

Science Professional Learning: focusing on the needs and interests of local school communities

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This paper draws on the data from an intervention project designed to provide rural teaching experiences to pre-service primary education students and also to provide professional development in primary science education to the teachers at five local primary schools. This project used a mixed methods research design, with data sources such as pre and post questionnaires and written reflections. This paper examines the research methodological issues that impacted on the results. There are unforeseen issues such as difficulties in recruiting and liaising with schools and pre-service teachers, responding to changed situations and the breakdown in communication among the researchers and participants. There are also foreseeable issues, such as missed opportunities to collect a greater variety of data, the challenges of completing a small research project (<\$5000) in very limited time, and the difficulties that distance plays on the project.

Introduction

A recent Australian national survey has indicated that children from provincial and remote schools did not perform as well as those in metropolitan schools (Lyons, Cooksey, Panizzon, Parnell & Pegg, 2006). The research has found significant disadvantage for rural schools, teachers and students in terms of availability and quality of on-line access, resource provision, professional development and access to technical assistance (Lyons *et al*, 2006).

Continuing professional learning is a global trend aimed at ensuring that teachers are highly skilled and up to date (Pickering, Daly & Pachler, 2007). Professional development of teachers most often occurs through the medium of workshops and conferences that focus on particular elements of practice, classroom activities and ideas, and skills and content knowledge. This has been shown to be quite ineffective in challenging and supporting more fundamental aspects of teaching practice and beliefs practices (Carrick 1989, Hoban 1992). There is almost universal agreement amongst education researchers that long term, ongoing professional development, sensitive to the needs of teachers and schools, is necessary to support significant teacher development. Many writers (Hargreaves 1994, Hall & Hord, 2001)

have emphasised that change requires teachers to ground new ideas in their own personal experience. Joyce and Showers (1995), drawing on research from a large number of studies, argue strongly for the need to site professional development within the teaching context. They emphasise that professional development occurs within a framework of cultural change, and argue the need for social support as teachers practise strategies that are new to their repertoire or implement areas of curriculum change. With these concerns in mind, the research project was designed to address the research question: What are the effects of a science professional learning model/intervention that focuses on the needs and interests of local school communities? The aims of the project were to:

- rejuvenate interest in science for teachers through the completion of a range of science experiences;
- forge strong links between school communities, teachers and students that would provide ongoing support for the pursuit of science in the area;
- provide an opportunity for children to develop skills of scientific investigation and to share scientific discoveries;
- enable teachers and teacher educators the opportunity to share their understandings of science and develop professionally from the interchange of ideas and strategies; and
- enable Deakin pre-service teachers who were studying science education to become involved 'at the coal face' and to develop a stronger understanding of the many aspects of teaching in rural schools.

Project Design

This small research project was part of a larger national study of pre-service preparation and rural incentive schemes for Teacher Education for Rural and Regional Australia (TERRAnova <http://www.terranova.edu.au>). There were two visits by the researchers, an initial two day visit, which incorporated the professional learning session, and a second two months later referred to as the *Big Day Out*. Contact was made with the principals and teachers before the first session to ascertain the science education needs of participating schools and their staff, with a particular focus on links to science within their local communities. Based on this information the first session of the professional development was designed with a broad focus of Water. Between the two visits, participating teachers implemented some classroom hands on activities. These integrated design, creativity and technology concepts and skills with science concepts based on the topic of floating and sinking as children from all schools designed and made boats to be raced during the third day, the *Big Day Out*.

This project offered a half day science professional learning program for five teachers and four pre-service teachers. This was followed by the pre-service teachers teaching small groups of children in two of the rural schools. The final activity, the *Big Day Out* was held in the regional city where teachers and pre-service teachers were to implement a range of planned science-based hands-on activities for children at all primary year levels. The researchers were to observe, make notes and speak with teachers during the activities to gain a sense of their professional learning.

Research Design

This small scale project adopted a mixed mode methodology/ approach collecting both quantitative and qualitative data. According to Johnson, Onwuegbuzie & Turner (2007, p.112) mixed mode research is “becoming recognized as the third major research approach or research paradigm along with qualitative research and quantitative research”. As the nature of research in general “is becoming increasingly inter-disciplinary, complex, and dynamic, ...many researchers need to complement one method with another” Johnson and Onwuegbuzie (2004, p. 15). The data sources for this project included questionnaires (with Likert and open ended questions), observations and student reflections. The questionnaires provided quantitative data that helped identify themes and areas which required further probing. Since there were no face to face interviews, the open-ended responses, and student reflections were used to provide support or refute the interpretations, providing validity to interpretations. The sample size was limited by the very nature of the project, with a limited number of individual truths that could be drawn on to arrive at a more central locus of truth.

Participants were surveyed before and after the initial program and further data were collected through reflective reports from the pre-service teachers. The data consisted of 7 pre and 6 post intervention teacher questionnaires which were comprised of 9 questions using a 5 point Likert scale and further four questions which were open in nature and allowed for reflective comment. The pre-service teacher questionnaires were also administered pre and post intervention to 4 student teachers. The pre intervention questionnaire consisted of 7 open-ended questions whilst the post intervention questionnaire consisted of 5 questions using a 5 point Likert scale and 9 open-ended questions.

