Stage 3
Interim research and evaluation report 14

QLD, NSW and TAS Curriculum Leader Workshops: October 2007 – February 2008

A research report for the Australian Academy of Science

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Introduction

Primary Connections is a teacher professional learning program supported by exemplary curriculum resources that aims to reform the teaching of science in Australian primary schools. The implementation of any new initiative in primary schools requires the strong support of the principal and strong leadership from leader teachers or coordinators in that learning area. Research with professional learning programs at secondary and primary schools (Goodrum, Hackling & Trotter, 2003; Goodrum, Hackling & Sheffield, 2003; Hackling & Prain, 2005; Lewthwaite, 2006) indicate that the provision of professional learning workshops and exemplary curriculum resources, opportunities for collegial interaction and reflection on practice, support of the principal and strong leadership by leader teachers/coordinators are required for successful implementations. The growth and effectiveness of teacher leaders depends on their personal attributes (e.g., motivation, self-efficacy), microsystem factors such as collegial and external supports, mesosystem factors such as the priority placed on the subject by their school and the schools openness to change, exosystefactors such as parent and community expectations, and macrosystem factors such as state and national curriculum agendas (Bronfenbrenner, 1989; Lewthwaite, 2006).

The implementation of *Primary Connections* is supported at national and jurisdictional levels by support structures that have been established during the development and implementation phases of the *Primary Connections* project. At the national level the partnership between the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) and the Australian Academy of Science has ensured strong leadership and sufficient resources to establish an expert resource development and professional learning support team at the Academy. The provision of exemplary and innovative curriculum resources, professional learning workshops to develop a cadre of professional learning facilitators and workshop resources for the facilitators has ensured that the human and material resources are available nation-wide to implement teacher professional learning programs aimed at reforming the teaching and learning of science in primary schools (Hackling, Peers & Prain, 2007).

At the jurisdiction level, professional learning programs are being implemented within the structures, cultures and processes of the individual jurisdictions with the support of professional learning resources of the jurisdictions in ways that meet the needs and priorities of the jurisdictions and sectors.

The implementation of *Primary Connections* as a teacher professional learning program and as a curriculum resource needs support and leadership within the school. Leadership at school level through the school executive and at the curriculum/learning area level through a science coordinator/curriculum leader is required for effective implementation of the program. In-school curriculum leadership and coordination is needed to complement the support that can be provided by the professional learning facilitators.

Two-day curriculum leader workshops have been negotiated collaboratively between the Academy of Science and jurisdictions. They were conducted locally to support the professional learning of curriculum leaders who will lead and coordinate science programs within their schools. This report outlines the program of professional learning offered at these workshops and reports on an evaluation of the workshops and their impacts on workshop participants.

Method

Workshop Program

Two-day workshops provided participants with an introduction to *Primary Connections* and its main elements: linking science with literacy; the 5Es teaching and learning model, cooperative learning; inquiry approach and investigations; embedded assessment; and, the Indigenous perspective. The workshops also outlined the available curriculum resources and how they are organised and provided time for unit planning and jurisdiction facilitated planning time. An outline of the workshop program is attached as Appendix 1.

Participants

This report is based on data collected at five workshops that were conducted in:

- Cairns – all sectors (October 2007)
- Brisbane – Education Queensland (November 2007)
- Launceston – all sectors (November 2007)
- Sydney – Association of Independent Schools (November 2007)
- Sydney – Department of Education and Training, NSW - North Sydney Region (February 2008)

The workshops were attended by a total of 231 participants. Of these 199 completed an initial questionnaire and 217 completed an end of workshop questionnaire. The data reported here are for the 185 participants who completed both questionnaires at the workshop they attended.

Data Collection and Analysis

A questionnaire based survey method was adopted because questionnaires are effective and economical for gathering information from large numbers of participants and the data gathered are relatively easy to code and analyse. Participants completed an initial questionnaire before the workshop and another at the end of the workshop. The questionnaires included a mix of open response questions, closed objective items and rating scale items. Copies of the questionnaires are attached as Appendices 2 and 3. Coding manuals were developed to guide the coding of data and its entry into spreadsheets that could be downloaded into SPSS for calculation of descriptive statistics. Responses to open-ended questions were coded and grouped into categories and the frequency of responses in each category was recorded. Rating scale items were coded from 5 to 1, i.e., from the most positive to the least positive response.

The initial questionnaire elicited information about the participants' leadership experience, science background, beliefs about primary science and literacy teaching, confidence as a teacher of primary science, beliefs about professional learning and goals for participating in the workshop. The questionnaire also included a new scale developed for the study that assessed participants' self-efficacy as a curriculum leader and a scale that assessed their confidence with facilitating professional learning workshops. The post-workshop questionnaire contained some items from the initial questionnaire so that the impact of the workshop on participants' beliefs about primary science and literacy teaching, confidence as a teacher of primary science, beliefs about professional learning, self-efficacy as a curriculum leader and confidence with facilitating professional learning workshops could be assessed. The final questionnaire also included items about factors likely to influence the uptake of *Primary Connections* at their schools, their effectiveness as curriculum leaders, and how well the workshop had prepared them for the role. At the end of the workshops, each participant was given a sticky dot that could be placed on a correlation chart which had two dimensions: degree to which expectations of the workshop were met; and, confidence in capacity as a curriculum leader. These correlation charts were converted to scatter graphs to represent a measure of satisfaction with the workshop

Results

Demographic Data

A total of 231 participants attended the five curriculum leaders workshops for which data are presented in this report. Of these, 199 completed the initial questionnaire, 217 completed the post workshop questionnaire and 185 completed both questionnaires (Table 1). The data analysed and reported are based only on the participants that completed both questionnaires.

