PrimaryConnections®
Linking science with literacy

Stage 3
Interim research and evaluation report 9

University science educators' workshop:
February 2007

A research report for the Australian Academy of
Science

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**Department of Education,
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Introduction

A number of national and international reports have highlighted how important primary science is for developing interest in science and commencing the learning journey towards scientific literacy (ATSE, 2002; Goodrum, Hackling & Rennie, 2001; Hackling, 2006). Other reports have indicated that, although science should be a priority in primary schools it has low status, is poorly resourced and many primary teachers lack science teaching pedagogical content knowledge and hence have low confidence and self-efficacy for science teaching (Angus et al., 2004; Hackling & Prain, 2005). Research indicates that if teachers' practice is to be reformed they need the support of ongoing professional learning and curriculum resources which help teachers build their pedagogical content knowledge, bring about changes in their beliefs about the purpose of science teaching and about effective practice, and increase their confidence (Goodrum, Hackling & Trotter, 2003; Hackling & Prain, 2005; Sheffield, 2004).

Australia has a history of reasonably successful initiatives that have been taken to reform the teaching of science at the secondary and primary levels (e.g. Australian Science Education project [ASEP], Web of Life, Primary Investigations and *Primary Connections*), and the most successful of these have combined curriculum resources with professional learning. Reform agendas are often promoted through professional learning programmes for in-service teachers (e.g. Queensland's Spotlight on Science, Victoria's Science in Schools and WA's Primary Science Project) because it is the experienced teachers in schools that have most influence over school curriculum and culture (Anderson & Mitchener, 1994). Fresh graduate teachers are mentored by experienced teachers and have an influence over their practice, often shaping their practice so that it more closely conforms to that of the school rather than that promoted in their teacher education programme. As Loughran (2007) agues, new teachers need to be supported in professionalisation rather than being socialised into traditional pedagogical practices.

Primary Connections is unique in that it has taken a highly strategic and innovative approach to teacher professional learning, combining initiatives with both in-service and pre-service teacher professional learning. An ideal scenario would see new teachers developing innovative and effective science teaching practices in their pre-service education, going into schools and being mentored by experienced teachers who share the same beliefs and practices and teaching using the same curriculum resource, *Primary Connections*. The *Primary Connections* project is developing primary science curriculum resources, training professional learning facilitators to deliver professional learning workshops to in-service teachers throughout Australia, and providing professional learning for science educators who teach science education units to pre-service primary school teachers in all Australian universities that have a teacher education programme. This report outlines the findings from an evaluation of a workshop for university science educators conducted in February 2007.

Purpose

The purpose of the workshop was to inform university science educators about the *Primary Connections* programme, its teaching and learning model, curriculum resources, professional learning model and resources, and to support them implement elements of *Primary Connections* in primary science units in teacher education courses. A copy of the workshop programme is attached as Appendix 1.

The purpose of this study was to elicit from the university science educators information about: their beliefs about teacher professional learning, experiences of the workshop and feedback about the workshop and the professional learning resources, and any further support needs.

Method

A questionnaire based survey method was adopted to gather information from the science educators at the end of the workshop. Questionnaires are effective and economical for gathering information from large numbers of participants and the data gathered are relatively easy to code and analyse.

The questionnaire included a mix of open response questions and closed objective items. A copy of the questionnaire is attached as Appendix 2.

Sample
Sixty-four science educators drawn from all 36 Australian universities that offer a teacher education programme attended the workshop. Of these 64, 56 completed the end of workshop evaluation questionnaire.

Results

Data reported are based on the 56 complete questionnaires that were returned. In most cases, categories of responses from open response questions have not been condensed, so the full range of responses can be seen. Data are reported for the science educators' beliefs about professional learning, self-efficacy and confidence as professional learning facilitators, achievement of workshop aims and rating of how well they have been prepared by the workshop for facilitating *Primary Connections* workshops, feedback on the workshop and resources, and needs for further support.

Beliefs about high quality teacher professional learning
The characteristic of quality teacher professional learning most frequently cited by the science educators (61%) was relevance of the topic to the teachers' classroom needs. They also cited a cluster of characteristics related to the facilitator and the pedagogy of facilitation, these included: the expertise of the facilitator (experience, knowledge, preparation and credibility, 34%); pedagogy that is stimulating and engaging (29%), practical, interactive and applied (29%), involves dialogue, collaboration and sharing between participants (25%), reflection on learning (14%), based on sound theory and research (21%), models the practice being taught (11%) and focuses on essential information (7%). They also indicated that quality professional learning needs to be ongoing (18%), well resourced (13%) and have clear outcomes (5%).