Table 1 Responses to post – project Questionnaire on PD (n=10)

Item	Mean*
1. The pd workshop was well organised.	4.3
2. The pd workshop was interesting and well taught	4.3
3. The pd was relevant to my teaching	4.3
4. The pd was successful in increasing my confidence to teach science.	3.8
5. I have been introduced to some new ideas about curriculum.	4.3
6. The pd session has motivated me to think about my teaching	4.0
7. The pd facilitator has encouraged my learning in this pd session	3.8
8. The pd facilitator has been enthusiastic about teaching science	4.8
9. The pd facilitator has pitched delivery of the science content at an appropriate level for me	4.3

* Likert scale 1-5 with 1 strongly disagree and 5 strongly agree

Research Analysis

The data from the participants indicated that the Professional Development program had a positive impact as evidenced by the responses to the items in the post questionnaire with means being greater than 4 (Likert scale 1-5, With 1 =strongly disagree and 5 strongly agree 1) for most items in the questionnaire (see Table 1).

Methodological Research Issues

The characteristics of this research that impacted on the results extend from the design and methodology through to analysis and include the constraints of being a

small research project, having ambitious expectations of what the research could achieve; the limited data for analysis, the challenges of research in a rural setting, and the breakdown in communication among researchers and schools. Some of the issues arising through the research were foreseeable; while others could not have been anticipated. The issues concerning each of the characteristics will be discussed.

The constraints on small research projects

While the research project had a budget (\$3,900) consisting of relief for teachers (\$1200), travel costs for 2 academic staff and up to 10 pre-service teacher (\$1420) and some administrative support (40 hours = \$1312), the time required by academics, to prepare, conduct and analyse the research was not included. Tasks such as obtaining ethics clearance, developing questionnaires, planning lessons, and analysing data were not costed. In hindsight, the budget was inadequate to provide for sufficient data to be collected to address the research questions and aims of the project.

The funding for the project came from the research group for the School of Education at Deakin University (EFI). This required the submission of a short proposal, evaluation and approval, gaining ethics approval, organizing participating schools and teachers willing to be involved, then undertaking the research, and analyzing the results. The constraint was that this must all be completed in a short time frame of approximately 8 months alongside the normal teaching, research and service commitments. Funds not expended by end of the academic year were rescinded.

Ambitious expectations

The aims of the project outlined on page 2 reveal the ambitious nature of the project despite the limited time, resources and funds. The consequences of this ambition are that the limited time, resources and budget impacted adversely on the quality and analysis of data sources.

The participation in the project particularly by teachers was limited. For the teachers, the research became a Professional Development program offering relief from face-to-face teaching. The lecturers leading the Professional development programme and supervising the pre-service teachers, and teaching children at the Science day were not able to act as researchers.

Limited data for analysis

The data (pre- and post questionnaires from teachers and pre-service teachers and reflective journals for pre-service teachers) collected recorded their perceptions. There was little corroborating data. This was a shortcoming of the planned data collection that was required to adequately address the Research Question: *What are the effects of a science professional learning model/intervention that focuses on the needs and interests of local school communities?* This is a consequence of the ambitious nature of the project with limited time, resources and budget.

The analysis so far has been reported descriptively, however, with richer data from the pre-service teachers than the scant data from the teachers, a change in the approach to a case study of the four pre-service teachers may be more fruitful. The data would be used to provide a case study of the four pre-service teacher and their motivation for volunteering for a rural teaching experience, and their actual experiences. This response to the limitation of the available data would provide a

comparison of the pre-service teachers, however it would require a change to the research questions and the overall aims of the project.

The challenges of research in a rural setting

This project was conducted in regional Victoria and required lecturers and pre-service teachers to travel to rural schools twice for several days. This meant that most students were unable to participate due to other commitments resulting in only 4 students electing to be involved in this project. In addition, the timing of the visits had to suit the schools, and the lecturers, but also be completed within the narrow window in line with the timing constraints for the small research grant.

Breakdown in communication among researchers and schools

One of the researchers was Chief Investigator in a large project focussing on effective communication of the principals /teachers in rural Victorian schools. The project about which this paper is reporting, grew from the larger project. Unfortunately no data from the larger project was made available to the researchers in the small project. This lack of communication contributed to the limitations of the data. Another example of lack of communication occurred between the principals and university staff. Liaising with principals to arrange dates and times proved problematic, with teachers often unaware of some of the expectations of the project.

Conclusion

There are four important points that have been identified through the experience of this research project. Firstly, thorough planning of a rigorous research design based on proven identifiable research should form the foundation irrespective of the size of the research project; secondly, the multiple data sources should be consistent with the research design and be useful to help answer the research questions; thirdly, the research design must be budgeted accurately – with sufficient time and resources to conduct the research; and lastly the researchers must constantly evaluate the trajectory of the research to identify any need to modify or adapt to changing situations.

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