' perceptions of these, in order to understand the underlying issues and their relation to rurality. The state of Victoria was chosen for the study for reasons of convenience. Victoria is a relatively densely populated state without the large remote areas characterising much of inner Australia, but has substantial rural communities with a variety of socio-economic and historical contexts. A study of these schools, while reflecting particular educational and geographical settings, should uncover themes about professional learning and development provision for teacher of subjects in rural schools that are relevant for Australia more widely, and indeed globally.

3. **The research questions**

The research questions addressed in this paper are:

- What are the provisions that schools make for PD for teachers of science and mathematics in schools in rural Victoria and what are teachers' perceptions of these provisions?
- What actions do teachers of science and mathematics in schools in rural Victoria take towards their professional learning and what are the issues that they confront?
- To what extent is the provision of PD influenced by issues of rurality?
- What theoretical perspectives might we take to better understand and support the PD needs of teachers of science and mathematics in schools in rural areas?

4. **Data generation and analysis**

The data were gathered by semi-structured interview rather than by survey, to provide a grounded approach that would increase the possibility of all of the relevant issues emerging. Our

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