Table1: Science educators' responses to the question "What do you believe are the most important characteristics of high quality teacher professional learning?" (n=56)

Characteristic	Number of responses	Per cent of respondents with this response
Topic relevant to teachers' needs and the classroom	34	61
Facilitator is credible, prepared, experienced, has knowledge of participants	19	34
Delivery is stimulating, engaging	16	29
Interactive, practical, applied in workshop	16	29
Collaboration, sharing, dialogue between all	14	25
Based on sound pedagogy, theory, current research	12	21
Ongoing support provided	10	18
Reflection on learning (in workshop)	8	14
Good resources, support materials	7	13
Models what you want	6	11
Focus on essential info/not too much detail	4	7
Clear outcomes	3	5
Fits with schools demands (funded, in school hours)	2	4
Total number of responses	**150**	

The University science educators' beliefs about professional learning were similar to those of the professional learning facilitators (PLFs) that attended the January 2007 workshop (Hackling, 2007). A slightly higher percentage of the science educators cited credibility of the facilitator, collaboration and sharing, theoretically sound pedagogy and reflection than the PLFs.

Self-efficacy and confidence as a professional learning facilitator
The science educators' beliefs' about their effectiveness with aspects of teacher professional learning facilitation were elicited using a nine-item scale on which the educators rated their effectiveness on a five-point scale. These data are reported in Table 2.

Table 2: Science educators' ratings of self-efficacy as professional learning facilitators. (n=56)

Aspect of self-efficacy as professional facilitator	Per cent with this response					Mean and standard deviation	
	SA	A	UN	D	SD	mean	s.d.
I am effective in eliciting teachers' prior knowledge and beliefs and adjusting the professional learning workshop to meet the needs of the teachers	41	54	5	0	0	4.36	.586
My science content knowledge enables me to answer teachers' science questions effectively	52	39	7	2	0	4.41	.708
My knowledge of effective science teaching practices enables me to answer teachers' science pedagogy questions effectively	68	30	2	0	0	4.66	.514
I am quite comfortable with having my professional learning workshops evaluated	63	34	2	2	0	4.57	.628
I am able to pose engaging tasks for teachers to work on in small groups in my workshops	55	36	7	2	0	4.45	.711
My deep understanding of the culture of primary schooling enables me to give valuable advice to teachers on matters of primary science pedagogy	41	38	14	7	0	4.13	.916
My deep understanding of the culture of early childhood education enables me to give valuable advice to ECE teachers about science pedagogy	16	34	21	25	4	3.34	1.133
My deep understanding of literacy teaching practice enables me to give valuable advice on integrating literacy education into science education	23	52	13	13	0	3.86	.923
I am able to choose and apply effective facilitation tools and techniques to enhance the learning of teachers in workshops	50	45	5	0	0	4.45	.601

Note. 5= SA = strongly agree, 4=A = agree, 3=UN = undecided, 2=D = disagree, 1=SD = strongly disagree

Mean item scores ranged from a high of 4.66/5 to a low of 3.34/5. The highest mean self-efficacy scores were for items relating to answering teachers' questions about science pedagogy, having their workshops evaluated, posing teachers engaging tasks and using effective facilitation tools and techniques. Lower scores were recorded for aspects requiring knowledge of early childhood teaching culture and literacy teaching practice.

Total scores for the self-efficacy scale were calculated by aggregating item scores (1-5) over the nine items giving a maximum self-efficacy scale score of 45. The science educators' scores are summarised in Table 3.

Table 3: Frequency of science educators' scores for self-efficacy as professional learning facilitators at the end of February 2007 workshop (n=56)

Self-efficacy scale score	number	Per cent
0-25	0	0
26-30	5	9
31-35	6	11
36-40	27	48
41-45	18	32
Mean self efficacy score for all facilitators	38.21	
S.D.	4.276	

Note. Self-efficacy score = sum of nine self-efficacy scores for each participant, (/45), with the most positive response given the value of 5 and the least positive the value of 1 on a five-point agreement scale

Eighty per cent of the science educators had high self-efficacy score that were greater than 35/45 and none had a score lower than 25.

The self-efficacy of the science educators was compared with that of the 2006 cohort of professional learning facilitators. Table 4, compares the science educators' mean item scores after their two-day workshop, with the PLFs mean scores after their end of term 3 workshop following five days of familiarisation with *Primary Connections* and training in facilitation. Both groups responded to eight item and the science educators responded to a new ninth item. On the eight common items, the science educators had two mean scores less than four while the PLFs had only one score less than four. Both groups were less efficacious on the item relating to early childhood education and the science educators were less efficacious on the item related to literacy teaching.