Table 1: Numbers of respondents to curriculum leader workshop questionnaires by workshop location

Workshop location	Initial questionnaire	End workshop questionnaire	Both questionnaires
Cairns (30, 31 October 2007)	35	48	33
Brisbane (6, 7 November 2007)	52	51	51
Sydney 1 (8, 9 November 2007)	14	22	10
Launceston (27, 28 November 2007)	65	62	58
Sydney 2 (18, 19 February 2008)	33	34	33
All workshops	199	217	185

Professional roles and experience

A large majority of participants was female (82%) and almost all (96%) were based in primary schools. Three-quarters of the participants were class teachers and only 11 (6%) were currently (i.e., in 2007) acting as a science coordinator while 14 were members of the school executive (Table 2).

Table 2: Professional role of participants in 2007 Curriculum Leaders workshops (n=185)

Role in 2007	Number
Class teacher	140
Science coordinator	11
Deputy	8
Principal	6
Coordinator of school subsection	6
Teacher librarian	3
Curriculum coordinator	3
Assessment leader/moderation support	3
Literacy coordinator	2
DEO officer	2
Coordinator of other KLA	1

Although only 11 participants were acting as science coordinators in 2007, 46 had acted as science coordinators for periods of time ranging from five years or less to 10 years (Table 3). Half (93 of 185) of the participants had no previous leadership experience and therefore

leading and coordinating the implementation of *Primary Connections* at their schools represented a significant opportunity for professional growth.

Table 3: Participants' responses to the question "How many years have you been in any of the following leadership positions" (n=185)

Years of employment in current role	Number of respondents in this role for given number of years			
	Principal	Deputy principal	Science learning area coordinator	Other learning area coordinator
5 or less	7	6	38	37
6 to 10	3	2	6	11
More than 10	1	0	2	2
93 respondents did not indicate that they had experience with any leadership role				

Only three participants had been *Primary Connections* trial teachers and 35% had previous experience teaching with Primary Investigations and would therefore be familiar with the 5Es model and the cooperative learning strategies embedded in *Primary Connections*.

Qualifications

Almost all of the participants were four-year trained (BEd or degree plus Dip Ed), nine per cent had masters degrees and six per cent had a BSc. About 10% had a science specialisation in their academic qualifications, about another quarter had completed some undergraduate studies of science while about half had no more than Year 12 studies of science and of these 14% had no more than Year 10 studies of science (Table 4). The science background of the participants was quite varied and this has implications for their understanding of the nature of science and their ability to answer teachers' questions about science.

Table 4: Highest level of science content/discipline studies (n=185)

Highest level of science study	Number	Per cent
Year 10	26	14
Year 12	72	39
1-3 undergraduate science units	54	29
Science major	15	8
Postgraduate science	4	2
Not indicated	14	8

Goals for Participating in the Workshop

When asked about their personal goals for participating in the workshop, the most frequent categories of responses (see Table 5) were to learn for themselves to improve their own teaching (63% of participants), to find out about *Primary Connections* (28%), to help other teachers teach science better with *Primary Connections*, how to implement *Primary Connections* across the school (16%) and to learn about linking the teaching of science to literacy (7%).

Table 5: Teachers' responses to the question "What are your personal goals for participating in this workshop?"

Goal	Number of responses	Per cent of respondents with this response (n=177)
Learning for one self, to teach better	111	63
Find out about PC	50	28
Help teachers to teach science better with PC	50	28
How to implement PC across school/system	29	16
To learn about literacy links in science	12	7
Link to current program	7	4
How to link to other KLA's	7	4
To assess better	7	4
To learn leadership/coordinating skills	6	3
How to facilitate PC workshops	4	2
Networking	4	2
Total number of responses	*288*	
Number who did not respond to question	*8*	

Beliefs about Primary Science and Literacy Teaching and Professional Learning
The participants responded to a series of open ended questions about the purpose of science teaching, characteristics of effective science and literacy teaching and beliefs about typical professional learning and what needs to be improved.

Beliefs about science and literacy teaching
Before the workshop the participants believed that the main purpose of teaching primary science was to develop cognitive and affective learning outcomes and scientific literacy (Table 6). The proportion believing that the development of scientific literacy was the main purpose rose from 42% prior to the workshop to 60% after the workshop.

Table 6: Participants' responses to the question "What do you believe is the main purpose of teaching science in the primary years of schooling?" (n=185)

Main purpose	Before workshop		After workshop	
	Number	Per cent of respondents	Number	Per cent of respondents
Cognitive	110	60	104	57
Affective	89	49	75	41
Scientific literacy	76	42	110	60
Total responses	275		291	
Number who did not respond to question	3		2	

The participants believed that the most important characteristics of high quality primary science teaching were: an inquiry-based pedagogy/uses 5Es; hands-on and practical; a teacher who is knowledgeable, skilful, engaging and enthusiastic; and that it should be based on a good and relevant curriculum (Table 7). These beliefs are consistent with the current research literature about effective science teaching and supportive of the *Primary Connections* approach to teaching and learning, however, very few participants mentioned cooperative learning or embedding assessment into teaching and learning. After the workshop, the proportion of participants who believed that the pedagogy should be inquiry oriented increased markedly and this may have been linked to the reduced proportion who mentioned that science should be hands-on. This may reflect the development of a more sophisticated understanding of the role of practical work in supporting inquiry-based learning.

