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Identifying some issues in professional learning in early childhood science

- Coral Campbell

Abstract
In a small research project, four case studies were developed around the science education of pre-school centres in Victoria, Australia. A quantitative approach was used as the pre-school teachers were asked for information about their qualifications and those of other staff; science experiences within their early childhood setting and the opportunities they had for science education professional development. As part of the research, educators were questioned about the science they provided and their comfort in teaching science. The interviews revealed that early childhood educators believed that they provided a large number of varied experiences, although often they were unsure of the science content or the science understanding. They felt that this limited their abilities to develop the science activities further. Early childhood educators also indicated that, whilst there was access to some science professional development, more would be welcome. The types of professional development that they felt would be most beneficial were ‘hands-on’ experiences – a ‘quick fix’ approach. This article discusses the findings of the research through a socio-cultural framework, noting some of the issues identified during the discussions with the educators.

Keywords

Introduction
Professional development or professional learning is essential for ensuring that teachers in all sectors of education continue to address the learning needs of their students in a society where change is continuous. Continuing professional learning is a global trend, aimed towards ensuring that teachers are highly skilled and up-to-date (Pickering, Daly & Pachler, 2007). However, effective professional learning is both complex and difficult. 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. While this short term ‘skills and knowledge’ approach can be valuable and efficient in disseminating information and ideas, it has been shown to be quite ineffective in challenging and supporting more fundamental aspects of teaching practice and beliefs practices (Owen, Johnson, Clarke, Lovitt & Morony, 1987; Carrick, 1989; Hoban, 1992). The ineffectiveness of the approach is related to the lack of connection with school priorities or the direct needs and concerns of participants, and the lack of long-term and systematic planning (Campbell, Chittleborough, Hubber & Tytler, 2007). There is thus almost universal agreement amongst education researchers that long-term professional development, sensitive to the
needs of teachers and their contexts, is necessary to support significant teacher development.

Many writers (Hargreaves, 1994; Hall & Hord, 2001) have emphasised that change requires of teachers that they 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 practice strategies that are new to their repertoire, or implement the difficult areas of a curriculum change. Contemporary large-scale reform projects in a number of countries have tended to incorporate these principles (Beeth, Duit, Prenzel, Ostermeier, Tytler & Wickman, 2003).

Other research indicates that professional learning needs to happen in an environment where organisational conditions support teacher improvement and where values of sharing, trust, collaborative inquiry and self-assessment are evident (Campbell, Chittleborough, Hubber & Tytler, Barty & Stacey, 2007). The OECD report (2006) Starting Strong II highlights the very low levels of investment in quality early childhood services in Australia. Australia spends less than any other first-world country on pre-school, and our kindergarten teachers are the worst paid and least trained.

Early Childhood Australia’s CEO, Pam Cahir, recently spoke about the key features of a high-quality early childhood service system – one ‘which meets the needs of children and families now and into the future’. Below is an extract from Pam Cahir’s presentation:

‘Qualifications matter. Staff with responsibility for children should have early childhood qualifications. In fact the more staff in a service who have early childhood qualifications the better. Research shows that there are better social and cognitive outcomes when children’s care and education is in the hands of early childhood specialists – this too can no longer be contested.’

Early childhood education in the state of Victoria (Australia) is now a division within the Department of Education and Early Childhood Development (DEECD) and reforms indicate that professional learning will be a major part of this process: ‘We will improve the quality of early childhood services by emphasising the importance of learning and increasing the qualifications of staff’ (Victorian Government, 2008, pp.16–17). This declaration stems in part from the Commonwealth Government’s plan for early childhood: ‘…improving the quality of early childhood education and care through…support and training of the early childhood workforce’ (Australian Government, 2008, Box 2.2 p.3). Although early childhood educators are not registered under the Victorian Institute of Teaching (VIT), the issue of standards and registration for this sector across Australia has been a discussion point for some time (Elliott, 2005). Elliott (ibid) suggests that registration can ‘…provide a gatekeeping and professional learning function that strengthens professionalism – and quality’. Under current VIT regulations for registration, teachers are required to undertake a minimum of 50 hours of approved professional learning within a five-year period (VIT, 2008). If early childhood educators are to come under such a registration
scheme, it is clear that professional learning content and modes of delivery need to be revamped to provide for the needs of both educators and their organisations.

