Scientists in Schools

"Science Has Changed My Life!"

Evaluation of the *Scientists in Schools* Project 2008-2009

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Executive Summary

The Scientists in Schools (SiS) project is an initiative of the Australian Government Department of Education, Employment, and Workplace Relations, whose Quality Outcomes Programme provided funding to the Commonwealth Scientific and Industrial Research Organisation to manage the project. SiS began as a Pilot Project during July to December, 2007, and after this successful pilot stage it was continued into 2008 and 2009. The expanded project retained the same aims as the Pilot Project, which were to

bring the practice of real world science to students and teachers,
inspire and motivate teachers and students in the teaching and learning of science,
provide teachers with the opportunity to strengthen their knowledge of current scientific practices,
enable scientists to act as mentors or role models for students,
broaden awareness of the types and variety of careers available in the sciences,
enable teachers and scientists to share ideas and practices with other teachers and scientists, and
increase scientists' engagement with the broader community, thus raising public awareness of their work and its social and economic importance.

This document reports an independent evaluation of the expanded SiS project. The evaluation was based on data collected through the analysis of evaluation forms completed by participants at the three regional SiS symposia held during 2008 in Hobart, Townsville and Melbourne; five focus groups and 34 interviews involving a total of 34 scientists and 30 teachers, together with 12 longitudinal case studies of SiS partnerships in Canberra, Melbourne and Perth; student data collected from 9 of the case study schools; and feedback from an online survey held at the end of 2008. The online survey achieved a proportionally representative national sample of 256 scientists and 274 teachers from every Australian state and territory, every school type, and from schools located in capital and regional cities, rural and remote areas. These data were supplemented by interviews with the Scientists in Schools Project Officers (SiSPOs) relating to the regionalisation of SiS partnership management. Further, with assistance from members of the central Project Team, the effectiveness of the SiS website and database, and trends relating to the number of partnerships, were examined.

Conclusions

Progress of SiS Following the Pilot Evaluation

The evaluation of the SiS Pilot Project made four recommendations relating to the continuation of the SiS project; the maintenance and extension of its website; the provision of additional support to partnerships, particularly in terms of net-working opportunities; and a further evaluation after allowing time for the real outcomes of the project to become evident. The first three of these recommendations were implemented and the extended time frame and additional support allowed most of the partnerships to mature into stable, effective relationships. By May, 2009 over 1100 scientist-teacher partnerships were in place, and the position then was one of a viable, supported project which had significant benefits for the great majority of its participants. This document is a result of the implementation of the fourth recommendation. It reports the results of the evaluation of the extended project and provides information about the nature of partnerships and the determinants of their longevity, the effectiveness of SiS management, the challenges experienced and steps taken to overcome them, significant outcomes and achievements and recommendations for the future effectiveness and efficiency of SiS.

Nature of SiS Partnerships Established

Description of partnerships

At May 1, 2009, 1107 scientist-teacher partnerships were registered in 891 schools located in every state and territory, in every school sector, and in all kinds of geographical areas. Proportionally more secondary than primary schools were involved in SiS. By the end of 2008, about 70% of partnerships were running activities and about 22% were involved in planning, but around half of these latter partnerships were less than 2 months old.

SiS activities tended to occur predominantly at the upper primary level in the content area of living things, however, all year levels and content areas received some attention. The least covered content area was mathematics. Further, activities that promoted the curriculum theme of working scientifically (which covers all content strands) was a major focus, particularly in primary schools. The most common activities involved scientists visiting schools to interact with students, assisting the teacher with science content, and raising students’ awareness about careers in science.

There is no one, typical kind of partnership and this diversity is demonstrated in the 12 case studies reported. Partnership activities depend on contextual factors, including the scientist’s speciality and location, the year level of the students, content area of the curriculum, the structure of the school and the flexibility allowed by its timetable, its facilities and enthusiasm of its staff, and the circumstances of the scientist’s employment. These results reiterate a key finding of the Pilot Project evaluation: The ability of the SiS project to allow flexibility and variation in activities is a strength, because it allows the scientist and the teacher to take ownership and control of their partnership.

Partnership targets

The nominal target number of partnerships for SiS was 1500 by the end of June, 2009. At the end of April, 2009, there were 1107 partnerships recorded as assigned, active, closed or dormant. Data from the evaluation highlighted the need for constant monitoring to keep in touch with what is happening in partnerships. A major challenge for the SiSPOs was managing the dual tasks of making new partnerships to meet their assigned target, and monitoring the partnerships they already had in their region to keep them active. Six of the nine SiSPO regions were between 25% and 50% under target. Targets need to be examined carefully to ensure that they are realistic, not only in terms of being achievable, but also able to be maintained in the amount of time SiSPOs have to work with them.

Effectiveness of SiS Management

The management model which had proved effective in the SiS Pilot Project was retained for the continued project. The major change was the devolution of partnership management to the SiSPOs, beginning in July, 2008.

Website and database

The website was expanded in line with the recommendations of the Pilot Project, refined and refurbished. It is used for registration and provides relevant information about, and resources for, the SiS Project, but it is not well utilised by SiS participants. The website deserves greater use, and needs continued promotion. The database containing partnership details was continually updated over 2008 to allow for the increased number of participants and access for SiSPOs. It is working effectively.

Contribution of SiS events

The two main kind of events run by SiS were the regional symposia held in Townsville, Melbourne and Hobart, and the networking/information events run locally, now often by SiSPOs. The symposia were well received by both scientists and teachers, and continue to play an important role in providing up-to-date information on specific science topics, and opportunities for face-to-face contact between teachers and scientists. It is important that the symposia retain the educational focus associated with the overall goal of SiS. Similarly, the networking and information sessions were important for making contact between scientists and teachers and providing examples of successful partnerships.

Regionalisation of SiS management by the SiSPOs

The regionalisation of the SiSPOs was successful in promoting SiS and for making and sustaining partnerships, where the SiSPOs' ability to make personal contact with participants and their local knowledge were considerable assets. Many SiSPOs had adapted their role to the specific environment in which they were located, and developed a range of methods to make and sustain partnerships, along with methods to deal with common problems arising in partnerships. However, four issues restricted the SiSPOs' effectiveness. First was the dilemma inherent in making partnerships at the expense of monitoring and sustaining existing partnerships. Second was the pressure to meet targets, with most falling well short. Third was the feeling of isolation, and ways to alleviate this must be considered. Fourth was the difficulty some SiSPOs experienced in dealing with both scientists and teachers, who work in quite different ways. Until they gain the necessary experience, SiSPOs require advice and assistance from the SiS Project Team.

Challenges Experienced and Steps Taken to Overcome Them

With an effective management structure, most challenges related to making and sustaining successful partnerships. Only some challenges to success in partnerships can be overcome by the management team, however, others depend on the goodwill of the people involved.

Challenges to successful partnerships

The first challenge is effective communication, which operates at three levels. At the first level, teachers and scientists must talk to each other frequently, either face-to-face or by email. Partnerships with effective communication had realistic and respectful expectations of each other, were able to make mutually satisfactory plans for activities and make those plans happen. Many struggling partnerships reported either that communication was unresponsive, had been lost, or that one partner didn't quite know what to do with the other. At the second level, principals must communicate with teachers, and scientists' employers must communicate with scientists, to ensure that participation in the partnerships is not only endorsed but supported, particularly in terms of the partner's work load. At the third level, scientists must be able to communicate with students. Some partnerships were at risk because there were communication problems at this level.

