

Can you teach an old dog new tricks?

A teacher's perspective on changing pedagogy using *Primary Connections*

by Michelle Lloyd

The National Review of the Status and Quality of Science Teaching and Learning (Goodrum, Hackling and Rennie, 2001) found that the teaching of science in primary classrooms is patchy. It recommended that primary teachers of science have access to quality professional learning opportunities supported by rich curriculum resources, such as are offered by the *Primary Connections* project. This study, using ethnographic techniques, was designed to examine how a change in my teaching pedagogy affected the educational outcomes in the learning area of Science for the children in my classroom. Through the use of the *Primary Connections* teaching and learning approach, I have been able to improve the learning outcomes of my students. They have become more confident in using scientific terminology and are more able to transfer their learning to new situations. The use of scientific investigations has also improved in my classrooms with the children now planning, conducting and evaluating their investigations independently. *Primary Connections* has also provided me with a teaching and learning model that I am now able to confidently use within my classroom.

Background

My experiences in education have been wide a varied over the past 13 years. They range from tutoring 1st Year students at the School of Environmental Biology while completing my degree to making volcanoes with Pre-Primary students at Marvel Loch Primary School, approximately 400 km east of Perth. Currently I am teaching 0.8 FTE in the Year 3/4 classroom. All of these experiences have contributed to my growth as an educational professional and have led me to where I am today.

I am employed at Sawyers Valley Primary School, located approximately 40km east of Perth. Sawyers Valley Primary School has a strong historical background and has developed a reputation for participating in new and

innovative programs. In December 2004, it was selected to participate in the trial of a new science program – *Primary Connections*. As the Science Learning area coordinator at the school I was one of two teachers asked to represent the school in this trial in 2005. At this point, I had no idea that *Primary Connections* would offer me a solution to my problem of improving my science curriculum. I believed it was simply an interesting opportunity and a chance to develop my own skills further.

Up until joining the Primary Connections program my pedagogical approach to the learning area of Science was to establish prior knowledge and then offer the students several experiences of a phenomenon. This has worked well for me and I have always had great success with my students.

Now that I have discovered that by using the *Primary Connections* 5Es teaching and learning model (engage, explore, explain, elaborate and evaluate) there is a more cohesive way for me to structure the learning experiences of my students. This has led me to question my teaching methods as well as the ways in which I assess my students. In January 2006 I was selected to attend the facilitator training in Canberra so that I may assist my school and others in their roll out of the *Primary Connections* program.

The *Primary Connections* Project

Primary Connections is an innovative and exciting new initiative linking the teaching of science with the teaching of literacy in Australian primary schools. It is a partnership

between the Australian Academy of Science and the Commonwealth Department of Education, Science and Training. *Primary Connections* provides a comprehensive approach to the development of scientific literacy and consists of a professional learning program supported by a rich curriculum resource.

The *Primary Connections* teaching and learning approach was constructed by elaboration of the 5Es model (Bybee, 1997). It is based on an inquiry and investigative approach in which children work from questions through investigations to constructing explanations and is therefore consistent with contemporary constructivist theory. The core commitment of a constructivist position is that knowledge is not transmitted from one to another, but is actively built up by the learner (Driver et al, 1994; p 5). With *Primary Connections* students are given opportunities to represent and re-represent their developing understandings using a wide range of texts and information communication technologies (ICT), and assessment is integrated with teaching and learning. See the article 'Primary Connections: Reforming science teaching in Australian primary schools in this issue for further details.

First taste of Primary Connections

When I first began teaching the unit 'Plants in Action' Term 1 2005, I felt that my teaching had become scripted and staged. The lessons were to be followed outlined in the unit of work and even the children asked me 'Mrs Lloyd, why are you reading from that book?' However I persevered and became more confident with the material as the unit progressed.

'Plants in Action' gives students the opportunity to observe and describe features of seeds and record observations. They are able to make observations and take measurements of seed germination and describe the stages in the germination process. Finally students are able to investigate the conditions required for plant growth. Even though the children already had a broad knowledge base about plants, I was able to develop concepts about lifecycles and the stages of plant development and growth. The children responded positively to the program and were keen to display their understandings through a variety of activities.

To judge the effectiveness of the program on just one unit is impossible, as is it impossible to talk about the pedagogical changes in myself as a result of one unit's work. However, this brief introduction provided me with a springboard for change. I was able to see how the new model of learning could be incorporated into my teaching. For the first time in my career as a primary teacher I began to question, is what I am doing good enough? How can I improve my teaching to make learning more meaningful for my students? Is there another way?

The impact on my teaching pedagogy

At this point in time, I have now taught three units of work under the *Primary Connections* trial—*Plants in Action*, *Spinning in Space* and *All Sorts of Stuff*. Having observed students and collected work samples, I feel I am now in a better position to reflect upon the impact of the program on my teaching pedagogy. I can now clearly identify the key areas in which the learning of my students have improved and the quality of my teaching has strengthened. They are the students' understandings of scientific concepts, their science investigations and my delivery of a cohesive learning program. I will provide real examples from the unit I have been teaching over the last term – *All Sorts of Stuff*. These are purely anecdotal observations but I feel they are vital not only to my own reflections and analyses but provide real examples for other teachers to examine, critique and relate to their own experiences.

Increased understanding of scientific concepts

The unit *All Sorts of Stuff* introduced aspects of the Natural and Processed Materials strand. The purpose of this unit was to identify the properties of materials such as tensile strength and hardness, and how these affected the use of these materials in a variety of household objects. In the beginning of the unit we brainstormed words associated with materials and their properties. Initially the children came up with responses such as hard, soft, weak, and strong. All of these words were displayed as a Word Wall which was at the front of the classroom. The original responses of the children were added to *over the* term so that they could see how their vocabulary was developing. During the term, words such as tensile strength, opaque and transparent were added.

