PrimaryConnections®
Linking science with literacy

Stage 3
Interim research and evaluation report 16

Trial teachers' perceptions of the implementation of *Primary Connections* at their schools in Term 1/2 of 2008

A research report for the Australian Academy of Science

Mark W Hackling
Edith Cowan University

Research Consultant to the *Primary Connections* Project

August 2008

Australian Government
Department of Education, Employment and Workplace Relations

Australian Academy of Science

Acknowledgements and disclaimer
This project is funded by the Australian Government Department of Education, Employment and Workplace Relations as a quality teacher initiative under the Australian Quality Teacher Programme. Website: www.qualityteaching.dest.gov.au/Content/

The enthusiastic support of *Primary Connections* by trial schools and the support of Trial Teachers in completing surveys for the research and evaluation program is greatly appreciated. Trial schools and teachers have made a significant contribution to the development of *Primary Connections*. The coding and collation of data was efficiently completed by Barbara Bowra, which has contributed significantly to the quality of this report.

The views expressed in this report do not necessarily represent the views of the Australian Academy of Science nor the views of the Australian Government Department of Education, Employment and Workplace Relations. The author accepts responsibility for the views expressed and all errors and omissions in this report.

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Introduction

Teachers' practice is strongly influenced by their beliefs about practice (Keys, 2003; Peers, 2001) and self-efficacy (Riggs & Enocks, 1990) and confidence (Yates & Goodrum, 1990), and their pedagogical content knowledge (Appleton, 1995). To improve practice teachers need the support of quality professional learning and curriculum resources (Goodrum, Hackling & Rennie, 2001). Research with professional learning programs at secondary and primary schools (Goodrum, Hackling & Trotter, 2003; Goodrum, Hackling & Sheffield, 2003; Hackling & Prain, 2005; Lewthwaite, 2006; Peers, Diezmann & Watters, 2003) indicates that the provision of professional learning workshops and exemplary curriculum resources, successful pedagogical experiences, opportunities for collegial interaction and reflection on practice, support of the principal and strong leadership by leader teachers/co-ordinators are required for successful implementations of new initiatives. The growth and effectiveness of teacher leaders depends on their personal attributes (e.g., motivation, self-efficacy, willingness to modify practice and beliefs (Peers, Diezmann & Watters, 2003) 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, exosystem factors such as parent and community expectations, and macrosystem factors such as state and national curriculum agendas (Bronfenbrenner, 1989; Lewthwaite, 2006).

Research into the perceptions of Trial Teachers regarding the implementation of *Primary Connections* in their classrooms and more broadly in their schools is required to understand how teachers and their schools can be further supported to ensure a successful implementation. Trial Teachers were provided with an initial five-day professional learning workshop in January 2005 and with a series of follow-up one-day workshops to enhance their confidence, self-efficacy and pedagogical content knowledge for science and literacy teaching, and to prepare them for trialling curriculum units. Trial Teachers have had access to trial units and to revised and published units for implementation in their classrooms. Research has demonstrated that *Primary Connections* has significantly improved teachers' confidence with a range of science and literacy teaching practices, self-efficacy beliefs and time committed to teaching science, and that teachers report improvements to their teaching practice (Hackling & Prain, 2005; Hackling, Peers & Prain, 2007). Research conducted with Trial Teachers in 2006 (Hackling, 2007) revealed that "Levels of implementation and commitment to *Primary Connections* appear to be constrained by difficulties in linking PC to other programs. Unpicking integrated units of work that include science requires a commitment to *Primary Connections* and a readiness to revise aspects of school-developed integrated curriculum units" (p.17).

Trial Teachers have had sufficient professional learning and experience of teaching with *Primary Connections* to provide informed insights into teachers' implementation of *Primary Connections* in their classrooms and the factors influencing the implementation of the program within their schools.

Purpose

The purpose of this study was to elicit from Trial Teachers information about their teaching of *Primary Connections*, how the program is being implemented in their schools and factors influencing the implementation of the program in their schools.

Method

A questionnaire based survey method was adopted to seek the Trial Teachers' views about their teaching and the status of *Primary Connections* in their schools. A survey was distributed to the Trial Teachers at the end of Term 1 in 2008 by email attachment. Teachers completed the survey and faxed it back to the research team. 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 1.