The second challenge is flexibility. The demands of their normal working life require both scientists and teachers to be flexible about fitting their communication and planning into their busy work schedule. Further, the SiS activities must be able to fit into the school day. Primary schools have two advantages here: both their timetable and the content of their curriculum are more flexible than in secondary schools. The usual requirement of secondary teachers to plan around subject disciplines, with a large amount of content to be covered, reduces flexibility to fit in SiS partnership activities. Further, the senior secondary level is additionally difficult, because the focus on assessment leading to post-school options can place significant pressures on teachers.

Challenges in sustaining partnerships

Due to factors such as lack of time and limited flexibility in their workplace, stress is placed on many partnerships and they need support to survive. When partnerships are stressed, sensitive counselling by the SiS Project Team can assist by offering ideas of alternative activities, acting as intermediaries when communication has broken down, and providing motivation to sustain partnerships. Regular opportunities for networking and occasional email newsletters help partners to keep in touch with SiS and maintain their enthusiasm.

Some scientists and teachers battled to maintain their partnership because they were not supported by their employer. Often this reflected a lack of importance attributed to SiS. A positive community profile for SiS must be maintained through promotion including publicity, particularly by schools and employers showcasing the positive outcomes of their involvement. In cases of individual hardship, where participants are funding their own travel or buying needed materials, the possibility of applying for some funds, which might be granted on a case-by-case basis, could make a significant difference to sustaining the partnership. Recognition for partners by their employers, such as allowing time flexibility, or including community service in an employee's work objectives, facilitates their involvement in SiS.

Significant Outcomes and Achievements

Perhaps the most important achievements of the SiS project are associated with its impact on students. Scientists and teachers were agreed that students benefited primarily from the opportunity to see scientists as real people, to increase their knowledge of contemporary science and also their interest in a science-related career. Further, students had fun, and given the widely perceived disaffection of many secondary students in science, this is an important outcome. A further outcome for students derived from the opportunity to experience science with practising scientists. According to scientists and teachers, students increased their ability to recognise and ask questions about science-related issues and awareness of the nature of scientific investigation.

Teachers enjoyed communicating and working with scientists, and also the opportunity SiS gave them to increase their students' engagement with science. Of great benefit to many teachers were the opportunities for professional learning, in terms of updating their knowledge of current science and scientific practices and methods.

Importantly, primary teachers reported educationally significant improvements in their confidence in teaching science through their involvement with SiS.

More than 90% of scientists considered it beneficial to them to communicate with students and they enjoyed working with them. Scientists also enjoyed the opportunity to communicate and work with teachers. Other benefits included opportunities to promote public awareness of science and also to better understand the community’s awareness of science, scientists and their work.

Recommendations

The synthesis of the evaluation findings indicates that SiS is a project that continues to achieve demonstrable benefits for scientists, teachers, and students. The following recommendations are aimed at improving the effectiveness and efficiency of SiS.

Recommendation 1
SiS should be continued and the following recommendations should be considered to ensure that it remains effective and efficient.

Recommendation 2
SiS targets need to be examined carefully to ensure that they are realistic, in terms of being both achievable and sustainable.

The notional SiS partnership target based on 15% of the schools in each region should be re-examined. Consideration must be given to the potential number of scientists available in each region, and their location, and this information used to refine the targets. The experiences of the current SiS Project Team, including the SiSPOs, should be used to predict what realistic targets might be in terms of the number of partnerships that can satisfactorily be managed given the time available to do so. With the current staff resources a realistic total number of partnerships is unlikely to exceed 1500.

Recommendation 3
The website should be updated as required, but not greatly expanded.

Recommendation 4
The database must be kept up-to-date in terms of its monitoring role, and also to reflect technical advancements.

Both the SiS website and the database remain fundamental to the registration process, and thus should be kept up-to-date in order to reflect the latest information relevant to the project. It is also recommended that advice to participants on what to do if their partnership is not progressing well be included under the Frequently Asked Questions section for easy reference. Further promotion of the resources on the website is advised.

Recommendation 5
The regionalisation of the SiS Project should continue, and the SiSPOs be continually supported in their roles.

The current SiS Project Team should work together to address the identified issues facing SiSPOs. As part of this process, it is recommended that SiSPO training workshops be held annually.

Recommendation 6
The symposia and networking sessions should be continued but their structure refined to ensure they address networking, partnerships, and maintain a focus on education.

Science topics chosen for symposia must be relevant to teachers and their classrooms, thus, a move away from theoretical contemporary scientific sessions to a more applied approach is recommended. As there are many different ways to develop partnerships, the symposia should provide frequent opportunities for small-group sessions to work through partnership pragmatics. These recommendations suggest the symposia should shift its balance a little from scientific lecture to partnership discussions.

Recommendation 7
Every opportunity should be sought to obtain positive publicity for the SiS Project and its outcomes.

Providing support to partnerships also requires promotion of the outcomes of the project. Publicity through various media outlets, including coverage of SiS activities by the local press, gives a boost not only to the students, teachers and schools, but also to the scientist and his/her organisation. The outcomes of SiS are positive and deserve attention.

Recommendation 8
Should SiS continue into the future, it is recommended that there be a further evaluation in the third year to ensure that the management and outcomes of SiS remain current and appropriate in the contemporary Australian educational context.

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Evaluation of the Scientists in Schools Project 2008-2009

Background to the Project

Scientists in Schools (SiS) is an initiative of the Australian Government Department of Education, Employment, and Workplace Relations, whose Quality Outcomes Programme provided funding to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the project from 2008 to June, 2009. A pilot project carried out and evaluated during Semester 2, 2007, revealed that the project had achieved considerable success during its short life, and showed promise of making a significant contribution to the promotion of science in schools and a greater awareness of science in the community. The pilot project was supported by Australia's Chief Scientist, Dr Jim Peacock, who championed the project, chaired the project's steering committee, and was significantly responsible for the mainstreaming of the project in 2008. Following his retirement as Chief Scientist in August, 2008, Dr Peacock continued his strong support of the project in his role as Chair, CSIRO Science Team.[1]

The aims of the 2008-2009 project remained the same as for the Pilot Project. They are that, through the establishment of sustained and ongoing partnerships between scientists and school communities, the Scientists in Schools Project aims to

1. bring the practice of real world science to students and teachers,
2. inspire and motivate teachers and students in the teaching and learning of science,
3. provide teachers with the opportunity to strengthen their knowledge of current scientific practices,
4. enable scientists to act as mentors or role models for students,
5. broaden awareness of the types and variety of careers available in the sciences,
6. enable teachers and scientists to share ideas and practices with other teachers and scientists, and
7. increase scientists' engagement with the broader community, thus raising public awareness of their work and its social and economic importance.

CSIRO Education managed the SiS Project by continuing the website established for the SiS Pilot Project. It was expanded, particularly with case studies of exemplary partnerships and other resources, and refurbished towards the end of 2008. The website remained a central component of the Project, allowing online registration of teachers and scientists, and the use of this information by Project Officers to form the partnerships by matching teachers with suitable scientists. The SiS Project Team was expanded during 2008 to assist in monitoring the increasing number of active partnerships. To increase contact between the Project Team and partnership members, a number of mainly part-time SiS Project Officers were employed to facilitate the forming and monitoring of the partnerships in assigned geographical areas.

As part of the SiS Pilot Project in 2007, a 2-day national symposium on a topic of major scientific importance, Energy and Climate Change, was held in Newcastle, and 50 teacher-scientist partners were invited to attend. The evaluation of the Pilot Project[2], indicated that

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[1] A videotaped message from Dr Peacock can be accessed from the SiS home page at http://www.scientistsinschools.edu.au/.