Table 4: A comparison of self-efficacy mean scores for university science educators in February 07 and professional learning facilitators at the end of term 3 in 2006.

Aspect of self-efficacy as professional facilitator	Sci eds	PLFs end term 3 06
I am effective in eliciting teachers' prior knowledge and beliefs and adjusting the professional learning workshop to meet the needs of the teachers	4.36	4.4
My science content knowledge enables me to answer teachers' science questions effectively	4.41	4.3
My knowledge of effective science teaching practices enables me to answer teachers' science pedagogy questions effectively	4.66	4.4
I am quite comfortable with having my professional learning workshops evaluated	4.57	4.6
I am able to pose engaging tasks for teachers to work on in small groups in my workshops	4.45	4.4
My deep understanding of the culture of primary schooling enables me to give valuable advice to teachers on matters of primary science pedagogy	4.13	4.4
My deep understanding of the culture of early childhood education enables me to give valuable advice to ECE teachers about science pedagogy	3.34	3.8
My deep understanding of literacy teaching practice enables me to give valuable advice on integrating literacy education into science education	3.86	4.4
I am able to choose and apply effective facilitation tools and techniques to enhance the learning of teachers in workshops	4.45	

Note. The higher mean is shaded. The science educators' confidence with facilitating professional learning workshops related to various aspects of *Primary Connections* was elicited by asking them to rate their confidence against seven items on a five-point confidence scale which ranged from very confident no confidence. These data are reported in Table 5.

Table 5: Science educators' confidence with facilitating professional learning workshops. (n=56)

Aspect of self-confidence as professional facilitator	Per cent with this response					Mean and standard deviation	
	VC	C	OK	LC	NC	Mean	s.d.
Introducing *Primary Connections* and its five underpinning principles	48	48	2	2	0	4.43	.628
Linking science with literacy	36	50	14	0	0	4.21	.680
Understanding and applying the 5Es teaching and learning model in primary science	68	30	2	0	0	4.66	.514
Conducting investigations in primary science	75	23	0	2	0	4.71	.563
Using co-operative learning strategies	68	27	5	0	0	4.62	.590
Using embedded assessment processes and effective questioning techniques	55	41	4	0	0	4.52	.572
Co-ordinating the science programme in a primary school	33	42	22	4	0	4.04	.838

Mean confidence scores for all aspects of *Primary Connections* were very high and ranged from 4.04/5 to 4.71/5. Mean confidence scores for the science educators were compared with the PLFs mean confidence scores. Mean scores for items for both groups were all greater than 4/5 (Table 6).

Table 6: A comparison of university science educators and professional learning facilitators' mean scores for confidence with facilitating workshops.

Aspect of self-confidence as professional facilitator	Mean scores	
	Sci eds	PLFs end term 3 06
Introducing *Primary Connections* and its five underpinning principles	4.43	4.6
Linking science with literacy	4.21	4.4*
Understanding and applying the 5Es teaching and learning model in primary science	4.66	4.5*
Conducting investigations in primary science	4.71	4.5
Using co-operative learning strategies	4.62	4.5
Using embedded assessment processes and effective questioning techniques	4.52	4.4*
Co-ordinating the science programme in a primary school	4.04	4.5

Note: * These statements were slightly different in the PLF 06 questionnaire

Achievement of workshop aims

The science educators were asked to what extent the workshop aims had been achieved for them. They rated aim achievement on a five-point scale ranging from a large extent to a limited extent (Table 7). Responses were generally positive with less than five per cent of responses in the two lowest categories for all aims except the one regarding familiarity with the roles of School Co-ordinator, Professional Learning Facilitator and Jurisdiction Co-ordinator, and the support for professional learning available in each jurisdiction, which in hindsight was an unrealistic aim as some aspects were not addressed in the workshop.

Table 7: Science educators' responses to the question "To what extent have the aims of the workshop been achieved for you?" (n=56)

Workshop aim	Per cent of respondents with this response				
	To a large extent		OK		To a limited extent
Understanding of the theoretical underpinnings of the programme and research findings regarding the impact of the programme on teachers, students and schools	61	29	7	4	0
Understanding of the *Primary Connections* teaching and learning model and the professional learning model	64	25	9	2	0
Understanding of the pedagogical approaches used to support the development of literacies of science and investigation skills, and how assessment is embedded in the teaching and learning programme	48	38	13	2	0
Familiarity with the curriculum and professional learning resources developed by the programme	48	32	18	2	0
Familiarity with the roles of School Co-ordinator, Professional Learning Facilitator and Jurisdiction Co-ordinator, and the support for professional learning available in each jurisdiction	16	32	29	11	13
Familiarity with examples of professional learning sessions for in-service teachers	30	41	27	0	2
Awareness of opportunities to use *Primary Connections* resources to exemplify aspects of primary science teaching in pre-service science education units	48	36	13	2	2

A large majority of the science educators believed they were very well prepared or well prepared for facilitating *Primary Connections* professional learning workshops for both in-service (84%) and pre-service teachers (89%) which is an important indicator of the success of the workshop (Tables 8 and 9).

