Increasing student participation in science investigations in primary schools: The *MyScience* initiative

By Anne Forbes and Gerry McCloughan

MyScience (www.myscience.edu.au) is a pioneering primary science initiative that uses a distinctive team approach, with primary teachers, primary students and volunteer mentor scientists working collaboratively as students conduct authentic scientific investigations to find answers to their own questions. The initiative is distinctive in that structures to support teacher professional learning, teaching and learning practices and school-community engagement are profoundly integrated in the underpinning educational model. _MyScience_ takes advantage of external awards schemes as a motivational vehicle to bring participants together, providing a powerful setting for the development of common understandings about the purpose, level and quality of the scientific investigations that students conduct. Participation and evaluation data from a funded pilot indicates that the initiative has been successful in engaging students in quality scientific investigations in which they are empowered to make decisions in a science context and feel confident to discuss the learning associated with their work. Access to the underpinning educational model and key implementation resources will be freely available to all schools.

Helping to Move Primary Science Education Forward

School science education should be about students developing an interest in science ideas and learning, and fostering *a curiosity and willingness to speculate and explore the world* (from ACARA 2009; also see Tytler, 2007). These are generally accepted components of scientific literacy - the key driver for Australian science education policy and curriculum development (Goodrum, Hackling and Rennie, 2001; Goodrum and Rennie, 2007). The Shape of the Australian Curriculum: Science proposes a national science curriculum focus for Year 3-6 students that includes *recognising questions that can be investigated scientifically and investigating them* (ACARA, 2009, p. 5 & 7). A move towards scientific literacy requires the primary teachers who design and facilitate student learning experiences to have, along with a knowledge of science concepts associated with curriculum content, inquiry skills, creativity, confidence, and an ability to be flexible.

As *many primary teachers, both preservice [sic] and inservice, lack confidence in their background knowledge and competence in teaching Science* (Fensham, 2008, p. 56), and their education is by necessity generalist, the issue is one of how best to support primary teachers in the science learning area. *MyScience* is distinctive from other initiatives designed to support primary science teaching and learning because of the nature of its collaborative team approach (of teachers, students and 'scientist' mentors) and its specific focus on working with primary students to carry out their own scientific investigations by 'thinking and working scientifically' (Hackling and Garnett, 2005). This paper reflects on and reports some of the findings and achievements of the *MyScience* pilot, 2006 – 2008; emphasises the importance of the systematic implementation of the five elements of the educational model for effective sustainability; and then considers how the future directions being instigated in 2009-2010 might address the challenges identified in the pilot.

An Urban-Based Community-Linked Primary Science Project

Within Australia, various initiatives have been undertaken to approach the problem of transforming science teaching and learning through

> *embedding teacher professional development within a school context and paying attention to the different layers through which teachers relate to students, colleagues, school leadership and the community* (Tytler, 2007, p. 191).

The Victorian *School Innovation in Science* (SIS) project (2000 -2002) and recently reported school-community-linked science initiatives in rural settings (Tytler, Symington, Kirkwood and Malcolm, 2008) concluded that such strategies offer great promise for incorporation into mainstream science curricular activities. Commenting on the effectiveness of school and community-linked projects in fulfilling the *promise of satisfying many of the conditions for an engaging and meaningful science education.* Tytler (2007, pp. 52-53) states that:

It is quite striking, in SIS, how most of these community-linked projects occur in rural schools and in clusters. It is possible that the linking of school and community is easier to achieve in rural towns where teachers have more embedded relations with community members and the school is a more overtly acknowledged community resource… More research is needed on the conditions under which these projects succeed, on how the link between school and community is constructed, on how they might best be promoted in metropolitan areas, on what learning outcomes proceed from them, and on the ways they might best be embedded in the science curriculum. There is a need to develop models of school and community links that are both embedded and sustained. It seems that often they are initiated and kept alive by the actions of enthusiastic individuals. We need such partnerships and programs to be more common in the mainstream delivery of Science.