Sample
The survey was emailed to all those teachers on the Australian Academy of Science Trial Teachers database. This included the 106 teachers who were trained in 2005 and others who have since been appointed to the role by schools who have lost trained Trial Teachers to other schools. Some of the replacement Trial Teachers would have attended some of the one-day follow-up professional learning workshops. Although 158 teachers on the Trial Teachers database were surveyed, only 44 were actively involved in trialing units in Term 1 and 2 of 2008, and 42 in Term 3 of 2007.

Data Analysis
Objective and rating scale items were coded and entered into SPSS for calculation of descriptive statistics. Responses to open-ended items were read and re-read until categories of responses were identified. Individual responses were then coded by category and the frequency of responses in each category were identified. Categories were then reviewed to eliminate any overlap between categories and where appropriate categories were combined.

Results

This section reports demographic data about the teachers who responded to the survey, the extent to which these teachers are teaching science in their own classrooms and the level of commitment to and implementation of *Primary Connections* in their schools. Factors influencing the uptake of *Primary Connections* in their schools are also reported.

Demographic Data
Thirty-six teachers completed the 2008 survey adding to the existing data previously gathered from 106 Trial Teachers in 2005 and from 86 Trial Teachers in 2006. Given the modest sample size and low return rate caution should be exercised in attempting to generalise findings beyond the sample of 36. Most of the returned surveys came from teachers in South Australia, Western Australia, Victoria and New South Wales (Table 1) and from the Government school sector (Table 2).

Table 1: Number of Trial Teachers who responded to the end of Term 1 2008 survey

State	Responded to end of Term 1 2008 survey	Number participating in 2006 PC trial	Total numbers in original PC 2005 trial
WA	7	12	21
SA	9	12	16
NT	0	2	2
QLD	3	13	18
NSW	6	21	22
ACT	3	6	4
VIC	6	18	18
TAS	2	2	4
TOTALS	**36**	**86**	**106**

Table 2: Origin of Trial Teachers by sector (n=36)

Sector	Number	Per cent
Government	27	75
Catholic	5	14
Independent	4	11

Professional Roles of the Trial Teachers

The professional roles of the teachers who completed the survey and their teaching responsibilities are summarised in Tables 3 and 4.

Table 3: Professional role of Trial Teachers in 2008 (n=36)

Professional role	Number
Class teacher	17
Science coordinator and teacher	8
Principal/Deputy/Assistant principal	6
Principal/deputy and teaching	3
Relief teaching	2
TOTAL	36

Most of the respondents were classroom teachers while others had additional responsibilities as the science coordinator, were members of the school executive and teaching, relief teaching or members of the school executive and not currently teaching (Table 3). All 36 respondents were based in a primary school in 2007 while two of the 36 indicated their responsibilities spanned more than one school in 2008. Teaching responsibilities spanned year levels from pre-primary to Year 7 (Table 4).

Table 4: Year level taught by Trial Teachers in 2007 and 2008 (n=36)

Year level	2007 number	2008 number
PP	4	4
PP & 1	3	2
1	2	2
1 & 2		
2	4	2
2 & 3	1	1
3	1	3
3 & 4		
4		
4 & 5	1	1
5	2	3
5 & 6	8	6
6	2	1
6 & 7	1	1
7	3	2
Teach to several year groups/classes	3	3
Not teaching	1	5
Total	36	36

Trial Teachers' Teaching of Science

For each term of 2007 and for the first two terms of 2008 teachers were asked to identify the science topic taught and for the last two terms of 2008 what science topic they planned to teach. These data are affected slightly by the two Tasmanian teachers who teach only three terms each year. Table 5 shows that the frequency of teaching for a particular *Primary Connections* topic is influenced by the year in which it is trialled. The number of terms in which no science was taught by the teachers fell from 22 in 2007 to 14 in 2008.