Table 8: Science educators' responses to the question "How well prepared do you feel for facilitating *Primary Connections* professional learning workshops for in-service teachers?" (n=56)

Per cent of respondents				
Very well prepared	Well prepared	OK	Poorly prepared	Very poorly prepared
21.4	62.5	14.3	1.8	0

Note. Two participants did not answer this question

Table 9: Science educators' responses to the question "How well prepared do you feel for incorporating elements of *Primary Connections* into your pre-service teacher education programme?" (n=56)

Per cent of respondents				
Very well prepared	Well prepared	OK	Poorly prepared	Very poorly prepared
44.6	44.6	10.7	0	0

Feedback on the workshop and needs for further support
Aspects of the workshop that the science educators found particularly helpful were the opportunity for networking and sessions that outlined the theoretical rationale for the programme and the research findings. A wide range of other aspects are reported in Table 10.

Table 10: Science educators' responses to the question "What aspects of this two-day workshop did you find particularly helpful?" (n=56)

Helpful aspects	Number of responses	Per cent of respondents with this response
Networking	18	32
Research sessions	9	16
Theoretical rationale/overview session	9	16
Resources package	8	14
Practical applications	7	13
Good balance, structure	7	13
Small group workshops	7	13
Literacy workshop	6	11
Knowledgeable presenters	5	9
Time to reflect/discuss	4	7
Investigating session	3	5
New strategies	3	5
Lots of things	2	4
The three shared sessions	2	4
None	1	2
Videos	1	2
5Es session	1	2
DEST session	1	2
Total responses	**94**	

When asked what improvements could be made, only two aspects were suggested by more than 10% of respondents; these were that the workshop was too rushed and could be longer or attempt less, and more input from trial teachers. Other suggestions are reported in Table 11.

Table 11: Science educators' response to the question "What improvements could be made to the workshop?" (n=56)

Suggested improvements	Number of responses	Per cent of respondents with this response
Too rushed/make longer/do less	10	18
More input/discussion with PC trial teachers	8	14
More discussion between attendees	4	7
More on indigenous focus	4	7
Do or model some activities	3	5
More/less focus on research	3	5
Recognise prior knowledge	3	5
Provide background reading before workshop	2	4
More time preparing modules to present at workshops	2	4
More reflection time	2	4
Improve literacy sessions	3	6
Give us handouts of powerpoints	2	4
Link uni educators role more to PC PL model	2	4
Treat us as tertiary educators	2	4
Sharing curriculum session was weak	1	2
More on assessment	1	2
Faster pace	1	2
Negative comment	10	18
Total responses	**63**	

With regards to the science educators' needs for further support, four types were mentioned by more than 10% of respondents; these were: regular updates of resources; contact with other participants; a workshop set of *Primary Connections* units; and, a follow-up workshop. Eighteen-percent indicated they needed no further support.

Table 12: Science educators' response to the question "What further support will you need for your role as a *Primary Connections* professional learning facilitator?" (n=56)

Support needed	Number of responses	Per cent of respondents with this response
None	10	18
Regular updates of resources	12	21
Contact with other facilitators	10	18
Provide a workshop set of PC books	10	18
Follow up workshop	7	13
Have a buddy, mentor	3	5
Academy/PC team support (by email)	2	4
A practicing PC teacher with me / observe trial teacher	2	4
Electronic access to resources for uni students	2	4
Money	1	2
To teach PC myself first	1	2
More time to prepare	1	2
Access to copyright materials	1	2
I am not a facilitator	1	2
Need a timeframe for delivery in schools	1	2
Updates of research and evaluation	1	2
Total responses	**65**	

The science educators' initial impressions of the professional learning resources, which were prepared for in-service teacher professional learning rather than for the pre-service teachers they teach, were very positive. The most common responses were that they were excellent, or good, were detailed and had a good structure, and were supported by research (Table 13).