[2] Howitt, C. & Rennie, L. J. (2008). Evaluation of the Scientists in Schools Pilot Project. ACT: CSIRO. Available online at http://www.scientistsinschools.edu.au/evaluation.htm

participants reported increased self knowledge, increased awareness of what was happening in other partnerships, and were inspired and enthused. They appreciated the provision of resources/ideas for teaching, provision of excellent networking opportunities, information on how to engage students, demonstration of the types of research that CSIRO is involved in, and illustration of the importance and necessity of community scientific literacy. The symposium also provided an excellent opportunity for partners to become familiar with each other. There was strong support in the evaluation for a continuation of the symposium.

The success of the Newcastle Symposium resulted in three, one and a half-day symposia for scientists and teachers being held in Hobart, Townsville and Melbourne during 2008. These included plenary sessions on relevant cutting-edge science, and structured sessions amongst scientists, amongst teachers, and both together, enabling partnerships to learn from others' experiences. SiS Team members also arranged networking meetings in each State and Territory, and these and the symposia allowed partners to meet (sometimes for the first time), plan their activities and network with others.

Purpose of the Evaluation

The aims of the SiS Project were continued from the Pilot Project. Consequently, the purpose and approach of this evaluation were similar to those of the Pilot Project evaluation. Because of the longer time frame, it would be possible to gather a larger and more diverse data set, and to gather longitudinal data. Specifically the aims of this evaluation were to assess the outcomes of the SiS project in terms of

1. benefits to students
    a. increased knowledge and understanding of real world, contemporary science
    b. opportunities to experience scientists as role models/mentors
    c. increased awareness of the types and variety of careers available in the sciences
2. benefits to teachers
    a. updated and strengthened knowledge of current science and scientific practices
    b. opportunities for professional learning through communication with scientists and other teachers
    c. increased awareness of the types and variety of careers available in the sciences
3. benefits to scientists
    a. opportunities to communicate with teachers, students and other scientists about their work
    b. increased understanding of the community's awareness and perceptions of science, scientists and their work.
    c. improved methods of communication with students and teachers
4. the procedures used to set up partnerships and monitor participation,
5. the contribution to the project of the planned symposia and other major events, such as regional meetings, and
6. the effectiveness of the management model of basing SiS Project Officers in each State and Territory CSIRO Science Education Centre, particularly with regard to
    a. the promotion, recruitment and support of SiS and its participants, and
    b. helping participants feel connected to a national program.

Approach Taken in the Evaluation

The major part of the evaluation was carried out during 2008, with final, follow-up data collected during March, 2009. During the evaluation the researchers

1. maintained close contact with the project team throughout, in order to
    a. monitor progress in setting up partnerships,
    b. obtain descriptions of the partnerships, and
    c. select a representative sample of partnerships, stratified with regard to type of school, location and nature of partnership.
2. conducted 5 focus group discussions and 34 face-to-face interviews with teachers and scientists.
3. constructed 12 longitudinal case studies of a representative sample of scientist-teacher partnerships using phone, email and face-to-face interviews with teachers and scientists. Final contact with case study partners was made in April, 2009.
4. invited case study teachers (where feasible) to obtain written comments from students in case study schools using a short, age-appropriate, open-ended survey.
5. surveyed teachers and scientists in all partnerships with an online survey hosted on the CSIRO SiS website. An invitation to participate in the survey was emailed to partners.
6. attended the Melbourne symposium and other networking events for informal data collection from participants. Researchers requested, and were allowed, input into and access for analysis of evaluation/feedback sheets used at the Hobart, Townsville and Melbourne symposia.
7. attended the training workshop in Canberra in November, 2008 for data collection from the CSIRO SiS Project Officers, and interviewed them by phone or email in April, 2009.

The researchers received approval from the Curtin University of Technology Human Ethics Research Committee for the approach taken in the evaluation. The Ethics Approval number is SMEC 20070045. Permission from the carers of all children who could provide data to the researchers was requested through schools.

Preparation of the Instruments and Data Collection

The researchers had prepared a number of instruments for use in the Pilot Project evaluation, and there was value in using similar instruments for this evaluation to facilitate comparison of data collected. Consequently, the earlier instruments were modified, where appropriate, for use in the current evaluation. These included the Symposium Evaluation Form, Interview Schedule for Teachers and Scientists, Student Survey Forms, and Online Surveys for Scientists and Teachers. All instruments were designed to reflect the SiS project aims and to detect any unexpected outcomes. With the exception of the Interview Schedules, all instruments were screened by the Project Team, and the researchers responded to any comments to improve the instruments. The construction and purpose of the instruments are described in the following sections.

Symposium Evaluation

The SiS symposia were designed to complement and strengthen the SiS partnerships by bringing together scientists and their partner teachers to discuss cutting edge science and facilitate networking, both between partners and amongst teachers and scientists. During 2008, one and a half-day symposia were held in Hobart, Townsville and Melbourne. The Hobart symposium was an initiative of the Tasmanian Science and Technology Council and was supported by Biotechnology Australia. This symposium occurred from May 22 – 23, with a focus on “Biotechnology”. The Townsville symposium was an initiative of the North Queensland Science Centre of Innovation and Professional Practice (SCIPP), Queensland Department of Education, Training and the Arts, and was supported by James Cook University. It focused on “Science in the Tropics” and was held on September 5 – 6. The Melbourne symposium was hosted by the Walter and Eliza Hall Institute of Medical Research and the Gene Technology Access Centre. The Melbourne symposium had a focus on “Health and Medical Research”, and was held on October 23 – 24.

Attendance at the Symposium

Only registered partnerships were invited to attend the symposium in their local region. Preference was given to those partnerships where both teacher and scientist could attend. However, the second day of the Townsville symposium was also open to all teachers in the region, as part of the arrangement between North Queensland SCIPP and the Queensland Department of Education, Training and the Arts.

Together with teachers and scientists, representatives from the following organisations were also invited to attend the symposia: State Education Department, Catholic Education Office, the Association for Independent Schools, State Science Teacher’s Association, CSIRO Science Education Centre, plus various organisations and government departments who funded the event.

Structure of the Symposia

The symposia included two kinds of presentations. First, there were presentations relating to how the SiS Project works. These presentations were for teachers, for scientists, and for both teachers and scientists together to facilitate an exchange of ideas and plan for the future. They also were aimed at informing scientists more broadly about contemporary school science education. A breakout session was included within these presentations, where five teacher-scientist pairs had the opportunity to discuss their partnership and find out what other partnerships were doing. Second, there was a series of presentations of contemporary scientific research in the targeted topic as a means to facilitate the integration of up-to-date science knowledge into classrooms. In addition, a dinner was held on the evening of the first day to facilitate informal networking among participants.

The program for each of the three symposia can be found in Appendix 1. The structure of the Hobart symposium was different to that of the Townsville and Melbourne symposia. The first half-day in Hobart had a short session on how the project worked followed by another short session on biotechnology. This was followed by dinner. The second day had two sessions on biotechnology, together with one session that showcased SiS partnerships and also a breakout discussion. In contrast, the first day of the Townsville and Melbourne symposium included only information about how the project worked and the breakout session, while the second day included two contemporary scientific research sessions and showcasing SiS partnerships. Townsville also offered a tour of the James Cook University facilities, and Melbourne included a panel discussion on “The future global medical research dollar – where should it be spent?”