Table 5: Total number of terms science topics were taught by Trial Teachers in 2007 and 2008 (n=36)

Science topic	Number of terms	
	2007	2008
Early stage 1 topic		
No science taught	22	14
Weather in my world	6	11
On the move	3	4
Staying alive	12	3
What's it made of?	7	6
Stage 1 topic		
Push Pull	2	1
Spot the difference = material matters	1	1
Needs and wants = recycling	2	0
Sounds sensational	2	1
Schoolyard safari	7	4
Water works	1	4
Living things	0	1
Stage 2 topic		
Spinning in space	7	3
Light fantastic	2	1
Plants in action	1	3
Material world	2	1
Smooth moves	0	3
Stage 3 topic		
Earthquake explorers	13	2
It's electrifying	5	4
Marvellous micro-organisms	7	1
Package it better	1	4
Change detectives	0	12
Non-PC topics		
Life and living topic	5	8
Natural and processed materials topic	3	0
Energy and change topic	4	5
Earth and beyond topic	2	0
Investigating scientifically topic	2	0
Environment topic	3	4
Design/ technology topic	4	2
Topic undecided (last 2 terms of 2008 only)		12

Most of the teachers taught a science unit in each term if they were teaching in that Term and most of the science units taught were *Primary Connections* units (Table 6). For example, in Term 1 of 2008, 31 of the 36 teachers were teaching and 28 of these taught a science unit and 93% of the science units taught in that Term were *Primary Connections* units.

Table 6: Types of science taught by Trial Teachers in 2007 and 2008 by term (n=36)

Type of unit	Number of respondents							
	Term 1 2007	**Term 2 2007**	**Term 3 2007**	**Term 4 2007**	**Term 1 2008**	**Term 2 2008**	**Term 3 2008**	**Term 4 2008**
Science was taught	27	28	31	25	28	27	26	17
Primary Connections unit	18	23	24	18	26	19	19	13
Unit type undecided							1	7
No science taught	6	6	3	5	3	2	3	4
Not teaching	3	2	2	4	5	7	5	5
Per cent of science that is *Primary Connections*	67	82	77	72	93	70	73	76

Characteristics of Science Teaching at Trial Schools

Trial Teachers were asked to respond to a number of questions about the extent to which their schools science programs were based on *Primary Connections*. Table 7 shows that the proportion of teachers in Trial Teachers' schools teaching science with *Primary Connections* has increased from 2006 to 2008. Whole school implementation has increased from 23% of trial schools in 2006 to 44% in 2008 and the percentage of schools in which only the Trial Teachers were teaching science using *Primary Connections* has decreased from 21% in 2006 to 3% in 2008.

Table 7: Teachers' response to the question, "What is the extent of implementation of *Primary Connections* in your school?" for Trial Teacher surveys in 2006, 2007, 2008

Per cent of teachers			
Survey year	Only Trial Teachers are teaching *Primary Connections*	Trial Teachers and some others are teaching *Primary Connections*	All classroom teachers are teaching *Primary Connections*
2008 end Term 2 (n=36)	3	47	44
2007 end Term 1 (n=77)	8	60	32
2006 end Term 1 (n=66)	21	56	23

When asked about typical science teaching at their schools, the Trial Teachers indicated that about three-quarters of teachers taught whole *Primary Connections* units while about one-quarter teach parts of *Primary Connections* units. Half of the Trial Teachers indicated that most teachers are teaching *Primary Connections* units with very little modification, about one-fifth indicated that some teachers are making substantial modifications to units while about one-third indicated some teachers were developing their own units based on the *Primary Connections* teaching and learning model (Table 9). A little more than half of the Trial Teachers indicated that *Primary Connections* had replaced the previous science or integrated studies program at their schools while a little less

than half indicated that *Primary Connections* was being used to supplement the existing science program.

Table 8: Teachers' response to the question, "Which of the following statements describe typical science teaching at your school?" (n=36)

Per cent of teachers		
Most teachers are teaching PC units with very little modification	Some teachers are making substantial modifications to PC units	Some teachers have developed their own units based on the PC model
53	19	36

The Trial Teachers were asked how many *Primary Connections* units they would teach per year when a larger range of units is available. The most common response from the survey conducted in 2008 was two units per year, however, more than a quarter indicated they would teach four units per year. Surveys conducted in 2006 and 2007 show considerable variation with three units being the most common response in 2006 and four units being the most common response in 2007. Given the Trial Teachers' commitment to science teaching they might be expected to teach more units per year than other teachers in their schools.

Table 9: Teachers' responses to the question "How many *Primary Connections* curriculum units will you teach each year when a larger range of units is available?"

Per cent of teachers				
Survey year	1 unit	2 units	3 units	4 units
2008	6	49	17	29
2007	1	32	25	42
2006	0	28	34	31

Trial schools' commitment to *Primary Connections*

Surveys of Trial Teachers in 2006, 2007 and 2008 indicate that the commitment of trial schools to *Primary Connections* is increasing (Tables 10 and 11). In all of the surveys a large majority of the Trial Teachers indicated that the level of commitment was increasing at their schools and the proportion indicating that the level of commitment was high increased from 19% in 2006 to 53% in 2008. The proportion of schools with a low commitment decreased from 18% in 2006 to 6% in 2008.