MyScience has evolved as an urban school-community initiative which tentatively suggests likely 'conditions' for replicating rural successes and has produced evidence of 'learning outcomes' proceeding from its approach (see the 'Outcomes of the *MyScience* program' section). The school-community model underpinning *MyScience* provides an indication of how the initiative could be 'embedded in the science curriculum'. Furthermore, the *MyScience* project partially addresses Rennie's (2007, p.184) call for

more comprehensive evaluation… (of community-based) science programs to judge their effects in both the short and long term, and to examine the reasons for them.

The Model Underpinning the MyScience Initiative

The underpinning rationale of *MyScience* is the notion of creating an integrated and supportive context within which participants' skills and confidence in 'investigating scientifically' are built through scaffolded learning experiences that promote independence and autonomy. The focus on *increasing the use of open-ended activities and students working in groups* (Goodrum and Rennie, 2007, p. 15) with a consequent move *away from teacher delivery of knowledge* and a focus on *discussion, open questioning and higher-order conceptual explanation* (Tytler, 2007, p. 47), the authors believe, will improve interest in Science for primary students and their communities and will improve scientific literacy outcomes, as articulated in *Re-imagining Science Education*. Consequently, professional learning in *MyScience*, engages primary teachers in the processes of scaffolded open-ended scientific investigation and supports them to establish purposeful learning environments within which students will 'investigate scientifically'. These learning environments make use over time of well-briefed 'scientist' mentors dedicated to student teams, as well as of the encouragement of the wider s school community.

The *MyScience* model consists of five interrelated elements (see Figure 1):

1. Collaborative professional learning for primary teachers;
2. Clear achievement criteria;
3. Supporting primary students to investigate scientifically;
4. Scientists mentoring primary students; and
5. Celebrating achievement.

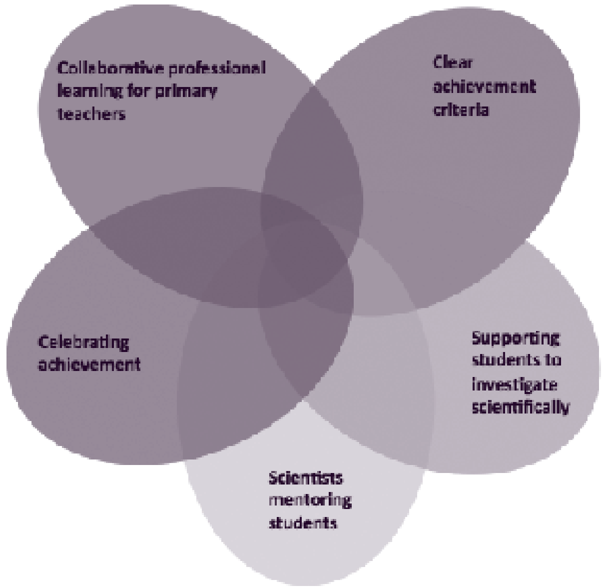

Figure 1: The five elements of the *MyScience* model.

Element 1: Collaborative Professional Learning

MyScience values teacher collaboration on several levels as teaching is a social activity, and *curriculum change requires mutually supportive interaction amongst teachers, and effective leadership, either by key teachers or administrators within the school* (Goodrum and Rennie 2007, p.19). Hence, in an initial professional learning workshop a minimum of two primary teachers from a school collaborate with each other and other school teams in the adaptation of learning from explicit instructions about investigating scientifically. Thereafter, a facilitator provides customised support directly (in the classrooms to school-based teams), and remotely (online and/or telephone). This is an optimal approach to teacher professional development as it combines in-school and out-of-school experiences, with multiple and ongoing opportunities for cross-collaboration. As Tytler argues, teachers need to be supported in any significant science curriculum initiative by resource development and *a significant professional learning approach that allows local control and contextual variation; that attends to teacher beliefs, and is supported in local areas through networks and consultants.* (2007, p.62) These features are evident in the *MyScience* initiative, where, for example, collaboration between secondary schools and their local feeder primary schools is specifically encouraged and was successfully sustained in one location in western metropolitan Sydney during the pilot.