Table 7: Participants' responses to the question "What do you believe are the most important characteristics of high quality primary science teaching?" (n=185)

Characteristic	Before workshop (n= 179)		After workshop (n=184)	
	Number	Per cent of respondents	Number	Per cent of respondents
Pedagogy inquiry based, uses 5Es	85	47	116	63
Hands on, practical	77	43	45	24
Teacher knowledge and skill	60	34	50	27
Teacher engaging and enthusiastic	43	24	57	31
Curriculum good, relevant	38	21	41	22
Resources available	17	9	11	6
Cooperative learning	6	3	10	5
Assessment links to curriculum/pedagogy	6	3	4	2
Other	21	12	39	21
Total number of responses	*353*		*373*	
Number who did not respond to question	*6*		*1*	

The participants reported those aspects of primary science teaching that need to be improved (Table 8). Aspects to be improved included: greater teacher knowledge and confidence to teach science; better access to curriculum and other resources; more inquiry oriented and hands-on pedagogy; increased importance of science in the school curriculum; a whole school approach to teaching the subject and integration with other learning areas. Each of these aspects is addressed by *Primary Connections* providing further corroboration that the project is addressing school and teacher needs and the needs of these teachers who are taking on a leadership role as curriculum leaders.

Table 8: Participants' responses to the question "What aspects of typical primary science teaching need to be improved?" (n=185)

Aspect of teaching to be improved	Number	Per cent of respondents (n=172)
Teacher confidence/knowledge/ability to teach/use resources	58	34
Classroom resources, better availability, access, storage	53	31
Make pedagogy inquiry based	32	19
Do more, raise its importance	32	19
More hands on, practical	26	15
Whole school approach/curriculum, not one offs	26	15
More links to other KLAs, integrated	19	11
Other responses	38	21
None	2	1
Total number of responses	*286*	
No response to question	*13*	

Teachers also identified what they believed were the most important characteristics of high quality literacy teaching (Table 9). Before the workshop the most frequently mentioned characteristics were: that literacy learning should be embedded in context; explicit development of skills; high levels of teacher knowledge and skill; and that it should cater for individual differences. Following the workshop the notion that literacy teaching should be meaningful and purposeful was mentioned far more frequently than before indicating that the participants had recognised that science provides a context and purpose for literacy work making it more meaningful.

Table 9: Participants' responses to the question "What do you believe are the most important characteristics of high quality primary literacy teaching?" (n=185)

Characteristic of literacy teaching	Before workshop (n=173)		After workshop (n=178)	
	Number	Per cent of respondents	Number	Per cent of respondents
In context, embedded in all learning areas	65	38	62	35
Explicit development of skills, learning scaffolded	55	32	59	33
Teacher knowledge and skill	38	22	20	11
Caters for different learning styles/abilities/ages	37	21	15	8
Enthusiasm/engaging/enjoyable	32	18	37	21
A variety of genres covered	32	18	35	20
Based on clear goals, quality framework, overall plan	21	12	12	7
Meaningful, with a purpose	14	8	58	33
Student centred	14	8	10	6
Develops effective communication	13	8	26	15
Supported by staff & current resources	9	5	7	4
Regular assessment/feedback, informs planning for correct level	8	5	9	5
Total number of responses	*340*		*352*	
No response to this question	*12*		*7*	

Beliefs about professional learning

The participants' beliefs about characteristics of high quality teacher professional learning and aspects of typical professional learning that need to be improved were elicited before and after the workshop (Tables 10 & 11). The most frequently cited characteristics of quality professional learning were: relevance of topic; active participation of teachers in the workshop; and a stimulating presentation that models the processes being discussed in the workshop. Following the workshop more people mentioned a stimulating presentation that models what is being taught, credible and well prepared presenters, and good supporting resources. The most frequently mentioned aspects of professional learning that need to be improved included: increased opportunity for ongoing professional learning; increased access/equity of access to professional learning; increased relevance of topics that are tailored to the needs and situations of the schools.

Table 10: Participants' responses to the question "What do you believe are the most important characteristics of high quality teacher professional learning?" (n=185)

Characteristic of high quality professional learning	Before workshop (n=174)		After workshop (n=176)	
	Number	Per cent of respondents	Number	Per cent of respondents
Topic relevant and readily transferable to classrooms	110	63	89	51
Active participation of teachers in workshop, apply in workshop	58	33	64	36
Delivery is stimulating, engaging, and models the process	34	20	50	28
Balanced program (talk, do, listen, network, etc)	18	10	19	11
Develops teacher pedagogy, not one offs	17	10	7	4
Presenters are credible, prepared	16	9	22	13
Good supporting resources/handouts	14	8	22	13
Based on sound pedagogy, best practice	12	7	20	11
Other responses	44	26	62	36
Total number of responses	*323*		*355*	
Number who did not respond to question	*11*		*9*	

Table 11: Participants' responses to the question "What aspects of typical teacher professional learning need to be improved?" (n=185)

Aspect of professional learning to improve	Number of responses	Per cent of respondents with this response (n= 151)
More PD, more often, not one-offs, follow-ups to share experiences of what worked	45	30
Topic relevant and readily transferable to classrooms	44	29
More teachers having access to PD, more equal access, greater access in rural areas	28	19
Fits with schools demands (funded, in school hours, suitable times) and linked to syllabus/program/outcomes	26	17
Active participation of teachers in workshop, apply in workshop	19	13
Other responses	48	33
Total number of responses	*210*	
Number who did not respond to this question	*34*	

Impact of the Workshop

The impact of the workshop on participants' confidence with science teaching, self-efficacy as a curriculum leader and confidence with facilitating professional learning workshops are reported here.