Table 13: Science educators' responses to the question "What are your initial impressions of the draft *Primary Connections* professional learning resources, which were developed for use by facilitators of workshops for in-service teachers?" (n=56)

Initial impression	Number of responses	Per cent of respondents with this response
Excellent, good	25	45
Detailed, good structure	25	45
Supported by research	6	11
Professional	3	5
Use is flexible	3	5
Getting better	2	4
Too teacher directed/prescriptive	2	4
Good teaching compromised	1	2
Total responses	**67**	

When asked to rate the resources on a five-point scale, 100% of the science educators who responded to the question rated them in the top two categories excellent or good (Table 14) and almost 80% indicated that no changes were required (Table 15).

Table 14: Science educators' responses to the question "The draft *Primary Connections* professional learning resources are … ?" (n=56)

Per cent of all science educators				
Excellent	Good	Satisfactory	Poor	Totally inadequate
55	43	0	0	0

Note. One participant did not answer this question

Table 15: Science educators' responses to the question "What changes would you like made to the professional learning resources that were prepared for facilitators of workshops for in-service teachers?" (n=56)

Changes to professional learning resources	Number of responses	Per cent of respondents with this response
None as yet	44	79
More ICT	3	5
Need overview of all modules	1	2
Models for application in different sectors	1	2
More emphasis on assessment	1	2
Add contexts for teaching the science	1	2
More connection to students' experience	1	2
Total responses	**52**	

Note. Six participants did not respond to this question

Given that the resources were designed to support professional learning for in-service teachers, the science educators were asked if additional resources were required to support them in their work with pre-service teachers. A majority said no, however, about one-third said yes (Table 16) and their suggestions are reported in Table 17.

Table 16: Science educators' responses to the question "Is there a need to develop any additional resources to support university science educators incorporate elements of *Primary* Connections into pre-service teacher education programmes? If yes, what resources would you like developed?" (n=56)

Are additional resources needed?	Number of responses	Per cent of respondents with this response
Yes	19	34
No	31	55
No response	6	11

Table 17: Science educators' suggestions for additional resources to support pre-service teacher educators (n=56)

Resources to develop	Number of responses	Per cent of all participants
Incorporating PC into a university unit	4	7
Examples of assessment items	3	5
Introduction (DVD?) for pre-service teachers	3	5
How pre-service teachers could use PC on practicum	2	4
How to order	2	4
Posters	2	4
Better animations	1	2

As can be seen from Table 17, there is no consensus by a significant number of science educators about what additional resources could be developed; all suggestions were made by less than five participants.

When invited to make any further comments, 35 did so and all comments were very positive indicating appreciation for a high quality workshop. Comments praised presenters, the workshop, networking, resources, accommodation and food (Table 18).

Table 18: Science educators' responses to the question "any other comments?" (n=35)

Comment on workshop	Number of responses	Per cent of respondents with this response
Praise for presenters and workshop	23	66
Great all round	6	17
Valuable networking	5	14
Praise for accommodation and food	3	9
Praise for PC, resources	1	3
Number who responded	**35**	

Key Findings

Key findings arising from analysis of the results are summarised below.

Number	Key finding	Supporting data
1	The 64 participants who attended the workshop were drawn from all 36 universities that offer pre-service teacher education programmes ensuring that *Primary Connections* is connected to all pre-service teacher education courses in Australia.	Workshop registration data
2	The science educators believed that quality professional learning needs to be relevant to the teachers' needs, delivered by a knowledgeable and credible facilitator in a stimulating and engaging manner, based on practical and interactive learning tasks which stimulate collaboration, sharing and reflection, based on sound theory and be ongoing.	Table 1
3	At the end of the workshop the science educators had high self-efficacy on seven of nine aspects of facilitation; they had lower self-efficacy on aspects of facilitation requiring an understanding of early childhood teaching and literacy teaching.	Table 2
4	Eighty per cent of the science educators had self-efficacy scale scores that were greater than 35/45 (high self-efficacy) and none had a score lower than 25 (low self-efficacy). Science educators that had completed a two-day workshop had levels of self-efficacy similar to those of PLFs who had completed five days of facilitation training.	Tables 3 and 4
5	The science educators had high levels of confidence with facilitating workshops related to seven aspects of *Primary Connections*. All mean confidence scores were greater than 4/5 and were similar to PLFs who had completed five days of facilitator training.	Table 5 and 6
6	When asked about the extent to which the workshop outcomes had been achieved, no less than 80% of participants rated five of seven outcomes in the two highest of five response categories. Most positive responses were for understanding the teaching and learning model and curriculum resources and for understanding the professional learning model and resources.	Table 7
7	More than 80% of the science educators reported that they were very well or well prepared for facilitating *Primary Connections* workshops with both pre- and in-service teachers.	Tables 8 and 9
8	The science educators found the opportunity for networking and sessions on the theoretical overview of the programme and on research the most helpful.	Table 10
9	The science educators suggested that the workshop could be improved by being less rushed and having more input from trial teachers.	Table 11
10	The most common support needs related to regular updates on resources, ongoing contact with other science educators and a workshop set of units.	Table 12