Table 10: Teachers' responses to the question "How would you rate the level of commitment to *Primary Connections* in your school?"

Per cent of teachers			
Survey year	Low	Medium	High
2008 end Term 2 (n=36)	6	42	53
2007 end Term 1 (n=77)	10	57	33
2006 end Term 1 (n=66)	18	63	19

Table 11: Teachers' responses to the question "Is the commitment to *Primary Connections* at your school changing?" for surveys in 2008, 2007 and 2006

Per cent of teachers			
Survey year	Decreasing	Remaining same	Increasing
2008 end Term 2 (n=36)	0	26	74
2007 end Term 1 (n=77)	5	21	74
2006 end Term 1 (n=66)	4	23	70

The Trial Teachers were asked to give reasons for the level of commitment to *Primary Connections* at their schools (see Table 12). For those teachers who indicted commitment was increasing the most common reasons related to: the move to whole-school implementation; matching the school's scope and sequence chart; science being a focus of the school; success from trial teaching; and, provision of professional learning to staff.

Table 12: Teachers' responses to the question "Why is the commitment to *Primary Connections* at your school changing?" for 2008 survey (n=35)

Reason for change in commitment	Number of responses	Our commitment is…
Some like it some don't	2	Same
Matches school scope and sequence	6	Inc/Same
Science is focus area of school	4	Inc/Same
PD	4	Inc/Same
Success from trial teaching	4	Inc/Same
Easy to use	3	Inc/Same
All staff are using it more	10	Inc
PC facilitators on staff	3	Inc
Student interest, success in the classroom	3	Inc
Teachers work in teams	2	Inc
Resources for units improving	2	Inc
Good units easy to use	2	Inc
Accountability in science learning area	1	Inc
Increased confidence in teaching science	1	Inc
More units needed	1	Inc
Moving to integrated units	1	Inc

Surveys conducted in 2006, 2007 and 2008 indicated that the main factors limiting the implementation of *Primary Connections* at their schools were resistance from other staff, time, units arriving later than anticipated and new staff at the school requiring professional learning support to implement the program. Lack of funding/resources, the crowded primary school curriculum, lack of professional learning for staff and working out how to integrate *Primary Connections* into the school's scope and sequence were inhibiting factors identified in earlier surveys (Table 13).

Table 13: Teachers' 2008 responses to the question "What factors are limiting the success of, commitment to and implementation of *Primary Connections* at your school?" (n=36) and comparison for 2007 and 2006 surveys

Factors limiting implementation	Number of responses	Per cent of Trial Teachers with this response		
	2008	2008 n=36	2007 n=76	2006 n=66
Staff resistance	9	25	20	17
Time	7	19	26	20
Units arrived late	7	19	18	11
New staff/new school	4	11	12	12
Money, resources	3	8	22	
Crowded curricula	3	8	9	15
Staff still need a driver/coordinator to ensure program followed fully	3	8		
Lack of PD for staff (who are new to program)	2	6	12	
Organizing resources	2	6		
Being a one teacher school/multiple levels per class	2	6		
Poor support from admin	1	3		
How to integrate with current program	1	3	12	38
Tandem teachers only in 2 days per week	1	3		
Have no science coordinator	1	3		
None	4	11		
Total	*50*			
No response	*2*			

Trial Teacher 4 indicated that "*Many staff need support in fully integrating units into literacy and other learning areas*" highlighting the importance of teacher professional learning workshops to support the effective implementation of *Primary Connections* into the school curriculum.

Factors enhancing successful implementation of *Primary Connections* at trial schools in 2008 and earlier years were: the support and enthusiasm of teachers; having a science coordinator; ease of use of *Primary Connections* curriculum units; good support from administration; and a range of other factors linked to a whole school implementation such as systems for organising resources and whole-school planning.