One aspect of the collaborative nature of teacher learning in *MyScience* is that it occurs over an extended time. This is a requirement for effective primary teacher science professional development programs *so that the new ideas put to the teachers can be tried out in school* (Fensham, 2008, p. 41) and that teachers have time *to reflect on their current practices, implement new activities/ideas/resources into their classrooms, and then can reflect upon the effects on their teaching and students' learning* (Goodrum and Rennie, 2007, p. 19).

Element 2: Clear Achievement Criteria

The focus for this element is to encourage teachers to use explicit criteria to guide and assess students as they perform scientific investigations. The Science Teachers' Association of NSW (STANSW) *Young Scientist* awards provide such a set of criteria, along with a rubric that describes levels of performance (Young Scientist Awards, 2010). The rubric provides participants with a way to judge the quality of students', investigative reports, as well as being a tool to assist teachers in focusing instruction across a class.

The concept, design, content and delivery of *MyScience* is clearly articulated through seven distinctive phases of implementation (Table 1). These phases provide a framework that guides participants as they work collaboratively. School principals play a key outreach role for their school communities in the *Orientation*, the *Teaching Phase 2* and the *Celebration*. Facilitators are primary science education experts who provide customised support to participating classroom teachers and school leaders. Teacher feedback indicates that Element 2 provides positive pressure to support them to reach their teaching goals.

Element 3: Supporting Students To 'Investigate Scientifically'

MyScience primary students are supported to scientifically investigate their own questions, usually based around a class theme. Examples of questions include: 'Which is the windiest part of the school?', 'Does exercise improve your memory', and 'Which type of fertiliser is best for growing nasturtiums?'. Proponents of student participation in authentic scientific activities indicate that students

> *should be involved in investigating questions they themselves pose, reasoning and argumentation activities, and undertaking investigations that relate to societal and personal contexts' (Tytler, 2007, p. 49).*

This can be achieved through

> *supporting students to apply their scientific and technological knowledge to practical problems in their lives and local communities and to take interest and action in relation to larger society concerns where Science and Technology are central parts of understanding and responding to issues* (Lemke, 2005).

MyScience teachers introduce the skills of investigating scientifically and these are then applied with the support of scientist mentors from local business/industry, universities, high schools and the school community.

Element 4: Scientists Mentoring Students

A keystone of *MyScience* is the use of scientist mentors - people who have a science- based qualification or long-term experience in science or technology-related careers. Scientist mentors come from a wide range of organisations and backgrounds. They can be scientists from research and industrial organisations; university and pre-service secondary science teachers; science teachers from local secondary schools (at times with Year 9/10 students filling an apprentice role) or parents and other school community members.

In the *MyScience* pilot, mentors came from ResMed, BASF, the Australian Catholic University, the University of Western Sydney (UWS) and the University of Sydney. The mentors provide students with insights into the importance of posing questions, considering possibilities and testing hypotheses. Mentors also provide support to primary students and teachers with science knowledge and advice both in the classroom and online (between school visits). While primary teachers focus on scaffolding the process of investigating scientifically in *Teaching Phase 1*, scientist mentors provide scientific and technical advice as students move into *Teaching Phases 2* and *3*.

School-community-linked initiatives with science professionals demonstrate the relevance of Science in everyday life to school students (Goodrum and Rennie, 2007) and showcase the contemporary nature of Science as a collaborative enterprise in community-based work settings (Tytler, 2007). This element of *MyScience* models for students how they could engage with science ideas in a community setting once they leave school, and therefore is an important component of a school science curriculum.