To be effective, professional learning should meet the needs of the individuals and their organisations. It should draw on the previous understandings of the teachers and should enable teachers to engage in reflection as new ideas are presented to them. Mitchell and Cubey (2005) found that, when professional development was effective, teachers engaged in critical reflection and more readily shifted their views and understandings. The seven principles of highly effective professional learning (Department of Education and Training, 2005) reflect this philosophy. Furthermore, Doll (2008, p.45) suggests that ‘effective staff learning and development needs to address the various needs of educators at various stages in their careers if it’s to lead to the best possible educational outcomes for students’. This theme of personal relevance is also taken up by Yeigh (2008) when suggesting a metacognitive model of professional learning.

Science in early childhood settings

Internationally, there is a large body of evidence that suggests that science is not often ‘taught’ in early childhood settings; however, this is not to indicate that science experiences do not occur, particularly through play (Campbell & Jobling, 2008). Many early childhood educators undertook their training when the idea of ‘teaching’ very young children was not considered the responsibility of Early Childhood (EC) centres. Most early childhood educators would have undertaken little or no training in science other than ‘nature study’ or ‘integrated studies’ into which science was incorporated. Current Early Childhood Bachelors’ degrees offered by universities now include science education in some form – sometimes stand-alone, or linked with another area of learning, or integrated. However, until recently, early childhood centres tended to be staffed by people with a range of degrees or training qualifications and the educational disciplines were not necessarily a part of the course coverage.

In America, Copley and Padron (1999) commented that the development of confidence in the early childhood professional was critical for enhancing science understanding and modelling positive dispositions to science. This is supported by Watters, Diezmann, Grieshaber and Davis (2001) in Australia, who stated that early childhood educators needed better preparation and background knowledge in science. In a study in New Zealand (Garbett, 2003), researchers found that pre-service early childhood teachers’ knowledge and understanding of science was quite poor and, disturbingly, they were unaware of how little they knew. It is a recognised issue throughout the world. The problem of what should be considered professional learning for educators and how best to serve their needs, formed some of the questions in this research.

We recognise that children are trying to make sense of their world through their own play explorations and, if we accept a constructivist approach to learning, we believe that children are building their own understandings from their own experiences. However, children are limited in how far the discovery can aid understanding. Interaction with peers and adults provides additional stimulus to extend understanding further. Biddulph and Osborne (1984) comment that ‘It is the task of
Science education to help children make better sense of their world. In experiencing the science of our world, being a co-investigator with the child (a feature of what is termed Emergent Curriculum by Dockett and Fleer, 2002, p.199), or asking effective questions that encourage further exploration, can provide children with the opportunity to extend their own investigations. For this reason, it is crucial that early childhood educators have a basic understanding of science in the world. Teachers who are attuned may recognise the science in spontaneous events and can make use of these to develop children’s deeper understandings.

The research questions addressed in this paper are:

- Are early childhood educators confident with the science experiences they offer to their children?
- What professional learning issues arise in discussion with early childhood educators about science education?

The research project

A survey was sent to seventy-five Early Childhood centres and kindergartens in Victoria, inviting the Director of each to respond to questions encompassing their qualifications and practices and those of their staff. They were also invited to participate in several informal interviews. Twenty-two responses were received. Four centres were chosen for interviews, one in a regional city, one in a rural location, one from an inner city suburb and one from an outer metropolitan area. In addition, eight centres were randomly chosen to represent a 'typical' selection from the remaining questionnaire respondents. Data from these eight centres (where staff were not interviewed) are also presented.