11	All of the science educators rated the professional learning resources as excellent or good, and 80% could not identify any need for change.	Tables 13 - 15
12	When asked if there is a need to develop any additional resources for pre-service teacher education a majority said 'no'. Of the suggestions for additional resources, all were made by less than five people, i.e., there was no consensus about what additional resources should be produced.	Tables 16 and 17
13	When given the opportunity to provide any other comments, responses where overwhelmingly positive with praise for the workshop, presenters, resources, networking, accommodation and meals.	Table 18

Discussion and Conclusions

The workshop was very successful at a number of levels; it attracted staff from all 36 Australian universities that offer a pre-service teacher education programme; the participating science educators who completed the workshop developed high levels of confidence and self-efficacy for facilitating *Primary Connections* professional learning, achieved key aims of the workshop relating to understanding the teaching and learning model, professional learning model and familiarity with *Primary Connections* resources; and the participants gave the workshop a very positive evaluation.

The science educators' levels of confidence and self-efficacy for facilitating workshops related to *Primary Connections* at the end of the two-day workshop were very similar to those of professional learning facilitators who had completed five days of facilitation training. Two areas of lower self-efficacy related to knowledge of early childhood education culture and pedagogy and literacy education pedagogy. This is not surprising given that the academics were recruited from primary science education programmes. Mean self-efficacy scores for these two areas were 3.34 (ECE) and 3.86 (literacy) out of a maximum score of five which are not low in an absolute sense, however, were lower than the mean scores for other aspects of facilitation which were high and ranged from 4.13 to 4.66.

More than 80% of the science educators indicated that they had achieved aims related to: using *Primary Connections* to exemplify aspects of primary science teaching in pre-service science education units; understanding the theoretical underpinning, teaching and learning and professional learning models; pedagogical approaches used to develop literacies of science, investigation skills and how assessment is embedded into teaching and learning; familiarity with the curriculum and professional learning resources; and, research finding on the impact of the programme. More than 80% believed they had been very well or well prepared for facilitating workshops in both pre- and in-service contexts.

The only needs for further support mentioned by more than 15% of participants were updates on resources, a workshop set of curriculum units and ongoing contact with other science educators. The *Primary Connections* resources were given a very positive evaluation and there was no consensus regarding any additional resources that should be developed to support pre-service science education programmes.

The supply of workshop sets of curriculum units, regular updates on the development of new resources and update sessions at the ASERA conference will enable the science educators to remain up-to-date in their knowledge of the programme.

References

Anderson, R. D. & Mitchener, C. P. (1994). Research in science teacher education. In D. L. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 3-44). New York: Macmillan.

Angus, M., Olney, H., Ainley, J., Caldwell, B., Burke, G., Selleck, R., & Spinks, J. (2004). *The sufficiency of resources for Australian primary schools*. Canberra: DEST.

Australian Academy of Technological Sciences and Engineering (ATSE) (2002). *The teaching of science and technology in Australian primary schools: A cause for concern*. Parkville, Vic: ATSE.

Goodrum, D., Hackling, M., & Rennie, L. (2001). *The status and quality of teaching and learning of science in Australian schools: A research report*. Canberra: Department of Education, Training and Youth Affairs.

Goodrum, D., Hackling, M. & Trotter, H. (2003). Collaborative Australian Secondary Science Programme: Pilot study. Perth: Edith Cowan University.

Hackling, M. W. (2006). *Primary Connections: A new approach to primary science and to teacher professional learning*. Proceedings of the ACER Research Conference 2006: Boosting science learning- what will it take? Camberwell, Victoria: Australian Council for Educational Research.

Hackling, M. W. & Prain, V. (2005). *Primary Connections: Stage 2 research report*. Canberra: Australian Academy of Science.

Loughran, J. J. (2007). Science teacher as learner. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp.1043-1065). Mahwah, N.J.: Lawrence Erlbaum Associates.

Sheffield, R. (2004). *Facilitating teacher professional learning: Analysing the impact of an Australian professional learning model in secondary science*. Unpublished PhD thesis, Edith Cowan University, Perth, Western Australia.