It is not, however, only school students who benefit from 'rubbing shoulders' with science professionals in the community. In *MyScience*, primary teachers have the opportunity to develop their knowledge and understandings of science content and skills through interactions with Scientist Mentors, thus addressing Fensham's call for,

PHASES OF TEACHING AND LEARNING	KEY PROCESSES
Orientation (3-4 Weeks)	School awareness – identifying and briefing participating schools, Scientist Mentors and system supports. Planning by hub leadership team.
Introductory Professional Learning (1-2 Weeks)	New knowledge and skills for teachers in authentic scientific investigation, including aspects of experimental design, data collection and analysis, and scientific reporting. Support in innovative assessment practices. Support to use online mentoring facilities to maximise mentor support.
Teacher Preparation (1-2 Weeks)	Collaborative reflection and consolidation; planning for teaching with continued support from a facilitator.
Teaching Phase 1 [High Direction] (3 Weeks)	Teachers introduce investigation skills to their students with continued support from a facilitator.
Teaching Phase 2 [Mentored Exploration] (3 Weeks)	Students apply learned skills and concepts to their own scientific investigations based around a programmed class theme or topic, mentored by practising scientists via classroom visits (two to three classroom visits over this phase and the next).
Teaching Phase 3 [Independence] (4 Weeks)	Scientist Mentors continue to provide scientific and technical advice to primary students via classroom visits and a secure online environment.
Presentation And Celebration (2 Weeks)	Acknowledgement through school display and celebration. Students' projects are appraised at a local level and submitted to a state-level awards scheme run by their State Science Teachers Association.

Table 1: Phases of teaching and learning in *MyScience*.

> *teachers in primary schools needing to increase their science knowledge and have access to science specialists to mentor their ongoing learning through the development of networks including secondary teachers and focused professional development* (2008, p. 91).

Element 5: Celebrating Achievements

Support for schools in addressing community awareness of the importance of science education is another designated component of *MyScience*. Schools are encouraged to engage the community through such activities as school-based science fairs or simply through the sharing of findings with other classes and the wider school community. Later, student projects are entered into a state-based awards program – *MyScience* utilises the STANSW Young Scientist Awards. State-based award schemes often provide written feedback to students, which by its positive nature, reinforces learning. Additionally there is potential for further acknowledgment of high-performing students, bringing recognition and valuing of science education to the school community. School-based celebrations provide an authentic component of accountability for students' work and an opportunity to celebrate the learning that has occurred. It also contributes to 'improved community understanding and awareness about science'. This is important as

> *poor community understanding of what Science is about, and what scientists do, results in ignorance about the extensive range of career options available for students who continue their participation in Science* (Goodrum and Rennie, 2007, pp. 9-10).

In *MyScience* families are involved in celebrating achievements and this support can influence students' selection of Science in later school years, as referred to by Tytler (2007).

MyScience embraces user-generated materials such as those created by schools, teachers and mentor organisations. *MyScience* examples include role statements, scaffolds for investigating scientifically, mentor recruitment posters and Science Fair invitations. In the pilot, communities of schools held combined *MyScience* celebrations, further reinforcing the importance and valuing of a collaborative approach.

The Development and Success of MyScience

MyScience was conceived out of an identified need. Early in 2006, the Science Foundation for Physics of the University of Sydney convened a meeting to initiate discussion around ways for the university to provide significant support for primary science education. A project team was established comprising representatives from the Foundation (Chris Stewart and later Adam Selinger), the NSW Department of Education and Training (NSWDET) (Anne Forbes and Gerry McCloughan), and IBM (Bettina Cutler). The Australian Catholic University (ACU) also became a foundational partner when Forbes joined its staff. To date, the program has been funded by small donations and sizeable in-kind support from the four founding partners – ACU, IBM, Western Sydney Region of the NSW DET, and the Science Foundation for Physics.

A *MyScience* pilot began in 2006 with a program in two primary schools – one in the Western Sydney Region (WSR) and one in the Northern Sydney Region (NSR) of NSW DET. By 2010, *MyScience* had expanded to include nine primary schools in both the Catholic (Parramatta CEO) and public education sectors, thirty primary teachers, over 1000 primary students (Grades 1-6 across all ability levels) and 140 volunteer scientist mentors. Anne Forbes, NSW School of Education, ACU and Gerry McCloughan, WSR NSW DET, designed and described the educational model that underpins the *MyScience* program. The period 2006 – 2008 saw the development and implementation of a 'hub' approach, where feeder primary schools were encouraged to work with their local secondary school.