Confidence with teaching science

The participants' confidence with their own science teaching before the workshop was satisfactory with a mean rating over nine aspects of 3.37/5. Following the workshop, the overall mean rating increased significantly ($p < .01$, two-tailed, paired t test) to 4.06/5. It would be expected for those in a curriculum leadership role, being confident with their own science teaching would enhance confidence with supporting colleagues with their science teaching.

Table 12: Mean ratings of confidence with aspects of science teaching (n=182)

Aspect of teaching	Mean rating of confidence (/5)			
	Before workshop (n=182)		After workshop (n=182)	
	Mean	Sd	Mean	Sd
Engaging students' interest in science	3.83	.786	4.26	.543
Managing hands-on group activities in science	3.71	.769	4.24	.573
Managing discussions and interpretation of science observations	3.40	.866	4.09	.637
Explaining science concepts	3.28	.856	4.02	.666
Teaching science processes	3.32	.826	4.00	.660
Developing literacy skills needed for learning science	3.53	.847	4.19	.567
Assessing children's learning in science	3.18	.820	3.93	.670
Using computers and ICTs in science	2.99	1.041	3.76	.810
Using an inquiry model to plan science units of work	3.07	.972	4.08	.685
Mean of individual means of confidence ratings (/5)	**3.37***	**.673**	**4.06***	**.517**

Notes: Confidence was rated on a five-point scale: No confidence = 1; Limited confidence = 2; OK = 3; Confident = 4; and Very confident = 5

* $p < .01$

Self-efficacy and confidence as a curriculum leader

The participants' self-efficacy as a curriculum leader was assessed using an eight-item self-efficacy scale developed for this evaluation. The scale was highly reliable with a Cronbach alpha of 0.898. Participants' ratings of self-efficacy increased on all eight items of the scale and the overall mean increased significantly ($p < .01$, two-tailed, paired t test) from 3.46/5 before the workshop to 3.87 after the workshop (Table 13).

Table 13: Participants' mean ratings for self-efficacy as a curriculum leader (n=156)

Statement	Mean score (/5)			
	Before workshop		After workshop	
	Mean	Sd	Mean	Sd
My well developed understanding of the role of curriculum leader enables me to be an effective leader.	3.45	.894	3.92	.619
My well developed leadership skills make me an effective curriculum leader.	3.53	.861	3.79	.642
My knowledge of effective science teaching practices enables me to answer teachers' science pedagogy questions effectively.	3.29	.950	3.81	.625
I am effective in encouraging teachers to 'tackle' new ideas.	3.61	.800	3.94	.606
I am able to organise engaging tasks for teachers to work on in small groups in my workshops.	3.41	.866	3.92	.611
My deep understanding of the culture of primary schooling enables me to give valuable advice to teachers on matters of primary science pedagogy.	3.34	.795	3.78	.705
My commitment to collegial approaches and regular communication with other curriculum leaders makes me an effective leader.	3.51	.863	3.84	.668
My deep understanding of literacy teaching practice enables me to give valuable advice on integrating literacy education into science education.	3.56	.788	3.97	.647
Mean of individual means (/5) and standard deviations for mean of means on the self-efficacy scale	**3.46***	**.681**	**3.87***	**.487**

Notes: Participants rated their self-efficacy on a five-point scale: 5 = Strongly agree; 4 = Agree; 3 = Undecided; 2 = Disagree; and 1= Strongly disagree.
* $p < .01$

The greatest increases for self-efficacy were for answering teachers' science pedagogy questions (0.52), organising engaging tasks for teachers to work on in small groups in workshops (0.51) and for a well developed understanding of the role of curriculum leader enables me to be an effective leader (0.47).

Total self-efficacy scale scores were calculated for each participant. Participants rated each of the eight items on a five-point scale and the eight ratings were summed to give a total scale score out of a total of 40. Total scale scores are reported in Table 14.

Table 14: Frequency of total scale scores for self-efficacy as a curriculum leader at the beginning and end of the workshop (N=156)

Total self-efficacy scale score	Number with score in this range	
	Before workshop	After workshop
1-5	0	0
6 -10	2	0
11-15	4	0
16-20	3	1
21-25	40	10
26-30	58	59
31-35	39	68
36-40	10	18
Mean self-efficacy scale score for all participants	27.71*	30.92*
S.D.	5.451	3.911

The mean total self-efficacy scale score increased significantly ($p < .01$, two-tailed, paired t test) from 27.7/40 before the workshop to 30.9 after the workshop. Of educational significance was the reduction in the number of participants with low-to-moderate self-efficacy (< 26/40) from 49 before the workshop to 11 after the workshop.

The participants also rated their confidence with facilitating professional learning workshops for their colleagues. The participants rated their confidence with facilitating seven aspects of teacher professional learning on a five-point scale. The mean overall rating of confidence increased significantly ($p < .01$, two-tailed, paired t test) from 3.17/5 before the workshop to 4.08/5 after the workshop (see Table 15).