Symposium Evaluation Forms

The symposium evaluation form for the Hobart symposium consisted of three questions that asked participants whether or not they enjoyed the workshop, what were the most useful aspects of the workshop, and what suggestions/improvements they had for the next workshop. This evaluation form was modified for the Townsville and Melbourne symposia to provide more specific feedback on the different presentations within the symposium. The modified evaluation form asked participants five questions about whether or not their attendance was worthwhile, how useful they found each day and why, what were the main points that they would take away from the symposium, and suggestions for improvement next time. The evaluation forms were distributed by members of the Project Team at all three symposia, collected by them, and forwarded to the researchers for analysis. Copies of the symposium evaluation forms can be found in Appendix 2.

Focus Groups and Interviews

Focus group discussions and interviews were conducted to obtain information from SiS participants about (1) what they considered to be the benefits of the project, (2) what kinds of things had assisted the partnership to progress, and (3) what kinds of things had hindered the partnership. A total of five focus group discussions were conducted in Canberra, Melbourne and Perth. In Canberra and Melbourne, participants were invited to attend a focus group by SIS Senior Project Officers. In Perth, participants attending a SiS networking workshop accepted an invitation to stay behind, if convenient, to attend a focus group.

The focus group discussions were led by one of the researchers and took between 40 and 65 minutes. Participants were asked to complete a simple feedback sheet which provided an overview of the details of their partnership, and presented the three major questions for the focus group discussion. See Appendix 3 for a copy of this feedback sheet. Participants were free to write any comments on this sheet which was collected after the discussion finished. Field notes were taken during the discussion, and all discussions were audio-taped, with permission, and later transcribed.

Interviews with SiS participants were held as opportunities arose. These were of two kinds. First, at SiS networking meetings, a symposium, and the CONASTA conference in 2008, the researchers sought out teachers or scientists who had already been involved in SiS and requested a brief interview, if time was available. Both members of three partnerships were interviewed by this means. A structured proforma was used by the researcher to record the interview. Most of these interviews were limited by the time available in the context of the meeting, and generally lasted about 10 minutes. Second, researchers were able to visit several schools in Perth, Canberra and Melbourne. Each teacher was interviewed according to a structured proforma on which the interviewer recorded the teacher’s responses. These interviews were between 35 and 50 minutes in length. All interviews used the same proforma with slightly different demographic sections according to whether the interview was with a scientist, teacher or during a school visit. Copies of the proformas are in Appendix 4. In addition, two scientists were “interviewed” by email, as they were unable to attend a meeting. The email “interview” enabled responses to be provided to the three basic questions covered in the focus group discussions.

Case Studies of Partnerships

The purpose of the case studies was to obtain detailed information about how the scientist-teacher partnerships had progressed over time, the perceived benefits obtained from the partnership to all participants, any problems faced by the partnerships and how these problems were overcome. Data were collected for 12 case studies of partnerships. Data to describe the partnerships were collected during 2008 and were of three kinds. First, information was obtained by interview, either face-to-face or in focus groups, as described above. Second, some scientist partners who could not attend interviews or focus groups were contacted by email and asked questions similar to those used in the face-to-face interviews. Third, in situations where it was feasible, teachers were asked to provide some data from students who had been involved in the SiS activities. In addition, some demographic data about schools were obtained from schools' websites. Follow-up data to ascertain the continuation of the case study into 2009 were obtained by emailing each partner during March/April, 2009. Some details about case study partnerships were also obtained from the SiS database.

Student Survey Forms

Feedback was obtained from students about their participation in the program using two forms, one for primary students and one for secondary students, which had been prepared and used effectively for the SiS Pilot Project Evaluation. The one-page forms requested demographic data, including year level and sex of the student, and also the topic covered in the SiS partnership. Each form had four questions asking about what was learned from the scientist, what it was like working with the scientist, what students learned about careers in science, and whether or not the student became more interested in a science career. The wording and the amount of response expected from each question varied between the two forms. For teachers with very young primary classes, the researchers provided suggested activities that enabled children to report by drawing or scribed discussion about their SiS experiences. Copies of the forms are provided in Appendices 5 and 6.

Data were collected by inviting teachers who were interviewed during school visits, at a symposium or networking event, and who were the focus of case studies, to collect some data from students who had participated in the SiS Project. Teachers were provided with a set of forms for their students and copies of information forms for parents with permission slips to enable the researchers to use the data provided by students. Thirteen teachers took the sets of forms but as it was close to the end of 2008, only nine were able to provide data.

Online Surveys for Scientists and Teachers

An important part of data collection for the evaluation of the SiS Pilot Project used online surveys designed for all participants in SiS partnerships. Parallel surveys were prepared for teachers and scientists and because they were demonstrated to be comprehensive and effective, it was decided to repeat their use in 2009. Consequently, the surveys were revised in collaboration with the SiS Team, to ensure coverage of new issues about SiS, to omit questions that were no longer relevant, and to shorten the survey. Copies are included in Appendices 7 and 8.

The survey contained four sections and again, parallel versions were prepared for scientists and teachers. Because anonymity of responses was assured, respondents did not provide identifying data and therefore it was not possible to match the responses of partnership pairs.

Sections A and B were identical on both surveys. Section A requested demographic data to describe the school involved in the partnership. Section B collected data about the partnership, requested reasons for participation, subject and year levels involved, whether or not this was the first partnership in which the respondent had been involved, how long since the partnership was formed, whether or not activities in the partnership had begun, and whether or not the respondent had participated in any SiS Project events. Those who had not begun their partnership activities were asked to skip to Section E, thus ensuring that the next set of data were collected about partnership activities that had actually occurred. Here, a series of nine descriptions of possible contributions of the scientist to the partnership were suggested, to which respondents could answer yes or no, and they were asked to add other contributions if appropriate.

Section C also was identical on both surveys and sought respondents' perceptions about the benefits of the partnership to students. Eleven possible benefits were listed, to which respondents answered yes or no, and they were asked to describe any other benefit. Scientists were also able to indicate if they were unsure of any benefit to students.

Section D was unique to scientists or teachers and asked for information about the benefit of the partnerships to them, personally. Scientists were offered ten, and teachers were offered eight, possible benefits and both were asked to describe any others. In addition, both teachers and scientists were asked to "give a specific example(s) of something that is working really well in the partnership", and also "to give a specific example(s) of something that is not working well". Teachers were asked two additional questions. They were asked to rate, on a four-point scale from "not very confident" to "very confident", their level of confidence about teaching science before involvement in the SiS program, and now, after involvement, at the time of completing the survey.

Section E was common to both surveys and sought information about the usefulness of the SiS website and resources, the SiS events, and what additional support they would like for their partnership. Respondents were asked whether or not, overall, they regarded their partnership as successful, and finally, they were invited to make any other comments they wished.

Access to the online surveys was publicised by an invitational email sent by the Project Team to all partnered scientists and teachers. The email was signed by the researchers and, to minimise over-surveying and avoid data repetition, contained a note to the effect that persons recently interviewed by the researchers need not respond. The surveys were open from October 30, 2008, a reminder email was sent out on November 28, 2008 and the survey finally closed on January 11, 2009. The surveys elicited usable responses from 256 scientists and 274 teachers.

Effectiveness of the Management Model for SiS

SiS is managed by a Project Team based in Canberra and, from July 2008, some regional SiS Project Officers (SiSPOs) were employed to assist with making and monitoring partnerships and other SiS management tasks. Evaluation of the effectiveness of the management model relied on obtaining information from the Project Team and SiSPOs. General information about the management of the overall project and the database was provided by the Project Director and Senior Project Officers, mainly though the frequent, often informal contact between them and the researchers. Two other more detailed sets of information were collected, the first relating specifically to the role of the SiSPOs, and the second relating to the trend in number of partnerships.