In 2008, *MyScience* won the national B-HERT (Business and Higher Education Round Table) Award for *Best Collaboration in Education and Training*. In 2009, the Ian Potter Foundation generously provided a $50,000 grant to develop and trial an online professional development resource for primary teachers in order to facilitate the expansion of the program.

The years 2009 and 2010 are proving to be a period of consolidation during which the project team is exploring opportunities and supports for scaling up *MyScience*. There has been some evidence to suggest that weakening of any of the five key elements of the *MyScience* educational model reduces its effectiveness and sustainability, and this will be reported on in more detail in a future publication. A significant challenge is presented in coordination of supports across a community of schools, and electronic media are being developed to meet that challenge.

Outcomes of the MyScience Program

MyScience aims to increase student participation, satisfaction and quality in scientific investigation in primary schools, leading to better student attitudes towards and interest in Science. This has been realised at a number of levels, including the following: The numbers of schools, teachers and mentors participating in *MyScience* increased dramatically over 2006 - 2008, as shown in Table 2. Note that the project team has not sought to expand the number of schools participating in *MyScience* in 2009 - 2010, as efforts have been devoted to consolidation of the program and resource development to enable 'scaled up' delivery of the program beyond 2010.

	2006	2007	2008	2009	2010
	PILOT			CONSOLIDATION	
SYDNEY LOCATION	DET WSR AND NSR	DET WSR AND NSR	DET WSR AND NSR	DET WSR AND NSR	DET WSR AND NSR CEO PARRAMATTA*
# primary schools	2	4	10	9	9
# secondary schools	0	2	2	1	0
# primary teachers	2	9	31	30	34
# secondary teachers	0	5	8	3	0
# primary students	60	270	930	900	1020
# secondary students	0	12	25	0	0
# mentors	15	40	80	100	120

*DET = NSW Department of Education and Training
WSR = Western Sydney Region
NSR = Northern Sydney Region
CEO = Catholic Education Office

Table 2: Numbers of schools and participants in *MyScience* 2006-2010 in the Sydney metropolitan area.

Table 3 shows the numbers of *Young Scientist Awards* that have been achieved by schools for the period 2006-2009. The number of award-winning *MyScience* projects indicates that *MyScience* provides participants with the necessary knowledge, skills and understandings to perform and report on scientific investigations at the highest level.

	PILOT YEARS		CONSOLIDATION YEARS		
	2006	2007	2008	2009	2010
Awards to *MyScience* entries	3	2	13	3	tbc
Awards to Non-*MyScience* entries	7	8	13	23	tbc
Total awards	10	10	26	26	tbc
% total awards given to *MyScience* entries	30%	20%	50%	11%	tbc

Table 3: Numbers of K-6 *MyScience* entries achieving *Young Scientist Awards* 2006-2009.

Schools have implemented *MyScience* in a variety of ways. Most pilot schools, with the exception of one which decreased its involvement, chose to increase uptake through additional teachers and across more classes. *MyScience* has become part of the educational and cultural practice in these schools, as evidenced by the following comments from principals and teachers captured on video footage, which is available on the *MyScience* website.