Table 15: Mean ratings of confidence in facilitating professional learning on the following aspects of primary science and literacy teaching at the beginning and end of the workshop (n=156)

Confidence in facilitating professional learning	Mean score (/5)			
	Before workshop		After workshop	
	Mean	Sd	Mean	Sd
An introduction to *Primary Connections*	2.95	1.069	4.15	.660
Coordinating the science program in a primary school	2.96	1.006	4.08	.642
Assessment of learning in primary science	3.01	.932	3.87	.707
Conducting investigations in primary science	3.34	.955	4.14	.676
Cooperative learning strategies	3.49	.891	4.12	.632
Developing literacies needed for learning science	3.24	.931	4.13	.619
Using an inquiry model to plan primary science units of work	3.19	.921	4.04	.699
Mean of individual means (/5) and standard deviations for mean of means on the confidence scale	**3.17***	.813	**4.08***	.551

Notes: Each confidence item was rated on a five-point scale where: No confidence = 1; Limited confidence = 2; OK = 3; Confident = 4; and, Very confident = 5.
* $p < .01$

The largest increase in mean confidence score was for facilitating a workshop on an introduction to *Primary Connections*.

Factors Influencing the Uptake of *Primary Connections*

The participants were asked about factors likely to influence the uptake of *Primary Connections* by schools in their jurisdiction and sector. The most frequently mentioned factor was the willingness of teachers to be involved, followed by funding for resources, time for professional learning and preparation, curriculum issues within schools, their own skill as a leader and support from administration. All of these factors are jurisdiction or school-based and susceptible to local rather than national influences.

Table 16: Participants' responses to the question "What factors will influence the uptake of *Primary Connections* by schools in your jurisdiction and sector?" (n=185)

Factor	Number of responses	Per cent of respondents with this response
Willingness of teachers to be involved	68	38
Money to provide resources	59	33
Time	42	23
Curriculum issues/other programs	39	22
Skill as a curriculum leader/presenter	33	18
Support from admin for program	32	18
Availability of PD for staff	17	9
Quality package, easy to use in classroom	15	8
Ranking of science/school region priorities	11	6
Other responses	23	13
Total number of responses	*339*	
Number who did not responded to question	*4*	

Factors Influencing Effectiveness as a Curriculum Leader

When asked about factors likely to influence their effectiveness as a curriculum leader the most frequently mentioned factor was preparation time for themselves and time needed from the school community for professional learning and the next most frequently mentioned factors were skill as a leader, willingness of staff to be involved and support from the school's administration (Table 17). The leadership skills of the curriculum leader and support from administration are likely to influence the willingness of other teachers to participate and the provision of time for professional learning. The large majority of the participants were not currently in a formally designated science coordinator/curriculum leader role at their schools (see Table 2) which suggests they may not have a time allocation to perform the role and this may be the reason for their main concern being related to time.

Table 17: Teachers response to the question "What factors will influence how effective you can be as a curriculum leader?" (n=185)

Factors influencing effectiveness	Number of responses	Per cent of respondents with this response
Time (preparing/ for PD)	78	45
Skill as leader/team builder	49	28
Willingness of staff to be involved	47	27
Support from admin	45	26
My own knowledge of science/PC	16	9
Resourcing	12	7
Other responses	33	19
Total number of responses	*280*	
Number who responded to question	*173*	

Only one participant indicated she needed more training which is an indication that the workshop satisfied the needs of the participants.

Participants' Evaluation of the Workshop
Participants rated the workshop in terms of how well it had prepared them for the role of curriculum leader (Table 18) and on a correlation chart (degree to which expectations met – confidence with capacity as a curriculum leader). A sample correlation chart is reported for a Sydney workshop as Figure 1.

Table 18: Participants' rating of how well the workshop had prepared them for the role of curriculum leader (n=179)

Number (per cent) respondents with various ratings				
Very poorly prepared	Poorly prepared	OK	Well prepared	Very well prepared
1(1%)	0 (0%)	33 (18%)	100 (56%)	45 (25%)

A large majority (81%) indicated they had been *Very well prepared* or *Well prepared* for the role of curriculum leader and only one person out of 179 who responded to the question gave a negative rating of how well they had been prepared. The correlation chart indicates a consistently high rating of the extent to which the workshop met expectations and high levels of confidence in capacity as a curriculum leader.

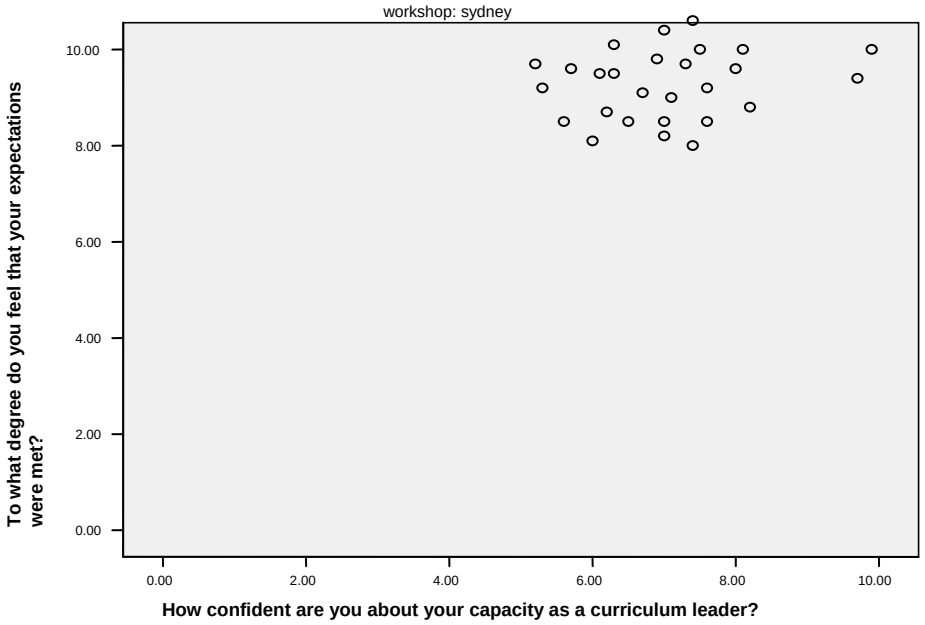

Figure 1: Correlation chart showing participants' evaluation of a Sydney workshop