Table 14: Teachers' responses to the question "What factors are enhancing the success of, commitment to and implementation of *Primary Connections* at your school?" (n=36)

Factors enhancing implementation	Number of responses	Per cent of Trial Teachers with this response		
	2008	2008 n=36	2007 n=76	2006 n=66
Enthusiasm/support of teachers	12	35	32	36
Specialist science teacher/coordinator/facilitator	9	26	5	
The PC units/format are easy to use	7	20	23	21
Good support from admin	5	14	20	13
Being a trial school	4	11		6
Resources are now organised	4	11	3	
Money/resources	3	9	15	3
Whole school approach/in school plan/integrated	3	9		
Working in teams	3	9		
Positive response from students	2	6	9	9

Ranking of science increased	1	3		
Time made available	1	3		
Literacy focus	1	3		
Own science lab/room	1	3		
Total responses	*57*			
Number who did not answer	*2*			

Comments from Trial Teachers provided further evidence of the importance of the curriculum resources as a key to effective implementation of *Primary Connections*:

"*There is an extremely strong commitment by the staff. They were very receptive to this relatively new program. The planned units have taken away all the stress and feeling of inadequacy toward science teaching*." (TT2)

"*I have introduced PC across five schools and not one teacher has rejected them* (the units). *The only adverse comment is they run out of time to complete the unit in a term because of the huge number of interruptions to the day's routine*." (TT15)

Science Coordination

When asked about how well various aspects of science coordination were being managed at their schools, the Trial Teachers rated the aspects on a three-point scale (Good-Adequate-Poor). Teachers' responses were scored Good = 3, Adequate = 2 and Poor = 1 so that mean ratings and standard deviations could be calculated. Data are reported in Table 15 for teachers' responses to the 2008 survey, and for 2006, 2007 and 2008 surveys in Table 16. The 2008 data indicate that aspects of coordination related to planning and organisation all had mean ratings above the mid-point of the scale (2/3) with *Linking the science curriculum to the assessment and reporting schedule of the school* given the most positive rating (2.53/3).The two items relating to meetings being held to share experiences and to review teaching of units were given lower ratings (<2/3).

Table 15: Teachers' responses to the question "What aspects of science co-ordination are working well at your school?" (n=36)

Aspect of science coordination	How well it is working (number of teachers)			Mean rating[a] (3)	S.d.
	Good	Adequate	Poor		
Linking the science curriculum to the assessment and reporting schedule of the school	21	13	2	2.53	0.609
Mechanisms or processes are in place to keep the school staff informed about developments with the *Primary Connections* program	16	17	3	2.36	0.639
School or year level or stage planning occurs to make connections between the science, literacy and other learning areas	18	9	8	2.29	0.825
Purchase, organisation and replacement of equipment and consumables	14	18	4	2.28	0.849
Developing a school scope and sequence chart that specifies science topics to be taught across terms and year/grade levels.	19	8	9	2.28	0.659
Productive meetings are held to share experiences, ideas and strategies	7	19	10	1.92	0.692
Productive meetings are held to review, evaluate and improve units	7	10	18	1.69	0.609

Note. [a] Mean rating was calculated by finding the mean of the scores for each item with responses scored on a three-point scale: Good =3; Adequate =2; and, Poor =1

The trend data reported in Table 16 indicate that the ratings of aspects of coordination improved progressively from 2006 to 2007 to 2008 indicating a progressive improvement in coordination of science teaching in these trial schools.

Table 16: Comparison of responses across three years

Science coordination aspect	Mean rating (/3)					
	2008 n=36		2007 n=75		2006 n=61	
	mean	S.d	mean	S.d	mean	S.d
Linking the science curriculum to the assessment and reporting schedule of the school	2.53	0.609	2.34	0.696	2.12	0.751
Mechanisms or processes are in place to keep the school staff informed about developments with the *Primary Connections* program	2.36	0.639	2.11	0.669	1.93	0.750
School or year level or stage planning occurs to make connections between the science, literacy and other learning areas	2.29	0.825	2.16	0.754	2.15	0.813
Developing a school scope and sequence chart that specifies science topics to be taught across terms and year/grade levels.	2.28	0.849	2.00	0.793	-	-
Purchase, organisation and replacement of equipment and consumables	2.28	0.659	2.24	0.728	2.11	0.798
Productive meetings are held to share experiences, ideas and strategies	1.92	0.692	1.91	0.791	1.79	0.755
Productive meetings are held to review, evaluate and improve units	1.69	0.796	1.73	0.708	1.58	0.766

The Trial Teachers provide a valuable perspective on *Primary Connections* as most of them have participated in sufficient professional learning to really understand the teaching and learning model and have enough experience of teaching the units to understand the strengths and weaknesses of the program. Trial Teacher 71 offered this endorsement of the program:

"*PC is outstanding. It is what has been required in primary schools for quite some time. It is user friendly and it supports less confident teachers. We find that the students look forward to science - they demand it! - and PC helps supply it. The parents at this community know their children are doing science at school because the children go home and discuss the program. the parents are really grateful and supportive and it is true what I have been saying for years, "there isn't a child alive that doesn't like science."* "

Summary of Key Findings

The key findings form the survey of Trial Teachers are summarised in Table 17.