A major innovation to the SiS Project during 2008 was the employment of the SiSPOs, who operated on a regional basis. The effectiveness of the devolution of some responsibilities to the SiSPOs was evaluated in two ways. First, one of the researchers attended a 2-day training workshop held on November 13 – 14, 2008 in Canberra. The eight SiSPOs attending the course came from the ACT, New South Wales, Northern Territory, north and south Queensland, Tasmania, Victoria and Western Australia. The aim of this course was to allow the SiSPOs to feel part of a team based around a national program, and have the confidence and skills to deliver that initiative. Sessions included a national overview, showcase of successful partnerships, working with volunteers, counselling, facilitation, and discussion of possible partnership problems and solutions. A copy of the program can be found in Appendix 9. A document on possible problems and solutions associated with establishing and sustaining partnerships was developed during one of the sessions and later sent to all SiSPOs.

The SiSPOs perceptions of the workshop were gathered with an evaluation form that asked if attendance was worthwhile, the usefulness of the sessions, and the main points the SiSPOs would take away. A copy of the form is included as Appendix 10. In addition, the researcher took formal notes during the sessions that reflected any concerns expressed by the SiSPOs and conversed informally with them, making written notes.

Second, in order to check progress in the development and effectiveness of the SiSPOs role, particularly how they made and sustained partnerships, SiSPOs were interviewed during March and April, 2009. Thirteen questions were emailed to the SiSPOs prior to the telephone interview, to give them time to think about their answers. A copy of the interview questions can be found in Appendix 11. At the time of the interviews there were nine SISPOs employed. Eight SiSPOs were able to be interviewed. Six interviews were conducted by phone with written notes taken. As they were unable to be contacted by phone, the other two SiSPOs emailed their answers back to the researcher.

The second set of information was requested from the SiS Project team to enable the researchers to gain an overview of the progress of SiS in terms of partnerships formed and maintained throughout the Project, from the inception of the Pilot Project in July 2007, to the end of April, 2009, which was the most recent monthly data available prior to the completion of the evaluation. These data provide an informative overview of SiS and suggest a basis for predicting realistic future targets.

Results from the Evaluation of the Scientists in Schools (SiS) Project

In the following sections the results from each stage of the data collection are reported and described. A roughly chronological approach has been taken. The first section describes the overall management of SiS, the establishment and maintenance of its website, the general procedures for registration of scientists and teachers, and the matching process and monitoring of partnerships. This overview section is followed by the results of each stage of data collection, and the documentation of trends in partnership numbers. The findings from all of these sections are gathered together in the final part of the report to draw conclusions and frame recommendations about the SiS project.

Administration and Management Procedures

In essence, the management procedures which had proved effective in the SiS Pilot Project were retained for the extension of the project. In particular, the website and partnership database remain central to the project. Registration is still achieved by aspiring participants via the website and the database remains the vital tool that allows effective and efficient collation and retrieval of data about participants, organisations, partnerships and events. Both the website and database have continued to be upgraded and refined as the project has evolved.

The major change to the management of the current project compared to the Pilot Project was the employment of regional Scientists in Schools Project Officers (SiSPOs) in each state and territory. It was clear that with an increasing number of program participants, considerably more people were needed to make and monitor partnerships. The employment of the SiSPOs necessitated a change of role for the headquarters staff from mostly operational tasks to mostly management tasks, with supervision of the SiSPOs now the responsibility of two Senior Project Officers located in Canberra. An organisational chart outlining this structure is shown in Figure 1. Strategic direction and governance for the project is provided by the Project Director in conjunction with the Steering Committee, which consists of representatives from CSIRO and the Australian Government Department of Education, Employment and Workplace Relations.

The promotion of the program to teachers and scientists, and the matching, monitoring and supporting of partnerships, became the primary responsibility of the SiSPOs. However the basic procedures used to establish and monitor partnerships remained the same as those used in the pilot. When a scientist and a teacher are matched, the partnership is recorded in the database with the status of “assigned”. As soon as the SiS team is aware that planning has begun, the status is changed to “active”. The partnership retains that status until a SiS team member is alerted to a different status. Some partnerships may be suspended for a period, for example whilst a participant is ill, absent, or on leave, and the partnership is given the status of “dormant”. Sometimes active partnerships conclude their activities successfully and their new status is recorded as “closed”. Partnerships which lapse, or do not work out, are described as “withdrawn”.

An ongoing challenge is ensuring that the status of the partnerships recorded on the database is as accurate as possible. For this reason, SiSPOs have made a concerted effort to follow-up and make contact with partnerships. Records are constantly updated, and the status of the partnerships is monitored on a monthly basis.

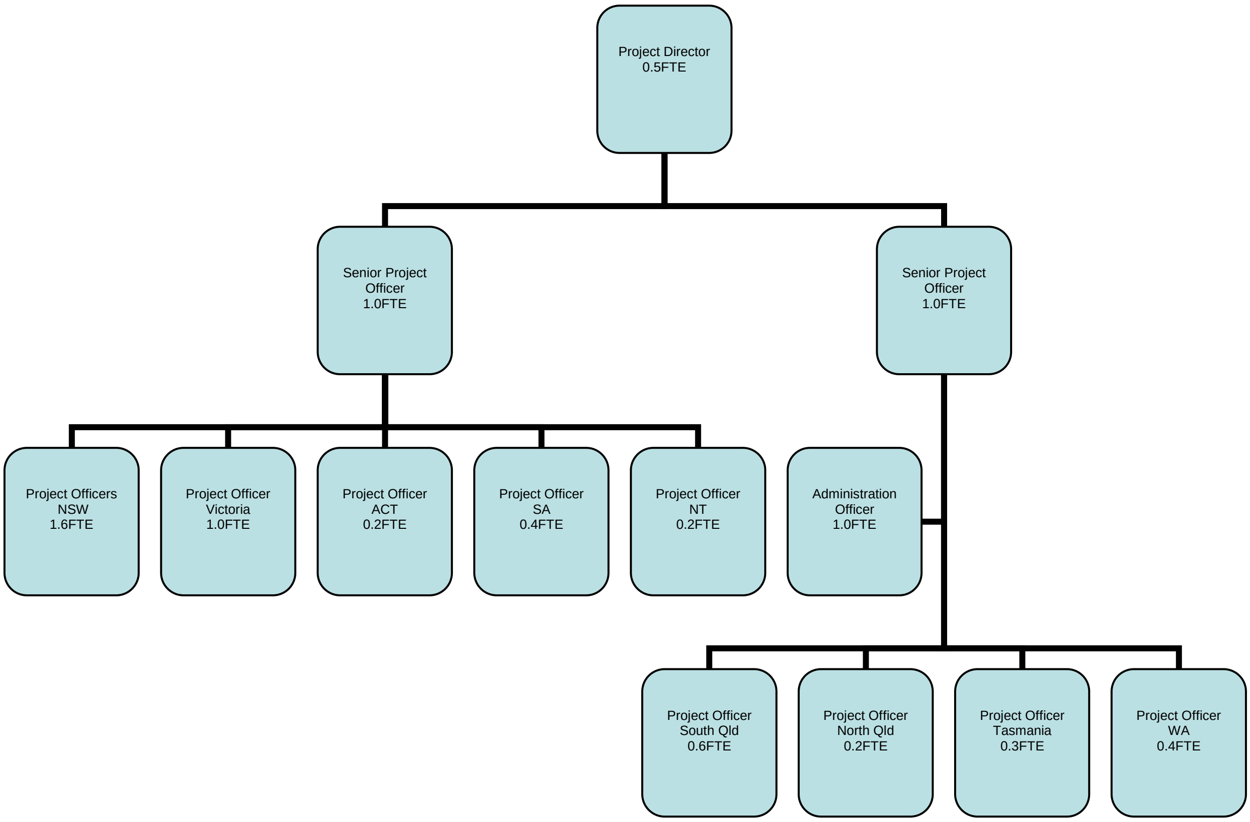


Figure 1. Scientists in Schools Organisational Chart, 2009

Findings from the Symposia

A summary of the teacher and scientist participants at each symposium, and the number from whom evaluations forms were collected, is presented in Table 1. It can be seen that the response rate averaged about 50% overall and was higher for teachers than scientists.