The children were then using these words as part of their written responses some of which were

'... you need to make a milk carton out of a material that has a high tensile strength. Otherwise the milk will run out'

Year 3 student

'... I have to have opaque stockings for dancing. That means you can't see through them'

Year 4 student

'Wow! The cellophane would not tear—it would just stretch. That must mean it has a high tensile strength.'

Year 5 student

Having taught these children for two consecutive years, I know that the capacity to use scientific terms correctly is newly developed. Previously their explanations were very simplistic and lacking in correct terminology. Now I found the children were using the Word Wall to spell terms correctly in their responses. They were also making **connections** to examples in their everyday world—for example the dancing stockings.

The Rainforest House

To allow the children to demonstrate their understandings of the scientific concepts developed in *All Sorts of Stuff*, the children were given a task to complete that related to the topic we were studying in Language. The children were asked to design and build a rainforest home and design a uniform that an exploration team would wear when working in the rainforest. The focus was on the materials they would choose to construct their home and the properties that would make it suitable for this purpose.

The children came up with some amazing connections. It demonstrated to me that they had a deep understanding of the concepts that had been covered during this unit as the children were able to apply their knowledge to a completely new situation. They were able to identify materials suitable for their constructions and relate this choice to the properties of the material. Here are some examples.

'This is the uniform we would wear in the rainforest. We would make the shirt and long pants out of cotton because cotton is cool and it would be hot in the rainforest. We would wear rubber boots so that when we were crossing rivers our feet don't get wet – rubber is water proof you know. If we were stuck in the rainforest, we would carve our helmets out of wood because wood is really strong. It would be silly to make a helmet out of paper!'

'Our house is built on stilts. That means that our house can't be flooded and cool breeze can flow around the bottom of our house. We need to build the poles for the stilts out of wood because it is strong. At the front of our rainforest house, we will put a big tarp made of plastic. Plastic is good because it is strong and will keep out the rain. We will use clear plastic so that it will let in the light too'

These are but some examples of the work that the children have produced as part of the Evaluate phase. They have been able to connect and apply their understandings to new and unfamiliar situations. The focus was on the material and its properties and the suitability of that material for a particular use. Every group was able to demonstrate that understanding. Success number 1!

Well planned science investigations

I feel this is the area in which improvements in the learning outcomes of my students are most noticeable. Before using the *Primary Connections* teaching and learning approach, my investigations were limited in their structure and effectiveness. Now, the children in my class are able to independently plan, conduct and evaluate their own investigations. At any one time, there may be several different investigations occurring in the classroom depending on the interests of the group.

From the structured investigations of the *Primary Connections* Units, I have developed my own Investigation Planners that the children are able to use when planning their own investigations. The children also have more ownership of the topic of their investigations due to the responsibility they now take in the planning phase.

I am more able and confident to manage the equipment required for investigations and the time provided for their successful completion in the classroom. It is possible for the class to spend a day working on an investigation from the planning and conducting to the evaluation of their results in the form of a formal report.

The children have more confidence in the investigations that they do and are able to share the organizational roles within their group to complete the work successfully.

Cohesive learning program

The use of the 5Es model in *Primary Connections* has allowed me to develop the conceptual understandings of my students in a more cohesive

manner. Rather than examining several phenomena in the one strand, I am now able to fully develop several key concepts – allowing the children to make connections to their previous understandings and construct their own meanings.

I have also used the 5Es model to plan and program other units of work. This is a valuable tool for me. When I first became involved in the *Primary Connections* program I was not sure what to expect and how this new program would impact on me and the children in my class. What soon became clear was that for some students, my change in methodology allowed them to demonstrate outcomes that had not previously been evident. Without the *Primary Connections* program I would not necessarily have made use of certain techniques and lesson structures to assist these children.

Conclusions and implications

So why is this in depth analysis necessary? What do I as an educator get out of this self-reflection? It gives me the opportunity to examine concrete examples of how the *Primary Connections* program has improved the learning outcomes for my students. This is demonstrated in the responses they give in answer to a challenge and the way in which they are able to apply their knowledge to new situations.

These stories allow me to confirm that I am on the right track and that the implementation of this new program is worth all of the effort on my part to ensure quality learning experiences for the children I teach.

On this journey I have reflected on two specific research questions

1. What has been the shift in my pedagogy as a result of my involvement in the *Primary Connections* program?

Before taking part in the Primary Connection initiative, my learning programs always offered a selection of different activities centered on a given topic. Now I confidently use the 5Es constructivist model to plan my units of learning.

2. How has my changing pedagogy as a result of the *Primary Connections* program impacted on the learning outcomes of my students?

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structure and effectiveness. Now, the children in my class are able to independently plan, conduct and evaluate their own investigations. At any one time, there may be several different investigations occurring in the classroom depending on the interests of the group.

The increased understanding of scientific concepts was demonstrated in the Evaluate lessons. This phase allows teachers to assess the children's understandings and their ability to transfer their knowledge to a new situation. The children's increase in scientific knowledge was also evident in the student's use of correct terminology.

The implications from my study are simple. Can you teach an old dog new tricks? Well in my case you can. As an experienced teacher of science, I have been able to embrace a new pedagogical style to incorporate into my teaching. I have seen the improvement in the learning outcomes of my students.

Hopefully this may inspire other teachers to be brave enough to investigate new methods of teaching to improve what they are already doing in the classroom.

References

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