Principal comments:

> *MyScience has allowed my senior students to become far more interested in Science, they are now talking about it amongst their peers, their teacher is now becoming more creative in what she is doing and she is talking about it in the staff room as well. They (students) have become very interested, they talk about it. They are actually now bringing their work to me that they are doing in their own timeframe, not necessarily just what's happening in the school and they are taking that further to things around their home and what they are seeing and hearing in the news.*
>
> *MyScience has lifted learning outcomes for students. The students are taking a much greater interest in Science. They are eager to work out what they can investigate... The community are aware of what the program is about and we've invited parents who actually have scientific backgrounds to come and work with the students and because of the nature of the program we've been able to get mentors from local businesses and we've also been able to tap into mentors who have come from the high school – not only the high school science teachers but also senior students in the high school come down and work with our students. Last year we started off with two classes and now we're up to five classes doing it and we're spreading it to the rest of the school.*
>
> *… really lifted the discussion levels in the staff rooms… teachers are talking Science. MyScience has highlighted the teaching of it.*
>
> Primary principals video (2008).

Primary teacher comments:

> *… it's made me more confident in teaching the practical aspects, MyScience has given me more structure so that I know which way to lead the children in their thinking.*
>
> *They love the option of actually being able to do their experiment.*
>
> *I think that it's a bit frightening at first. At first we felt that we weren't delivering those outcomes. We thought they were just playing but then we realized, 'no', by the time you're working yourself through it you realize how much they've learnt and how much they've got out of it.*
>
> *My attitude has definitely changed. I am now a little more confident of teaching Science. Before I would say 'no way', I would teach anything but Science, but these days it's getting a little bit better.*
>
> *It's made them (the students) more able to understand what they are learning about. They can reason as to why things have happened, they can relate it to the world around them whereas normally they've just learnt in isolation.*
>
> *There's a lot of preparing that has to go into it, there is a lot of pre work but the rewards for the children and as a teacher at the end are just really worth the effort that goes into it.*
>
> Primary teachers video (2008).

Student comments gathered anonymously through an online survey in 2007 in response to the statement 'I enjoyed being part of the *MyScience* program because…' include the following:

> *… it is fun to do the experiments and watch what happens.*
>
> *I got to meet scientists from uni and it was fun.*
>
> *Knowing more Science is useful because understanding can help you figure things out. Recognising Science is useful because we can do experiments relating to what we have seen. MyScience helped me with both of these things.*
>
> *It was extremely exciting being part of this wonderful program. My mentor was very encouraging, gave me great advice and gave me a lot of support. MyScience was a very valuable program and should occur every year!*
>
> *It was great. I got to meet new people [sic], find out important information and now I'm serisly [sic] considering a future job as a scientist.*

MyScience – A Comparison with other Australian Primary Science Community-Linked Initiatives

The School Innovation in Science (SIS) program (2000-2002) focused on the generation of specific school-based 'action plans' that had

> *a focus on teaching and learning and took into account particular school conditions and goals* (Tytler, 2006, p. 91).

The *Australian School Innovation in Science Technology and Mathematics* (ASISTM) program (2005-2008) focused on community projects, with particular emphasis on the

> *alignment of teachers and outside experts in a partnership around a project that represents contemporary practice*' (Tytler, Symington, Smith and Rodgrigues, 2008, p. 14).

Photo 1: The steps of investigating scientifically.

The *Scientists in Schools program* (2007+) aims to bring together interested teachers and scientists with a view to establishing and maintaining

> *sustained and ongoing partnerships between scientists and school communities as a means of developing more scientifically-literate citizens* (Howitt, Rennie, Heard and Yuncken, 2009, p. 35).

Each of these programs has provided, and continues to provide, valuable items on the menu of educational delivery. *MyScience* offers a collaborative framework for learning Science which appreciates the value of the socio-cultural nature of student learning as advocated in *Re-imaging Science Education*. It would appear that the *MyScience* model could partially fulfill Tytler's (2007) goal of determining conditions for sustainable science education that interests students in urban settings. This paper is the first attempt to describe to the profession some of the achievements and challenges experienced in developing and sustaining a grass roots initiative. We have had some success, we are marking time, we are developing resources,

Photo 2: Students investigating scientifically - Which soil is the best growing medium?

Photo 3: Science Fair presentation - Does the weather affect your pulse?

and the authors welcome discussion of the model and the contribution that it can make to addressing the identified need of providing significant support for primary science education.