Table 1. Breakdown of Participants Attending the Symposia

Location	Focus	Date in 2008	Participants		Evaluation Forms	
			Scientists	Teachers	Scientists	Teachers
Hobart	Biotechnology	May 22, 23	22	25	11 (50%)*	13 (52%)
Townsville	Science in the Tropics	September 5, 6	21	28	9 (43%)	19 (68%)
Melbourne	Health and Medical Research	October 23, 24	37	43	13 (35%)	20 (47%)

* Percentages in parentheses indicate response rates for returned symposium evaluation forms.

The findings from analysis of the Townsville and Melbourne symposia evaluation forms are presented first. Participants' responses to each of the five questions are combined over the two symposia. The results of the Hobart symposium are presented separately because the questions were different. However, the two sets of results revealed common themes.

Townsville and Melbourne Symposia

Question 1. Was your attendance at the symposium worthwhile?

All participants from Melbourne and all but two participants from Townsville agreed that their respective symposium was worthwhile. One teacher and one scientist reported that the Townsville symposium was "partly worthwhile" for them.

Question 2. How useful were Day 1 and Day 2 presentations for you?

All participants believed that the symposia were either "very useful" or "useful". For Days 1 and 2 of the Townsville Symposium, 70% and 75% (respectively) of responding participants rated the days as "very useful". The equivalent percentages for the Melbourne Symposium were 78% and 57%.

Question 3. Why were the presentations considered "very useful" or "useful"?

The main reasons that scientists and teachers considered the presentations as "very useful" or "useful" on each day of the symposia were clustered into categories that are summarised in Tables 2 and 3. Not all respondents gave reasons, and those that did often gave more than one reason. The discussion following the tables is illustrated with quotes from the responses of scientists and teachers.

Different patterns of responses were obtained on each of the two days, reflecting the structure of the symposia. Day 1 was based around how the project worked and included the breakout session, and the majority of responses from both the scientists and teachers reflected the pragmatics of partnerships, with more than half of the reasons given referring to finding out more about other partnerships. Day 2 of the symposia included two sessions on contemporary scientific research and a third showcasing SiS partnerships. Hence, the majority of comments (a third to a half) related to an increase in scientific knowledge in relation to the particular topic of the symposia. Both the scientists and the teachers had similar responses in these two major categories.

Table 2. Reasons Why Scientists and Teachers Thought Day 1 of the Symposia Was "Very Useful" or "Useful"

Category of Reason	Townsville		Melbourne	
	Scientists %	Teachers %	Scientists %	Teachers %
Finding out about other partnerships	71	76	100	86
Networking	14	53	10	7
I am more inspired/enthused	-	18	20	7
Resources/ideas for teaching/school	-	24	-	14
Got to know my partner better	29	-	10	7
Better understand teachers and schools	29	-	30	-
Better understand scientists and how they work	-	12	-	14
SiS program and how it works	14	12	20	14
Number of respondents (n)	7	17	10	14
Number of reasons given (n)	11	35	19	21

There was a spread of less frequent reasons. Some scientists and teachers mentioned networking, becoming inspired/enthused and gaining a better understanding of how the SiS program works, on both Day 1 and Day 2. Scientists referred to getting a better understanding of teachers and schools, and teachers referred to getting a better understanding of scientists. Other major reasons why Day 2 was considered "Very Useful" or "Useful" included the range and the quality of the presentations.

Pragmatics of partnership

It was clear that both scientists and teachers were pleased to see what other scientists (S) and teachers (T) were doing in their partnerships, and how others had gone about establishing and sustaining an ongoing partnership.

> Getting the insight in some partnerships and share experiences with other scientist-teacher pairs. Also, begin to establish the basis of a community of practice/community of purpose for all SiS participants. [S1, Townsville]

Table 3. Reasons Why Scientists and Teachers Thought Day 2 of the Symposia Was "Very Useful" or "Useful"

Category of Reason	Townsville		Melbourne	
	Scientists (%)	Teachers (%)	Scientists (%)	Teacher (%)s
Knowledge for self	78	89	44	71
Finding out about other partnerships	22	-	44	18
Networking	11	-	11	6
I am more inspired/enthused	11	11	11	18
Better understand teachers and schools	33	-	-	-
Better understand scientists and how they work	-	11	-	-
Quality of presentation	33	-	33	35
Resources/ideas for teaching/school	-	-	-	24
Range of topics presented	33	17	-	-
Integration of science	-	17	-	-
View facilities	11	11	-	-
SiS program and how it works	-	-	-	6
Number of respondents (n)	9	18	9	17
Number of reasons given (n)	21	28	13	30

> To hear the ideas, and partnerships that already exist gave me plenty of ideas and to hear how partnerships are working or suggestions on creating greater relationships with my scientist will make it more beneficial to my students. [T15, Townsville]
>
> I am a newly registered teacher who hadn't contacted their scientist yet. Therefore it is nice to become well informed about issues/solutions surrounding partnerships so we can get off on the right foot. [T17, Townsville]
>
> I thought it was a great idea to get scientists and teachers together discussing their experiences and problems. It was nice to also know what concerns teachers have with regards to SiS. The session also gave me some new insights into what I can bring into my school. [S5, Melbourne]
>
> Good to get honest opinions on the health of partnerships and why or why not they are working. [S10, Melbourne]
>
> I am new to the SiS program, so I found it useful to hear both sides (teacher and scientist) and how I could utilise our scientist at high school. (I still haven't figured it out!) [T10, Melbourne]

> I really enjoyed the session, mainly because it gave me the chance to meet other teachers and scientists involved in the program and to hear about their experiences. It was also useful to hear the positive feedback from the other scientists, particularly how they really enjoyed their experiences in the school, so much so that they used the word 'fun'. [T19, Melbourne]

Increased scientific knowledge

Both scientists and teachers commented on the increased scientific knowledge they obtained as a consequence of attending the symposium, although a greater percentage of teachers commented on this than scientists.

> Loved the range of scientific endeavours show cased – wonderful and inspiring even for this scientist! [S3, Townsville]

> Exposure to science research broadens the scope of what you teach students and where science can take them. [T10, Townsville]

> Seeing actual current science has re-sparked my enthusiasm for science, as well as given me great ideas for topics we can put into science units at school. [T16, Townsville]

> Improved [my] understanding of a branch of science not previously studied (or kept adequately abreast of). [S6, Melbourne]

> As a teacher of Unit 3 and 4 Biology, the presentations were quite relevant to the Biology course and an increase in my knowledge base. [T10, Melbourne]

> It was so exciting to see where we stand with medical research and to realise that teachers have the potential to excite our future scientists. [T18, Melbourne]

Question 4. What are the main points that you will take away from the symposium?