Appendices

Appendix 1: Workshop programme

Establishing Connections
A Conference for University Primary Educators about
Primary Connections
Australian Academy of Science
The Shine Dome, ACTON, ACT
12-13 February, 2007

DAY 1   Opening and introductions
            Theoretical rationale for *Primary Connections*
            Curriculum units
            Linking science with literacy
            Rotation 1 of interactive workshops

            A WARM WELCOME TO THE FELLOWS OF THE ACADEMY IN
ATTENDANCE.

DAY 2   Rotation 2 & 3 of interactive workshops
            Primary Connections research programme
            Primary Connections Indigenous Perspective
            Programming a primary science education unit incorporating *Primary Connections*
            DEST awards

            A series of three concurrent 70 minute interactive workshops will
            explore the major features of the programme demonstrating facilitation
            techniques used by professional learning facilitators with in-service
            teachers.

            Participants will be allocated to a workshop group designated by a
            sticker on their name tags. Workshop groups stay together for three
            separate workshops. Timetable schedules for the workshops will be
            available at Registration at the Shine Dome and on signs around the
            workshop spaces. The workshops and presenters are:

- **5Es teaching and learning model & embedded assessment**
  Presenters: *Ms Louise Rostron & Ms Robyn Bull*
- **Linking science with literacy**
  Presenters: *Professor Vaughan Prain*
- **Investigating & Cooperative learning**
  Presenters: *Professor Mark Hackling*

DAY 1

TIME	FOCUS	PRESENTER/S
9.00 (15mins)	**Registration, satchel collection** **Tea and coffee**	
9.15 (20mins)	**Welcome addresses** MC: Ms Louise Rostron Professional Learning Support Officer Australian Academy of Science	Professor Kurt Lambeck President Australian Academy of Science Mr Scott Lambert Director, Science and Maths Section, Curriculum Branch, Schools Outcomes Group Department of Education, Science and Training
9.35 (10mins)	**Introductions** *Primary Connections* team Research Consultants Introduce yourself to the people nearest you	Ms Shelley Peers Managing Director, *Primary Connections* project Australian Academy of Science
9.45 (30mins)	**Opening Address** • Purpose of *Primary Connections* • Purpose of the pre-service conference • Origin of *Primary Connections* • History of the project	Shelley Peers
10.15 (5mins)	**Housekeeping**	Ms Shannon Newham Executive Assistant, Education & Public Awareness Australian Academy of Science
10.20 (30mins)	**Morning Tea**	
10.50 (30mins)	**Setting the scene** • Theoretical rationale • Five principles • Teaching and learning model • Professional learning model • Links to national statements	Professor Mark Hackling Edith Cowan University Research Consultant to *Primary Connections*
11.20 (15mins)	**Question/answer session**	Mark Hackling
11.35 (40mins)	**Setting the Scene** • Orientation to exemplary curriculum units which put *Primary Connections* into practice • Science Background CD	Ms Claudette Bateup Unit Coordinator, *Primary Connections* project Australian Academy of Science

	• Website resources	
12.15 (45mins)	**Exploring the curriculum units** • Navigate using a checklist • Compare stage units • Concentrate on literacy focuses • Focus on the investigations (Elaborate)	
1.00 (45mins)	**Lunch**	
1.45 (15mins)	**Question/answer session on curriculum resources**	Claudette Bateup, Mark Hackling, Shelley Peers
2.00 (35mins)	**Setting the Scene** • Academic/research review about linking science with literacy	Professor Vaughan Prain LaTrobe University Research Consultant to *Primary Connections*
2.35 (5mins)	**Move to workshop space**	
2.40 **(70mins)**	**Rotation 1 of interactive workshops** • Linking science with literacy • 5Es and assessment • Investigating and cooperative learning	Vaughan Prain Louise Rostron & Robyn Bull Mark Hackling
3.50 (15mins)	**Afternoon Tea**	
4.05 (30mins)	**Question Generator Process Question/Answer session**	Louise Rostron to co-ordinate in Dome
4.35	**Close Day 1**	
6.30- 8.30	**Drinks, Barbeque at the Shine Dome**	

DAY 2

TIME	FOCUS	PRESENTER/S
9.00 (70min)	**Rotation 2 of interactive workshops** • Linking science with literacy • 5Es and assessment • Investigating and cooperative learning	All workshop presenters
10.10 (5mins)	**Move to Dome**	
10.15 (15mins)	**Primary Connections Indigenous Perspective**	Ms Robyn Bull Project Officer, *Primary Connections* project