When prompted to suggest improvements that could be made to the two-day curriculum leader workshop, the most common responses were to make positive comments about the workshop (44% of participants) or to suggest that no changes were needed (23%). There

was no single suggestion for any particular improvement that was mentioned by more than 6% of participants. Some suggestions are reported in Table 19.

Table 19: Participants' responses to the question "What Improvements could be made to the two day workshop?" (n=185)

Improvement suggested	Number of responses	Per cent of respondents with this response (n=154)
Positive comment	68	44
None	35	23
More doing, practical time	10	6
More time on individual units	9	6
More non-structured planning time	6	4
Venue was hot	6	4
More information to schools before the workshop on the curriculum leader role	6	4
Use microphones, hard to hear	4	3
More on leadership	4	3
Have a follow up workshop	4	3
More on fitting in with current program	4	3
Other responses	14	11
Total number of responses	*170*	
Number who did not respond to question	*31*	

Discussion and Conclusions

Data reported here indicate that the workshops were very successful on a number of measures. The sample of five workshops attracted good numbers averaging 46 participants to each workshop. Most were classroom teachers with others being in formally designated leadership positions within schools. About half had leadership experience and for the others leading the implementation of *Primary Connections* in their schools offered a significant opportunity for professional growth. Only 11 of 185 reported that they were currently their school's science coordinator which may indicate that many of the workshop participants were not in a formally designated curriculum leader/science coordinator role and yet would be expected to provide leadership and coordination in science.

About 10% of participants had a science specialisation and almost 30% had some undergraduate studies of science which would provide good background for the role of science curriculum leader, however, a significant number has no more than Year 12 science studies and 14% had not studied science beyond Year 10.

The participants' goals for attending the workshop were to improve their own science teaching (63%), find out about *Primary Connections* (28%), to help their colleagues improve their science teaching (28%) and to support the implementation of *Primary Connections* at their school (16%). These goals were consistent with those of the workshops which indicate that the workshops would be suitable to meet the teachers' needs and it was pleasing to see that their goals went beyond the informational and personal stages of concern from the Concerns-Based Adoption Model of Hall and Hord (1987) to those related to supporting the professional learning of colleagues.

Prior to the workshop participants believed that the purpose of primary science teaching is to achieve cognitive and affective learning outcomes and to develop scientific literacy. Following the workshop the most common response was to develop scientific literacy. Beliefs about characteristics of quality primary science teaching were also affected by the workshop with a shift from beliefs about hands-on teaching towards a more sophisticated view of inquiry-based pedagogy. These are important and positive outcomes as curriculum leaders need a clear and appropriate understanding of the purpose and characteristics of quality primary science teaching if they are to provide leadership of the learning area in their schools.

There was a close alignment between the participants' beliefs about aspects of typical primary science teaching that need to be improved and the resources, teaching and learning model and professional learning provided by *Primary Connections* (Table 8) which provides further corroboration of the good match between the program and the needs of schools. Beliefs about literacy teaching also matched the *Primary Connections* approach to explicit development of literacies with science being used to provide meaningful contexts and purpose for literacy work. Following the workshop there was a shift in beliefs towards the need for literacy work to be meaningful and purposeful. Strong alignments between the teachers' espoused beliefs about science and literacy teaching and the *Primary Connections* approach suggests that the teachers' beliefs will not act as a barrier to adoption of the program or of the teaching and learning model.

The workshop had large, positive and statistically significant impacts on the participants' confidence with science teaching, self-efficacy as a curriculum leader and confidence with facilitating professional learning which are important indicators of the success of the workshops and the potential of the participants to be effective as curriculum leaders. There was a particularly large increase in confidence with using an inquiry model to plan science units of work (from 3.07 to 4.08/5) indicating that the session on unit planning had been particularly successful and implying that these leaders may be confident in not only using

the *Primary Connections* model for writing new units but also adapting *Primary Connections* units to local contexts. The number of participants with low to modest self-efficacy as a curriculum leader was reduced from 49 to 11 after the workshop which provides another indicator of the workshop empowering participants to lead and coordinate science at their schools. Following the workshop, participants had greatest confidence with facilitating professional learning related to an introduction to *Primary Connections*, conducting investigations and developing literacies for science which are schools main needs for professional learning.

When asked about the factors likely to influence the uptake of *Primary Connections* at their schools and to influence their effectiveness as curriculum leaders they identified personal, school and jurisdictional factors. The most frequently mentioned potential barriers to implementation were the willingness of teachers to be involved, resources, time for professional learning and broader school curriculum issues; all issues for which a curriculum leader would need the strong support of school administration and the making of science a priority within the school. The most frequently mentioned factor likely to limit their own effectiveness as a curriculum leader was time for preparation and to facilitate professional learning. Given that most of the participants were not in formally designated science coordinator/curriculum leader positions it is likely that they may not have a time allocation for the role.