Table 17: Summary of key findings

Number	Key finding	Evidence
1	Thirty-six teachers completed the 2008 survey. Most of the returned surveys came from teachers in South Australia, Western Australia, Victoria and New South Wales and from the Government school sector. Most of the respondents were teaching science in primary schools and their teaching responsibilities spanned all of the primary years. Given the small sample size and low return rate the data should be interpreted with some caution.	Tables 1 - 4
2	Analysis of data regarding the science topics taught by the Trial Teachers in 2007 and 2008 indicated that their trialling of units had a strong influence on which units they taught.	Table 5
3	Most of the teachers taught a science unit in each term if they were teaching in that Term and most of the science units taught were *Primary Connections* units.	Table 6
4	The proportion of teachers in Trial Teachers' schools teaching science with *Primary Connections* has increased from 2006 to 2008. Whole school implementation has increased from 23% of trial schools in 2006 to 44% in 2008 and the percentage of schools in which only the Trial Teachers were teaching science using *Primary Connections* has decreased from 21% in 2006 to 3% in 2008.	Table 7
5	The Trial Teachers indicated that about three-quarters of teachers taught whole *Primary Connections* units while about one-quarter teach parts of *Primary Connections* units. Half of the Trial Teachers indicated that most teachers are teaching *Primary Connections* units with very little modification, about one-fifth indicated that some teachers are making substantial modifications to units while about one-third indicated some teachers were developing their own units based on the *Primary Connections* teaching and learning model. A little more than half of the Trial Teachers indicated that *Primary Connections* had replaced the previous science or integrated studies program at their schools while a little less than half indicated that *Primary Connections* was being used to supplement the existing science program.	Table 8
6	Half of the Trial Teachers who completed the 2008 survey indicated that once there was a greater supply of *Primary Connections* units they would teach two units per year, however, more than a quarter indicated they would teach four units per year. Given the Trial Teachers' commitment to science teaching they might be expected to teach more units per year than other teachers in their schools.	Table 9
7	Surveys of Trial Teachers in 2006, 2007 and 2008 indicate that the commitment of trial schools to *Primary Connections* is increasing. In all of the surveys a large majority of the Trial Teachers indicated that the level of commitment was increasing at their schools and the proportion indicating that the level of commitment was high increased from 19% in 2006 to 53% in 2008. The proportion of schools with a low commitment decreased from 18% in 2006 to 6% in 2008.	Tables 10 -11

8	For those teachers who indicted commitment to *Primary Connections* was increasing at their schools, the most common reasons related to: the move to whole-school implementation; matching the school's scope and sequence chart; science being a focus of the school; success from trial teaching; and, provision of professional learning to staff.	Table 12
9	Surveys conducted in 2006, 2007 and 2008 indicated that the main factors limiting the implementation of *Primary Connections* at Trial Teachers' schools were resistance from other staff, time, units arriving later than anticipated and new staff at the school requiring professional learning support to implement the program. Lack of funding/resources, the crowded primary school curriculum, lack of professional learning for staff and working out how to integrate *Primary Connections* into the school's scope and sequence were inhibiting factors identified in earlier surveys.	Table 13
10	Factors enhancing successful implementation of *Primary Connections* at trial schools in 2008 and earlier years were: the support and enthusiasm of teachers; having a science coordinator; ease of use of *Primary Connections* curriculum units; good support from administration; and a range of other factors linked to a whole school implementation such as systems for organising resources and whole-school planning.	Table 14
11	The 2008 survey data indicate that aspects of science coordination in trial schools related to planning and organisation were rated positively and *Linking the science curriculum to the assessment and reporting schedule of the school* was given the most positive rating. The two items relating to meetings being held to share experiences and to review teaching of units were given lower ratings. The trend data indicate that the ratings of aspects of coordination improved progressively from 2006 to 2007 to 2008 indicating a progressive improvement in coordination of science teaching in these trial schools.	Tables 15 - 16

Discussion and Conclusions

Trial Teachers have had sufficient professional learning and teaching experience with *Primary Connections* to provide highly informed opinions about the implementation of the program in their schools. Given the relatively small sample size and return rate for the 2008 survey of Trial Teachers the data should be interpreted with caution (KF 1).