The main points that the participants believed they would take away from either the Townsville or Melbourne symposium are summarised in Table 4. Those categories that had greater than a 5% response rate over both symposia were creating more enthusiasm, finding out about other partnerships, the importance of communication in the SiS process, the desire to become more involved in SiS, resources or ideas for teaching, how to engage students, developing a community of learners, the importance of science in education, and knowledge for self. These categories can be placed under three main headings: personal, partnerships and education, as shown in Table 4. Each of these headings is described below with example quotes from scientists and teachers.

Personal aspects

Three personal reasons were identified as the main points scientists and teachers would take away from the symposium: creating more enthusiasm, knowledge for self, and networking. The most common response for scientists and teachers related to enthusiasm, inspiration or motivation as a consequence of being involved in the project.

> [I have been] re-invigorated by knowing so many other people also care about science education. [S5, Townsville]

> Am feeling more enthusiastic about teaching science and look forward to being partnered with an enthusiastic scientist. [T2, Melbourne]

> A determination to improve the teaching of science at my school. An excitement about the possibilities of science in the future in this country. [T18, Melbourne]

An increase in personal knowledge specific to the symposium topic was an aspect several teachers identified as taking away from the symposia.

> Knowledge about cyclones and global warming. [T8, Townsville]

> A great deal of knowledge and information regarding scientific research. [T12, Melbourne]

The importance of networking and making contacts both in education and in science was also considered a valuable personal reason for attending the symposia.

> Lots of new friends and contacts in science and education. [S5, Townsville]

> There are people I can contact that can help with things I don’t know. [T16, Townsville]

Table 4. Main Points Scientists and Teachers Would Take Away from the Symposia

Category of Main Point	Townsville		Melbourne	
	Scientists (%)	Teachers (%)	Scientists (%)	Teachers (%)
Personal Aspects				
Creating more enthusiasm	44	32	8	33
Knowledge for self	-	11	-	28
Networking	11	11	-	-
Partnership Aspects				
Importance of communication	22	5	17	22
Finding out about other partnerships	11	11	8	28
The desire to get more involved in SiS	-	5	25	28
Community of learners/educators	11	21	-	17
Better understand scientists and how they work	-	11	-	6
Better understand teachers and schools	-	-	8	-
Education Aspects				
Resources/ideas for teaching/school	22	5	8	22
How to engage students	11	26	17	-
Importance of science in education	22	-	17	22
Potential of integration of science	-	11	17	-
Number of respondents (n)	9	19	12	18
Number of points given (n)	14	28	15	37

Partnership aspects

Both scientists and teachers believed that finding out about partnerships, how to make them work and how to sustain them was an important outcome of the symposia, with 6 of the 13 categories presented in Table 4 relating to partnerships.

The important place of communication to the success of a partnership was identified by both scientists and teachers.

> Need more communication between my school and I. [S3, Townsville]
>
> Good communication is necessary for the partnership to work out what is really going to work out for both of you. [S3, Melbourne]
>
> Regular communication, and preferably face to face contact, is vital for success. [T8, Melbourne]
>
> Good idea on how to maintain contact with very busy scientists – the post card/letter ideas. [T19, Melbourne]

Finding out what other partnerships were doing and how they operated was a major outcome of the symposia for some scientists and teachers.

> Various approaches to partnerships identified. [S4, Townsville]
>
> The huge benefit of scientists to students and ideas and projects being used by other partnerships. [T15, Townsville]
>
> The importance of passion and commitment to make the SiS partnership grow. [T20, Melbourne]
>
> Important to have teachers involved personally rather than take on a whole school approach. Every partnership is different. [T8, Melbourne]

Several scientists and teachers came away from the symposium with a greater desire to become involved in the SiS project, or to make their partnership work better.

> The project is viable and achieving good results in existing partnerships. I will do what I can to help increase the number of engineers available to be involved in the scheme. [S6, Melbourne]
>
> Any level of activity seems to have a good outcome. I feel it more likely I will be able to develop a fruitful relationship with the school. [S12, Melbourne]
>
> Inspired me to get going with my partnership. [T5. Melbourne]
>
> Encouragement to continue involvement, especially as the scientists are very willing to give their time and ideas. [T19, Melbourne]

The recognition that a community of learners and educators was being developed as a consequence of this project was a recognised outcome of the symposia.

> A wider sense of working together and community goal attitudinal development. [S1, Townsville]
>
> Both parties are willing to make the partnership successful and to not assume that the scientist can't be utilised in other areas of science that aren't his/her areas of expertise. [T10, Melbourne]

> That the parents, teachers, students and scientists probably enjoy and benefit from the program in ways I may not see or be able to measure. [T17, Melbourne]

Scientists believed they gained a better understanding of teachers, and teachers of scientists, as a consequence of participating in the symposia.

> There is a genuine interest from scientists to support teachers in schools for the enhanced delivery of science to students. [T6, Townsville]

> That there are many scientists willing to assist teachers and students to inspire/highlight relevance of the science curriculum. [T1, Melbourne]

Education aspects

Various aspects relating to education were considered major outcomes of the symposium. These included resources or ideas for use in schools, a greater understanding of how to engage students, the importance of science in education, and the potential for integration of science. Some participants acknowledged the resources or ideas obtained from the symposium that could be used in their schools.

> Ideas for future projects. [S7, Melbourne]

> Good ideas from partnerships. For example, buddy science, science newsletters. Lots of resources (websites). [T5, Melbourne]

> Ideas to bring back to school that others are using currently. [T7, Melbourne]

> Specific ideas and places to find resources. [T15, Melbourne]

Ideas on how to better engage students was considered a positive outcome of the symposium.

> The need to enthuse students about science and the available opportunities to achieve this. [T9, Townsville]

> Need to expose students to the range of possibilities in science. [T13, Townsville]

> The huge benefit of scientists to students. [T15, Townsville]

> Other ways of incorporating science into the school program. Ways of broadening the program and also what I can do with learning disadvantaged students to help them in understanding concepts. [S9, Melbourne]

The important place of science within education was also recognised as a major outcome from the symposia.

> How important it is to inspire kids to take up science. [S7, Townsville]

> Reintroducing science into schools is not only fun but important. [S8, Melbourne]

> It is important to continue and increase my teaching of science in the school. [T15, Melbourne]

> A determination to improve the teaching of science at my school. An excitement about the possibilities of science in the future in this country. [T18, Melbourne]

Some scientists and teachers saw the possibility of integrating science better into the schools as a consequence of participating in the symposium.

A broad based science that integrates 'maths' allows greater diversity in later careers. [T12, Townsville]

Mulitdisciplinary/context based – exactly what our syllabusi are trying to get us to educate through. [T17, Townsville]

Think outside the box – science can be woven into many aspects of the curriculum and there is plenty of room to be creative and inventive. [S13, Melbourne]

Question 5. What could be improved for next time?

The main aspects that the participants believed needed improvement within the symposia are summarised in Table 5. Three major points were identified as requiring improvement: the format of the sessions/symposia, providing more opportunities to build on partnerships, and bridging the gap between the contemporary scientific content and teaching. Following Table 5, each of these points is expanded and illustrated with quotes from scientists and teachers.

Table 5. Main Suggestions for Improvement (%) from the Townsville and Melbourne Symposia

Suggestion	Townsville		Melbourne	
	Scientists (%)	Teachers (%)	Scientists (%)	Teachers (%)
Format of the sessions	50	50	45	82
Build more on partnerships	38	50	55	18
Bridge the gap between content and teaching	12	-	18	9
Number of respondents (n)	8	10	11	11
Number of suggestions given (n)	8	10	13	12

Format of symposia

The most frequent suggestion for improvement, by both scientists and teachers, referred to the format of the symposium. For the Townsville symposium, these comments included keeping to time, allowing more time for questions, mixing up sessions to bring research talks forward, ensuring the dinner speakers are motivating, providing tours at different times (such as during the weekdays) to meet other scientists, more diversity in topics presented, and more choice in tours. For the Melbourne symposium these comments included a more appropriate panel discussion, pitching the scientific discussions at an appropriate level for the audience, providing more ideas for "hands-on" science (in particular for primary teachers), a map to provide detailed location of venues, presenting a one-day symposium only, and presenting snippet information on the research of the SiS scientists. Significant comments relating to the usefulness of the panel discussion are presented.