		Australian Academy of Science
10.30 (20mins)	**Morning Tea**	
10.50 (35mins)	**Setting the Scene** • Academic/research review of the research programme	Mark Hackling
11.25 (5mins)	**Move to workshops**	
11.30 (70min)	**Rotation 3 of interactive workshops** • Linking science with literacy • 5Es and assessment • Investigating and cooperative learning	All workshop presenters
12.40 (5mins)	**Move to Dome**	
12.45 (30mins)	**DEST Awards**	Ms Clare Wynter Assistant Director, Science and Maths Education Section Department of Education Science and Training
1.15 (30mins)	**Lunch**	
1.45 (75mins)	**Programming a science education unit**	Keith Skamp and Shelley Peers Mark Hackling and Jim Watters Vaughan Prain and Bruce Waldrip
3.00 (40mins)	**Panel discussion & questions**	
3.40 (10mins)	**Questionnaire**	
3.50 (10mins)	**Close**	

Australian Academy of Science: *Primary Connections* Programme

University Science Educators Workshop
Workshop Evaluation Survey

Dear Colleague

We seek your views about the workshop you have just completed. Data from this survey 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. We request your name 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

ID number

For office use only

Your background

Your name: _____

Your university: _____

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 facilitator of pre and in-service teacher professional learning

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 = Uncertain;
D = Disagree; SD = Strongly Disagree

Item	Statement	SA	A	UN	D	SD
1	I am effective in eliciting teachers' prior knowledge and beliefs and adjusting the professional learning workshop to meet the needs of the teachers					
2	My science content knowledge enables me to answer teachers' science questions effectively					
3	My knowledge of effective science teaching practices enables me to answer teachers' science pedagogy questions effectively					
4	I am quite comfortable with having my professional learning workshops evaluated					
5	I am able to pose 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 deep understanding of the culture of early childhood education enables me to give valuable advice to ECE teachers about science pedagogy					
8	My deep understanding of literacy teaching practice enables me to give valuable advice on integrating literacy education into science education					
9	I am able to choose and apply effective facilitation tools and techniques to enhance the learning of teachers in workshops					

Please rate your confidence with facilitating professional learning workshops focusing 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	Introducing *Primary Connections* and its five underpinning principles					
2	Linking science with literacy					
3	Understanding and applying the 5Es teaching and learning model in primary science					
4	Conducting investigations in primary science					
5	Using co-operative learning strategies					
6	Using embedded assessment processes and effective questioning techniques					
7	Co-ordinating the science programme in a primary school					

Feedback on the two-day university science educators workshop

To what extent have the aims of the workshop been achieved for you?

Aim To develop an enhanced……..	To a large extent		OK		To a limited extent
	1	2	3	4	5
1 understanding of the theoretical underpinnings of the programme and research findings regarding the impact of the programme on teachers, students and schools					
2 understanding of the *Primary Connections* teaching and learning model and the professional learning model					
3 understanding of the pedagogical approaches used to support the development of literacies of science and investigation skills, and how assessment is embedded in the teaching and learning programme					
4 familiarity with the curriculum and professional learning resources developed by the programme					
5 familiarity with the roles of School Co-ordinator, Professional Learning Facilitator and Jurisdiction Co-ordinator, and the support for professional learning available in each jurisdiction					
6 familiarity with examples of professional learning sessions for in-service teachers					
7 awareness of opportunities to use *Primary Connections* resources to exemplify aspects of primary science teaching in pre-service science education units					

How well prepared do you feel for facilitating *Primary Connections* professional learning workshops for in-service teachers?
Tick one box.

Very well prepared	Well prepared	OK	Poorly prepared	Very poorly prepared

How well prepared do you feel for incorporating elements of *Primary Connections* into your pre-service teacher education programme?
Tick one box.

Very well prepared	Well prepared	OK	Poorly prepared	Very poorly prepared

What aspects of this two-day workshop did you find particularly helpful?

_____

_____

_____

_____

What improvements could be made to the workshop?

_____

_____

_____

_____

What further support will you need for your role as a *Primary Connections* professional
learning facilitator?

_____

_____

_____

Feedback on the *Primary Connections* professional learning resources

What are your initial impressions of the draft *Primary Connections* professional learning
resources, which were developed for use by facilitators of workshops for in-service
teachers?

_____

_____

_____

_____

The draft professional learning resources are…. (tick one box)

Excellent	Good	Satisfactory	Poor	Totally inadequate

What changes would you like made to the professional learning resources that were
prepared for facilitators of workshops for in-service teachers?

_____

_____

_____

Is there a need to develop any additional resources to support university science educators incorporate elements of *Primary Connections* into pre-service teacher education programmes?

Yes / No

If yes, what resources would you like developed?

_____

_____

_____

Any other comments

_____

_____

_____

_____

Thank you for responding to this questionnaire; your feedback will be very useful