The science topics taught by Trial Teachers appears to have been strongly influenced by their responsibility for trialling new units (KF 2). Most of the Trial Teachers taught science in most of the terms in which they were teaching and most of the topics taught were drawn from the *Primary Connections* program (KF 3). There was an increase from 2006 to 2008 in the proportion of science units taught that were *Primary Connections* units and this may reflect the increasing availability of units (KF 4). The Trial Teachers indicated that almost all would teach two or more *Primary Connections* units per year when more units are available. About half indicated they would teach two units per year (KF 6). It would be expected that teachers and schools with a lower level of commitment to teaching science than trial schools may teach less units per year.

The Trial Teachers also reported on the science teaching of their colleagues. They indicated that most teachers were teaching whole *Primary Connections* units will little modification, however, some teachers were modifying units and others were developing their own science units based on the *Primary Connections* teaching and learning model (KF 5). Given the wide range of school contexts and science teaching confidence, there is likely to be a wide range of approaches to teaching science with *Primary Connections*.

The approaches to implementation of *Primary Connections* in trial schools varied. Almost half of trial schools had moved to whole-school implementation and in more than half of trial schools *Primary Connections* had replaced the previous science program whilst in other schools *Primary Connections* had supplemented the existing science program (KF 5). One would expect as more *Primary Connections* units are published and more schools recognise the alignment between *Primary Connections* and mandated curriculum frameworks, a greater proportion of schools will frame their science programs around *Primary Connections*.

Surveys of Trial Teachers conducted in 2006, 2007 and 2008 indicate an increasing commitment by trial schools to implementation of *Primary Connections* (KF 7) and the most common reasons for this relate to: the move to whole-school implementation; matching the school's scope and sequence chart; science being a focus of the school; success from trial teaching; and, provision of professional learning to staff (KF 8). Data from the 2008 survey indicate that factors that are inhibiting the implementation of *Primary Connections* include resistance from other staff, time, units arriving later than anticipated and new staff at the school requiring professional learning support to implement the program (KF 9). Moving to whole-school implementation requires school principals and science coordinators to overcome resistance from teachers in the school who are either not teaching science or not teaching with *Primary Connections* units and this requires these teachers to commit additional preparation time and be supported by a science coordinator. With the transient nature of school staffing there will be an ongoing need to provide professional learning support to those teachers who transfer to schools that have adopted *Primary Connections* and this may be an important role for science coordinators. Factors enhancing successful implementation of *Primary Connections* at trial schools in 2008 and earlier years were: the support and enthusiasm of teachers; having a science coordinator; ease of use of *Primary Connections* curriculum units; good support from administration; and a range of other factors linked to a whole school implementation such as systems for organising resources and whole-school planning (KF 10).

The role of the science coordinator is pivotal to successful implementation of a science program and the data from the 2006, 2007 and 2008 surveys suggest that aspects of coordination have improved progressively over the last three years in trial schools, particularly those related to planning and organising (KF 11). Given the increased pressure for accountability through assessment and reporting of students' achievement it is not surprising to find that the aspect of

coordination rated most positively by the Trial Teachers is linking the science curriculum to the assessment and reporting schedule of the school.

This report paints a picture of the level of implementation of *Primary Connections* in the classrooms and schools of the Trial Teachers who responded to the survey. The overall impression is one of a progressively increased commitment to *Primary Connections* and increasing amounts of science being taught, and taught using *Primary Connections* units. An increased proportion of trial schools have moved to whole-school adoption while some, as yet, have not reached this level of implementation. More than half of the schools are replacing an existing program with *Primary Connections* and other are supplementing an existing program with *Primary Connections* units. Research conducted in 2006 indicated that the difficulty of working out how to integrate *Primary Connections* with an existing program appeared to be a barrier to implementation (Hackling, 2007). There would be value in communicating information about *Primary Connections*, its alignment to curriculum frameworks and the availability of units to primary schools throughout Australia as these two factors are likely to influence Principals' decisions to adopt the program, and to adopt the replacement model of implementation rather than the supplementation model of implementation.