Survey questionnaire - Early Childhood Education (ECE)

1. How many staff work at your centre?
2. Please list their roles and qualifications (if any): Staff 1, Staff 2, Staff 3, Staff 4
3. Do any of your staff have specialist knowledge?
4. Does your centre have a policy relating to the content that is taught?
5. Is science (examples: floating & sinking, observing animals' behaviour, cooking) actively taught at your ECE centre?
6. If yes, could you explain what approach you take?
7. If science is not regularly undertaken, could you please indicate why not?
8. Have you had the opportunity to undertake any professional development in the area of science education in ECE centres? If so, where and what?
9. If science professional development has not been undertaken, could you please indicate the reason?
10. If you were able to undertake science professional development, what would you like to see offered? (e.g. ‘hands-on’ activities, theory-based, thematic units, workshops)
11. Any other comments you would like to make?
The interview questions at the case study centres were loosely based on the questionnaire questions, but the interview was semi-structured, allowing educators to follow new research pathways as appropriate. Questions relating to professional development featured in the interview. Observational notes were taken during two visits to the centres, but these were not used in this paper on professional learning.

Data
The following tables (1&2) give an indication of the range of qualifications held by staff and the nature of professional learning (professional development) offerings.

Table 1: Case study settings and staff qualifications

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Setting</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Study One</strong></td>
<td>4 year-old group, small community kindergarten, government-supported. Total number of children in the setting=25.</td>
<td>Director: Experienced, 33 years, Bachelor Early Childhood Studies. Assistant: not qualified. Teacher: Diploma of Teaching Early Childhood</td>
</tr>
<tr>
<td><strong>Case Study Two</strong></td>
<td>Regional city, privately sponsored early childhood centre, attached to a large private Prep-12 school. 4 year-old group. Approximately 25 children.</td>
<td>Director: Experienced 25 years, Bachelor of Early Childhood Education. Assistant: Diploma of Children’s Services. Teacher: Bachelor of Early Childhood Education.</td>
</tr>
<tr>
<td><strong>Case Study Three</strong></td>
<td>Regional city, privately sponsored early childhood centre, attached to a large private Prep-12 school. 4 year-old group. Approximately 25 children.</td>
<td>Director: Experienced 25 years, Bachelor of Early Childhood Education. Assistant: Diploma of Children’s Services. Teacher: Bachelor of Early Childhood Education.</td>
</tr>
<tr>
<td><strong>Case Study Four</strong></td>
<td>4 year-old group, outer suburban community kindergarten.</td>
<td>Director: B.Ed (Early Childhood), Diploma of Teaching (Early Childhood). Over 20 years’ experience. Teacher: Diploma of Teaching (Early Childhood). 2 Assistants: not qualified.</td>
</tr>
<tr>
<td><strong>Case Study Four</strong></td>
<td>Suburban, council-run long day care and kindergarten centre with 14 staff, two of whom are involved in the Kindergarten Room.</td>
<td>Assistant Director: Bachelor of Education (Early Childhood). Assistant: Diploma of Children’s Services.</td>
</tr>
</tbody>
</table>
Table 2: Survey responses relating to qualifications

<table>
<thead>
<tr>
<th>Staff Qualifications</th>
<th>Not qualified</th>
<th>Qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diploma (three-year training)</td>
<td>Degree (four-year training)</td>
</tr>
<tr>
<td></td>
<td>19%</td>
<td>26%</td>
</tr>
</tbody>
</table>

In addition, some staff had dual qualifications in music and Auslan (signing for the deaf).

Table three is a compilation of information derived from comments made on the survey questionnaires of eight selected centres:

Table 3: Professional learning indicated from questionnaire respondents

<table>
<thead>
<tr>
<th>Non-interviewed respondents</th>
<th>Type of professional learning already experienced</th>
<th>Type of professional learning wanted/ needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre 1</td>
<td>No science professional learning attended because days have been scheduled when teaching.</td>
<td>How to teach science at the 3- and 4-year old level and how to simplify or extend if needed.</td>
</tr>
<tr>
<td>Centre 2</td>
<td>No, as Director is able to provide leadership in the area.</td>
<td>Yes to ‘hands on’ activities, theory-based, thematic units and workshops.</td>
</tr>
<tr>
<td>Centre 3</td>
<td>No, but commented that it is an area that could be improved in terms of what it offers. What is available has been around for a long time.</td>
<td>‘Hands on’ workshops that involve children and teachers together. Need for new concepts to be introduced. Re-evaluation of what we think children should know in early childhood in relation to science.</td>
</tr>
<tr>
<td>Centre 3</td>
<td>No, but commented that it is an area that could be improved in terms of what it offers. What is available has been around for a long time.</td>
<td>‘Hands on’ workshops that involve children and teachers together. Need for new concepts to be introduced. Re-evaluation of what we think children should know in early childhood in relation to science.</td>
</tr>
<tr>
<td>Centre 4</td>
<td>Science workshops at regional conferences, but not recently.</td>
<td>‘Hands-on’ theory-based; ideas for experiences</td>
</tr>
</tbody>
</table>
Table 4 has been developed from the comments of the educators who were interviewed in the case study centres:

**Table 4:** Types of professional learning programmes that early childhood educators have attended and their stated needs in the case study centres.

| Centre 5 | Science workshops at regional conferences – Sue Elliott (but not recently). | Integrated activities. Workshops. |
| Centre 6 | Kindergarten/early childhood conferences and workshops. | ‘Hands on’ activities, theory-based, thematic units and workshops. |
| Centre 7 | Lady Gowrie Professional and training centre | ‘Hands-on’ activities, workshops and resource books with lots of pictures. |
| Centre 8 | No, even though an important area – other areas such as program implementation have taken priority. Comment that science course within recent graduate diploma was excellent. | ‘Hands-on’ ideas that can be used immediately with children. |

**Expanded comments**

**Case Study One**
The Director of this Centre listed professional development days conducted by her regional association as well as personal research via the Internet, print resources and personal contacts with expertise. The focus for her incorporation of science at the kindergarten was on ‘science activities that can be used in kindergartens with the children – things they can do – simple yet teach them through participation and
discovery’. She described the type of professional learning that she would like as ‘hands on’ activities and workshops with ideas that can be incorporated into the centre’s programs.

**Case Study Two**
The staff commented that they avail themselves of science education through early childhood conferences and workshops. There was no comment about sourcing additional professional learning opportunities, although the Director felt that she would like to see more science professional development offered, as her personal background was in visual arts and she needed support to integrate science. She apologetically admitted to having little or no formal training in science, commenting ‘I don’t have a strong background in science at all. It wasn’t an area of particular study for me either at school or at university.’

**Case Study Three**
The Director of this Centre had attended many professional learning sessions, listing the following as examples:
- Lady Gowrie workshops (each year this organisation runs one-off workshops on a variety of curriculum areas)
- Sue Elliott (Early Childhood Environmental Science Educator)
- Kindergarten Teachers Association of Victoria (KTAV)

She expressed a need to attend professional development about magnets, electricity and ‘tools’, such as ramps, levers, pulleys, etc., stating that ‘I’m a bit wary of teaching and explaining it (the first two) to young children in a way they understand’ (questionnaire).

When asked to comment on the types of professional learning that she would like to see offered, she responded ‘all of these!’ to the list provided (‘hands-on’ activities, theory-based, thematic units, and workshops), adding ‘can never know enough’. This was followed by the comment that ‘science (and maths) are the basis to everything (and boys respond very well!)’.

**Case Study Four**
The teacher interviewed at this Centre described in her questionnaire that ‘science education has been incorporated into different professional in-service/training’. Two examples given were a Lady Gowrie Program Planning for 5s, and a Swinburne University *Just Discover and Improvise*. She described how professional learning in science had not been a ‘professional interest until recently’.

When asked about professional learning for which she saw a need, she commented ‘the more I investigate with my group, the more I would like to increase my knowledge to assist facilitating their learning’.

**Analysis**
The number of staff members without qualifications (Tables 1 & 2), or with minimal qualifications (total 55%), and the current focus at both federal and state government levels, indicate that there is a need for a more co-ordinated and focused approach to
professional learning in science for early childhood educators. If we return to our initial research question, *Are early childhood educators confident with the science experiences they offer to their children?*, the following observations can be made.