The participants' evaluations of the workshops were extremely positive with a large majority indicating that they had been *Very well* or *Well prepared* for the role and rather than making suggestions for improvements to the workshop had given praise. The correlation charts gave further corroboration of the positive evaluations.

In conclusion, it can be confidently stated that the curriculum leader workshops were very successful in meeting the participants' needs and had positive impacts on their beliefs, confidence and self-efficacy and empowered them to be effective curriculum leaders. To be effective leaders and coordinators of the science learning area they will need the strong support of their principals, particularly in ensuring they will have time provided for the role. The role of science curriculum leader provides a real opportunity for professional growth for these participants and provides a large pool of teachers who have significant knowledge and skills and could be provided with further professional learning to enable them to act as professional learning facilitators.

The collaborative approach taken by DEEWR, the Academy of Science and jurisdictions has enabled large cohorts of teachers to be trained as professional learning facilitators and curriculum leaders and has provided Australia with a substantially increased capacity to meet the nation's needs for a scientifically literate community.

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Appendix 1: Curriculum Leaders Two-day Workshop Program

Day 1	
5Es PHASE	**FOCUS**
INTRO (30mins) 9.00-9.30	• Purpose • Participant expectations
ENGAGE **(50mins)** 9.30-10.20	What is *Primary Connections?* "The Bridge" Broad purpose of *Primary Connections*- Scientific literacy
EXPLORE (220mins total) 10.20-10.45	Cooperative learning (25mins)
MORNING TEA (30mins) 10.45-11.15	
11.15-12.15 12.15-1.00	5Es (60mins) Investigating (45mins)
LUNCH(30mins) 1.00-1.30	Distribute sets of curriculum units (7 units)
EXPLORE 1.30-2.15 2.15-2.30 2.30-3.00	 Linking science with literacy (45mins) Intro to curriculum units(15mins) Assessment for and of learning (30mins)
CONCLUSION 3.00-3.30	Summary Reflections Questions
Day 2	
EXPLAIN **(90mins)** 9.00-10.30	Curriculum unit plan and organisation (30mins) Essence of curriculum units (30mins) Indigenous perspective (30mins)
MORNING TEA (30mins) 10.30-11.00	
ELABORATE (120mins total) 11.00-12.00 12.00-1.00	 Unit planning (60mins) Being a curriculum leader (60mins) [OZ model of leadership]
LUNCH (30mins) 1.00-1.30	
IMPLEMENTING *PRIMARY CONNECTIONS* (60mins) 1.30-2.30	Jurisdiction planning time
EVALUATE (30mins) 2.30-3.00	Reflection: Dialogue for meaning
CONCLUSION **(30mins)** 3.00-3.30	Summary Evaluation Correlation Chart Post Questionnaire

Appendix 2: Initial Questionnaire

Australian Academy of Science: *Primary Connections*
Curriculum Leader Initial Questionnaire

Dear Colleague
As a curriculum leader you have a key role in framing and supporting the development of learning and teaching practice within your school. You have been invited to participate in the two-day leadership program focussing on Primary Connections. Two questionnaires will be used to gauge the effectiveness of this training program. You are requested to complete this one prior to the workshop and the other one after the workshop.
Data from these surveys will be aggregated and summarised so that it will not be possible to identify any respondent in any reports of this research. Data will be used for research purposes only i.e., to inform the improvement of the workshops and to evaluate their effectiveness. We request your name and workplace details for follow-up purposes only.

Please answer this questionnaire honestly and frankly. Respond in the way that it is, rather than portraying things as you would like them to be seen.

Professor Mark W Hackling
Edith Cowan University

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Your background

Your name: _____ Sex: Male / Female

Name of workplace for 2007: _____

Your professional role for 2007: _____

Please indicate how many years you have been in any of the following leadership posi

Principal	___	years
Deputy principal	___	years
Science learning area coordinator	___	years
Other learning area coordinator	___	years

Were you a *Primary Connections* trial teacher? Yes / No

Have you previously taught science using Primary Investigations? Yes / No
Please list all of your completed post-secondary qualifications e.g. BEd / BA, Dip Ed / MEd

_____

What is your highest level of science content/discipline studies (not science education)? *Please tick one box*.

Year 10	Year 12	1 –3 undergraduate science units	Undergraduate science major	Postgraduate science e.g. MSc

About primary science teaching

What do you believe is the main purpose of teaching science in the primary years of schooling?

_____

_____

_____

What do you believe are the most important characteristics of high quality primary science teaching?

_____

_____

_____

_____

In your opinion, what aspects of typical primary science teaching need to be improved?

_____

_____

_____

What do you think are the most important characteristics of quality literacy teaching?

_____

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Confidence as a teacher of primary science

Please rate your confidence with the following aspects of science teaching
VC = Very confident; C = Confident;
LC = Limited confidence; NC = No confidence

Item	Aspect	VC	C	OK	LC	NC
1	Engaging students' interest in science					
2	Managing hands-on group activities in science					
3	Managing discussions and interpretation of science observations					
4	Explaining science concepts					
5	Teaching science processes					
6	Developing literacy skills needed for learning science					
7	Assessing children's learning in science					
8	Using computers and ICTs in science					
9	Using an inquiry model to plan science units of work					

About professional learning

What do you believe are the most important characteristics of high quality teacher professional learning?

_____

_____

_____

_____

What aspects of professional learning for primary teachers need to be improved?

_____

_____

_____

Your goals for participating in this two-day workshop for curriculum leaders

What are your personal goals for participating in this workshop?