Strong leadership within schools, effective coordination of science and ongoing professional learning are required for effective implementation of a science program (Bronfenbrenner, 1989; Lewthwaite, 2006; Peers, Diezmann & Watters, 2003) which highlights the importance of the role of science coordinator if the teaching and learning of science is to be improved and achieve the goal of scientific literacy for all of our children. Further collaborations between the Academy and jurisdictions to train additional science coordinators would enable more schools to have the curriculum area leadership required for the implementation of effective teaching and learning of science.

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Appendix 1

Australian Academy of Science: *Primary Connections* Program

Trial Teachers Term 1/2, 2008 Questionnaire

Dear Colleague

We seek your views about the current status of science and literacy teaching, use of Primary Connections and coordination of science at your school.

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 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

ID number

For office use only

Your background

Your name: _____

State/Territory: _____

Sector: Government / Catholic / Independent

Name of workplace for 2007: _____

Name of workplace for 2008: _____

Your professional role for 2008: (*circle one or more of the options below as appropriate*)

Principal / Deputy / Science coordinator / Teacher of Year ___ / Teach science to several year groups / Other _____

What science topics did you teach in 2007 and in Term 1 of 2008?

Year/Term	2007 Term 1	2007 Term 2	2007 Term 3	2007 Term 4	2008 Term 1
Which year/grade?					
Did you teach a science unit in this term?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Unit name/topic					
Was this a *Primary Connections* unit?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No

What science topics will you teach in Terms 2 – 4 of 2008?

Term	2008 Term 2	2008 Term 3	2008 Term 4	**Please note:** **If you are teaching in Tasmania** cross out the column for Term 4 in both tables and tick this box ☐
Which year/grade?				
Will you teach a science unit in this term?	Yes / No	Yes / No	Yes / No	
Unit name/topic				
Will this be a *Primary Connections* unit?	Yes / No	Yes / No	Yes / No	

Science and literacy teaching in my school

(***Please tick as many of the options that apply to your school***)

What is the extent of implementation of *Primary Connections* in your school?

1. Only trial teachers are teaching *Primary Connections* ☐
2. Trial teachers and some others are teaching *Primary Connections* ☐
3. All classroom teachers are teaching *Primary Connections* ☐

Which of the following statements describe typical science teaching at your school?

1. Teachers teach whole PC units ☐
2. Teachers teach parts of PC units ☐

3. Most teachers are teaching PC units with very little modification ☐
4. Some teachers are making substantial modifications to PC units ☐
5. Some teachers have developed their own units based on the PC model ☐

6. PC has replaced the previous science/integrated studies program ☐
7. PC has been used to supplement the previous science/integrated studies program ☐

How many *Primary Curriculum* units will **you** teach each year when the full set of 19 units is available? 1 ; 2 ; 3 ; 4 (*circle one option*)

How would you rate the level of commitment to *Primary Connections* in your school?

1. High ☐
2. Medium ☐
3. Low ☐

Is the commitment to *Primary Connections* at your school …

1. increasing ☐
2. remaining the same ☐, or
3. decreasing ☐.

Why is this?

_____

_____

_____

Are there any factors **limiting** the success of, commitment to and implementation of *Primary Connections* at your school?

_____

_____

_____

Are there any factors **enhancing** the success of, commitment to and implementation of *Primary Connections* at your school?

_____

_____

_____

What is the status of science co-ordination at your school?

Is there an officially designated science coordinator at your school? **Yes / No** (*please circle one option*)

Please rate each of the following aspects in the table below (*please tick one box in each row*)

	Aspect of co-ordination	Good	Adequate	Poor
1	Purchase, organisation and replacement of equipment and consumables			
2	Linking the science curriculum to the assessment and reporting schedule of the school			
3	School or year level or stage planning occurs to make connections between the science, literacy and other learning areas			
4	Productive meetings are held to share experiences, ideas and strategies			
5	Productive meetings are held to review, evaluate and improve units			
6	Mechanisms or processes are in place to keep the school staff informed about developments with the *Primary Connections* program			
7	Developing a school scope and sequence chart that specifies science topics to be taught across terms and year/grade levels			

Any other comments

_____

_____

_____

_____

Thank you for responding to this questionnaire