Open-source online professional learning resources for primary teachers are currently being developed and trialled through collaboration between *MyScience* and the NSW Department of Education and Training's Centre for Learning Innovation, funded by a grant from the Ian Potter Foundation. An announcement on the *MyScience* website www.myscience.edu.au will be made when these resources are freely available.

Acknowledgement

The authors would like to acknowledge the advice and input of Keith Skamp, Adjunct Professor at the School of Education, Southern Cross University, in the structure and presentation of this paper.

References

ACARA (2009). *Shape of the Australian Curriculum: Science*. Retrieved August 31, 2009 from http://www.acara.edu.au/verve/_resources/Australian_Curriculum_-_Science.pdf

Fensham, P. (2008). *Science education policy-making: eleven emerging issues*. UNESCO. Retrieved 17 February, 2009 from http://portal.unesco.org/education/en/ev.php-URL_ID=55830&URL_DO=DO_TOPIC&URL_SECTION=201.html

Goodrum, D. & Rennie, L. (2007). *Australian School Science Education: National Action Plan* 2008–2012, Volume 1, The National Action Plan, Department of Education, Training and Youth Affairs, Canberra. Retrieved August 31, 2009 from http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/Australian_School_Education_Plan_2008_2012.htm

Goodrum, D., Hackling, M. & Rennie, L. (2001). *Research report: The status and quality of teaching and learning of Science in Australian schools.* DETYA. Retrieved February 28, 2009 from http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/status_and_quality_of_science_schools.htm

Hackling, M. W. & Garnett, P. J. (1995). The development of expertise in science investigation skills. *Australian Science Teachers Journal*, 41(4), 80-86.

Howitt, C., Rennie, L., Heard, M. & Yuncken, L. (2009). The Scientists in Schools project. *Teaching Science*, 55(1), 35-38.

Lemke, J. (2005). *Research for the Future of Science Education: New Ways of Learning, New Ways of Living.* Opening Plenary VIIth International Congress on Research in Science Teaching Granada, Spain. Retrieved August 31, 2009 from http://wwwpersonal.umich.edu/~jaylemke/papers/Granada%20Future%20Science%20Education.htm

Primary teachers video (2008). Retrieved April 26, 2010 http://e-learn.acu.edu.au/tlc/videos/primary_school_classroom_teachers.mov

Primary principals video (2008). Retrieved April 26, 2010 http://e-learn.acu.edu.au/tlc/videos/primary_school_principals.mov

Rennie, L. J. (2007). Learning Science outside of school. In S. K. Abell & N. G. Lederman (eds.), *Handbook of Research on Science Education* pp 125-167. New Jersey: Lawrence Erlbaum Associates.

Tytler, R. (2006). *School innovation in science: change, culture, complexity*. K. Boersma et al. (eds.), Research and the Quality of Science Education, 89—105. © 2005 Springer. Printed in the Netherlands.

Tytler, R. (2007). Re-imagining Science Education: engaging students in science for Australia's future. *Australian Education Review* No. 51. Australian Council for Educational Research, ACER Press. Retrieved March 19, 2009 from http://research.acer.edu.au/aer/3/

Tytler, R., Symington, D., Kirkwood, V. & Malcolm, C. (2008). Engaging students in authentic Science through school-community links: learning from the rural experience. *Teaching Science*, 54 (3), 13-18.

Tytler, R., Symington, D., Smith, C. & Rodrigues, S. (2008). *An Innovation Framework based on best-practice exemplars from the Australian School Innovation in Science, Technology and Mathematics* (ASISTM) Project. DEEWR. Retrieved August 31, 2009 from http://www.dest.gov.au/NR/rdonlyres/2970B4E8-1A29-4AB4-BA4D-CFA567F81D0D/20064/FINALASISTMInnovativeFrameworkReport_Feb08_.pdf

Young Scientist Awards (2010). Holistic assessment rubrics. Retrieved April 7, 2010 from http://www.stansw.asn.au/ys/categories.htm TS

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