Even those staff who are qualified, and that relates specifically to those interviewed, expressed an inadequacy in being able to provide the best possible science experiences for the children. Some commented on a personal lack of knowledge, some on not knowing how to translate the knowledge, whilst others felt that their own knowledge was not an issue if they were able to provide experiences for the children. For this latter group, having a more extensive repertoire of ‘science activities’ was most important. In light of the literature on Emergent Curriculum (Dockett & Fleer, 2002, p.199), in which teachers have to respond to the child’s questions and learning needs ‘on the spot’, it appears that some early childhood educators would not be prepared if their own background knowledge of science is insufficient. Dockett and Fleer (2002, p.198) note the unpredictable nature of emergent curricula and describe the role of adults as ‘one of focused observation and responding to the play that occurs in ways that extend and enhance learning’. This can be quite a challenge when confidence in one’s own conceptual knowledge and understandings is lacking.

Table 3 highlights the professional learning experiences and requirements of the early childhood educators who completed the questionnaire. Most expressed a need for ‘hands-on’ workshops, the desire for practical activities and some need for developing educators’ background knowledge. It is of concern to us as science educators that a few early childhood educators did not see the importance of improving their own understanding. Whilst we can describe what science we see occurring in early childhood centres, it is difficult to communicate what is actually happening. The learning experiences are rich in context and language, although we cannot comment on how the children’s science concepts or skills develop over time through repeated or challenging experiences. It is quite clear that early childhood teachers incorporate science into the experiences of the children; however, some admit to not being able to extend the children due to their own lack of knowledge. Improving the basic science knowledge of the early childhood educators is very important.

The information in Table 4, combined with that in Table 1, indicates that, although the case study centres were representative of city, urban, rural and regional centres, the professional learning requirements of the educators were similar.

In considering the second question, *What professional learning issues arise in discussion with early childhood educators about science education?*, four discrete needs were identified: activities rich in science; being able to translate knowledge into the appropriate level explanation for children; deeper understanding of science content, and being able to integrate science with other interests of the children. There are overlaps in these needs. With greater understanding of science concepts comes the ability to ‘see’ more science in a vast range of children’s experiences and often leads the way to be able to explain concepts in simpler terms. Being more familiar with science enables an early childhood educator to integrate more successfully and to develop a greater range of integrated activities rich in science.
As the data show, current professional learning programmes attended by the early childhood educators tend to be one-off workshops focusing on discrete elements of science. In many cases, this is exactly what the teachers want. However, research (see earlier) indicates that this is not the most effective form of professional learning. Professional learning must be embedded in the particular context and relate to each individual’s previous experiences. Although only half the respondents indicated that the science learning should be theoretically based, again research tells us that, to respond adequately to children’s questions and enquiries, the early childhood educator needs to have a reasonable science understanding her- or himself.

**Recommendations**

How can we meet the professional development needs of teachers, integrating conceptual knowledge with science activities?

The research suggests an alternative model for professional learning, which recognises the unique situation of most pre-school settings. It is difficult for a ‘team’ from any one setting to come together at the same time and it is often difficult for even one person to be released to attend a professional learning workshop. What seems to have worked in other settings, which could be translated into early childhood settings, is for early childhood teachers to develop professional learning networks that support each other. What is needed is a programme of workshops that are child-centred and scaffolded by the teacher educators. Early childhood educators would be able to work in a collaborative environment that encouraged exploration and the discussion of ideas.

The suggestion would be for the early childhood educators to meet initially with a science educator to gain deeper understanding of underlying science. At that time, together, they also devise a number of experiences that can be trialled in their own settings. Over the next few weeks, these experiences are trialled and educators note down their successes, any questions and issues. They return for a group meeting once a month (usually for several hours after work) to revisit their trials and discuss another science ‘topic’. It is important for teachers to be able to access follow-up support, as suggested by Watters *et al* (2000) and commented on in Case Study One, where the educator had access to a science expert. Such support may be provided by the informal networks suggested above; by the organisations providing professional learning programmes, and could include Web 2.0 interactive resources, such as blog or wiki use. An integrated approach could be taken where educators can develop curricula that have a solid theoretical basis, integrating areas such as science, mathematics, literacy and design, creativity and technology in a play base.

The findings of this small-scale study show that a diverse range of professional learning sessions had been attended and that perceived needs were similarly varied with some common themes emerging. The author has used these findings to suggest a way forward to meet the current and future needs of early childhood educators.
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