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Your self-efficacy and confidence as a curriculum leader

Please indicate the degree to which you agree or disagree with each statement below by ticking the appropriate box to the right of each statement:

SA = Strongly Agree; A = Agree; UN = undecided; D = Disagree; SD = Strongly Disagree

Item	Statement	SA	A	UN	D	SD
1	My well developed understanding of the role of curriculum leader enables me to be an effective leader.					
2	My well developed leadership skills make me an effective curriculum leader.					
3	My knowledge of effective science teaching practices enables me to answer teachers' science pedagogy questions effectively.					
4	I am effective in encouraging teachers to 'tackle' new ideas.					
5	I am able to organise engaging tasks for teachers to work on in small groups in my workshops.					
6	My deep understanding of the culture of primary schooling enables me to give valuable advice to teachers on matters of primary science pedagogy.					
7	My commitment to collegial approaches and regular communication with other curriculum leaders makes me an effective leader.					
8	My deep understanding of literacy teaching practice enables me to give valuable advice on integrating literacy education into science education.					

In your role as a curriculum leader please rate your confidence with facilitating professiona learning workshops on the following aspects of primary science and literacy teaching

VC = Very confident; C = Confident; LC = Limited confidence; NC = No confidence

Item	Aspect	VC	C	OK	LC	NC
1	An introduction to *Primary Connections*					
2	Integrating *Primary Connections* into the science program in a primary school.					
3	Assessment of learning in primary science					
4	Conducting investigations in primary science					
5	Cooperative learning strategies					
6	Developing literacies needed for learning science					
7	Using an inquiry model to plan primary science units of work					

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Thank you for responding to this questionnaire

Appendix 3: Final questionnaire

Australian Academy of Science: *Primary Connections*
Curriculum Leader Post Workshop Questionnaire

Dear Colleague
As a curriculum leader you have a key role in framing and supporting the development of learning and teaching practice within your school. You have been invited to participate in the two-day leadership program focussing on Primary Connections. Would you please complete this post workshop questionnaire.

Data from these surveys will be aggregated and summarised so that it will not be possible to identify any respondent in any reports of this research. Data will be used for research purposes only i.e., to inform the improvement of the workshops and to evaluate their effectiveness. We request your name and workplace details for follow-up purposes only.

Please answer this questionnaire honestly and frankly. Respond in the way that it is, rather than portraying things as you would like them to be seen.

Professor Mark W Hackling
Edith Cowan University

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Your background

Your name: _____

About primary science teaching

What do you believe is the main purpose of teaching science in the primary years of schooling?

_____

_____

_____

What do you believe are the most important characteristics of high quality primary scienc teaching?

_____

_____

What do you think are the most important characteristics of quality literacy teaching?

Confidence as a teacher of primary science

Please rate your confidence with the following aspects of science teaching
VC = Very confident; C = Confident;
LC = Limited confidence; NC = No confidence

Item	Aspect	VC	C	OK	LC	NC
1	Engaging students' interest in science					
2	Managing hands-on group activities in science					
3	Managing discussions and interpretation of science observations					
4	Explaining science concepts					
5	Teaching science processes					
6	Developing literacy skills needed for learning science					
7	Assessing children's learning in science					
8	Using computers and ICTs in science					
9	Using an inquiry model to plan science units of work					

About professional learning

What do you believe are the most important characteristics of high quality teacher professional learning?

Your self-efficacy and confidence as a curriculum leader

Please indicate the degree to which you agree or disagree with each statement below by ticking the appropriate box to the right of each statement:

SA = Strongly Agree; A = Agree; UN = undecided; D = Disagree; SD = Strongly Disagree

Item	Statement	SA	A	UN	D	SD
1	My well developed understanding of the role of curriculum leader enables me to be an effective leader.					
2	My well developed leadership skills make me an effective curriculum leader.					
3	My knowledge of effective science teaching practices enables me to answer teachers' science pedagogy questions effectively.					
4	I am effective in encouraging teachers to 'tackle' new ideas.					
5	I am able to organise engaging tasks for teachers to work on in small groups in my workshops.					
6	My deep understanding of the culture of primary schooling enables me to give valuable advice to teachers on matters of primary science pedagogy.					
7	My commitment to collegial approaches and regular communication with other curriculum leaders makes me an effective leader.					
8	My deep understanding of literacy teaching practice enables me to give valuable advice on integrating literacy education into science education.					

In your role as a curriculum leader please rate your confidence with facilitating professiona learning workshops on the following aspects of primary science and literacy teaching

VC = Very confident; C = Confident; LC = Limited confidence; NC = No confidence

Item	Aspect	VC	C	OK	LC	NC
1	An introduction to *Primary Connections*					
2	Integrating *Primary Connections* into the science program in a primary school.					
3	Assessment of learning in primary science					
4	Conducting investigations in primary science					
5	Cooperative learning strategies					
6	Developing literacies needed for learning science					
7	Using an inquiry model to plan primary science units of work					

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Primary science in your school

What factors will influence the uptake of *Primary Connections* in your school?

_____

_____

_____

_____

What factors will influence how effective you can be as a Curriculum Leader in your schoo

_____

_____

_____

_____

Preparation for the role of Curriculum Leader?

How well has this workshop prepared you for the role of curriculum leader?
Please tick one box.

Very poorly prepared	Poorly prepared	OK	Well prepared	Very well prepared

What improvements could be made to the two-day workshop for curriculum leaders?

_____

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Thank you for responding to this questionnaire

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