The panel discussion was unsuccessful due to the nature of the topic. The scientific discussions were too general to be of interest to the scientists and too complicated to be of interest to many of the teachers. I think the format of such a session needs to be reworked in the future. More practical presentations about teaching science and science communication would have been good. [S1, Melbourne]

Panel discussion should focus more on questions with SiS issues. It was too focused on medical funding. [S4, Melbourne]

Panel on medical research dollar was interesting, however the points presented were generally lost on those of us in the education sector. Final panel to be on science education and literacy rather than purely science industry. [T14, Melbourne]

Providing more opportunities to build on partnership

Many participants expressed their desire to have more face-to-face time with their partner, or with other teacher-scientist partners to share ideas and activities.

More time in smaller groups to work through how things can be done better – our group had primary school teachers as well as scientists. People don't know what was being done in other areas, so needed time to pick out strengths and weaknesses. [T1, Townsville]

Break out session to network with your partner to discuss, plan and evaluate. [T10, Townsville]

Sharing of projects being done in partnerships, more sharing on activities being done by scientists in schools. [T15, Townsville]

Have a session set aside for SiS teacher/scientist to get together to plan. [T17, Townsville]

Extending the face-to-face contact with the teachers. I enjoyed the smaller group workshops. [S5, Melbourne]

Examples of what other teachers/scientists are doing would be excellent too – to provide ideas for the future. [T17, Melbourne]

Bridging the gap between the contemporary scientific content and teaching

Finding a way to bridge the gap between the contemporary scientific content being presented at the symposia and teaching that science in the schools was seen as a significant issue.

Potential ways to include content on science talks into schools. [S6, Townsville]

I felt there was a significant disjoint between the scientific presentations and the SiS presentations. [S1, Melbourne]

Instead of research talks maybe more of a half/half research talk and how that could be implemented as a project/presentation in a school. [S3, Melbourne]

Possibly relate it back to school or give resources related to kids. [T12, Melbourne]

Hobart Symposium

The information presented for the Hobart symposium is a summary of results in tabular form. No quotes will be presented as the results support those for Townsville and Melbourne.

Question 1. Overall, did you enjoy the symposium?

All scientists and teachers reported that they enjoyed the workshop.

Question 2. What were the best aspects of the symposium?

A summary of the scientists' and teachers' best aspects of the symposium is presented in Table 6. Both scientists and teachers considered obtaining biotechnological knowledge for self, finding out about other partnerships, networking, being provided with resources and ideas, and having the opportunity to meet their partner as the best aspects of the symposium. Scientists also found that they could better understand how teachers work as a consequence of the symposium. These aspects are similar to those reported above for Townsville and Melbourne, and support the main themes identified above of pragmatics of partnerships and increased scientific knowledge.

Table 6. Summary of the Scientists' and Teachers' Best Aspects of the Symposium

Best Aspects	Hobart	
	Scientists %	Teachers %
Knowledge for self	27	54
Finding out about other partnerships	45	62
Networking	27	31
Resources/ideas for teaching/school	27	38
Got to know my partner better	28	31
Better understand teachers and schools	55	-
Better understand scientists and how they work	-	8
View facilities	-	15
Dinner	9	-
Meeting those behind SiS	18	-
Number of respondents (n)	11	13
Number of aspects given (n)	25	31

Question 3. What suggestions/improvements do you have for the next symposium?

The participants' suggestions/improvements from the Hobart symposium are similar to the results from the Townsville and Melbourne symposia, with the main suggestions referring to the format of the symposium and building more on partnerships. Suggestions for changing the format of the symposium included pitching the scientific discussions at an appropriate level for the audience, trying not to cover too much in too short a time, giving less emphasis to theory and more to practical aspects, making the symposium longer, having an annual regional symposium with a different theme each year, and adjusting the timing of the symposium to coincide with a large science fair. Many participants also expressed their desire to have more face-to-face time with their partner, or with other teacher-scientist partners to share ideas and activities.

Findings from the Focus Group Discussions and Interviews

A total of five focus groups discussions and 34 interviews were conducted. As shown in Table 7, the five focus groups included scientists only, teachers only, or a combination of scientists and teachers. All but one of the 30 participants in the focus groups had been partnered. Some of these partnerships were currently active; others were currently inactive, while some were meeting their partner for the first time. All of the interviewees were, or had been, in partnerships.

Table 7. Demographics of the Focus Group Discussions and Interviews

Focus group or Interview #	Location	Date	Number of participants	
			Scientists	Teachers
Focus Groups				
FG1	Canberra	15/10/08	4	-
FG2	Canberra	15/10/08	-	3
FG3	Melbourne	21/10/08	7	-
FG4	Melbourne	22/10/08	5	-
FG5	Perth	17/10/08	8	3
Interviews				
I1 – I6	Perth	29/04/08, 1/05/08	2	4
I7 – I12	Canberra	15-17/10/08	1	5
I13 – I21	Melbourne	20-23/10/08	2	7
I22 – I23	By email	13/10/08, 14/11/08	2	-
I24 – I29	Brisbane	7-8/07/08	2	6
I30 – I32	Perth	19/06/08, 16/10/08	1	2
Total Participants			34	30

Analysis of Data from Focus Groups and Interviews

The transcripts and notes from each focus group discussion were read carefully, themes identified, and a summary prepared. These themes were then compared across all five focus groups. In a similar way, the records of interviews were also read and common themes identified. Perhaps not surprisingly, as the questions were similar, the themes were also similar between focus groups and interviews. The themes could all be placed under one of the three questions that underpinned this section of the data gathering: What are the benefits of the project? What kinds of things have assisted the partnership to progress? What kinds of things have hindered the partnership? In the following sections, these questions are used to structure the discussion of the themes that emerged from the focus groups and interviews, and each theme is illustrated with quotes from participants. Due to the large size of Focus Group 5, it was not always possible to distinguish individual scientists or teachers.

1. What do you believe are the benefits of the SiS project?

The benefits of the SiS project, as perceived by the participants, fell into three main themes: an increase in the profile of science at school, opportunities for professional development for teachers, and a range of benefits for the participants.

Increasing the profile of science at school

Both teachers and scientists mentioned the importance of increasing the profile of science in schools. SiS was an important avenue to increase science in primary schools, and this was considered to be an investment in the future. About a third of the scientists participating had children at their partnership school, and some were motivated because they saw so little science in their child's primary school.

> That science has a high profile and that it has been raised. A scientist helps us do this. The children are developing a positive attitude. [FG5, T1 primary]

> I was quite shocked that there was no science curriculum at primary school….I am the only science program they have got. [FG4, S5]

> I wanted to get more science in schools. I was involved in recruiting [for employer] and I found people were good at using facts, but they couldn't think, explore a problem, or think like a scientist. [FG1, S4]

> [Our scientist] broke down the barriers about scientist stereotypes – not white coats, and they can be female [I17, T primary]

Opportunities for professional development for teachers

An important aspect of the SiS partnership was the opportunity perceived by both teachers and scientists for teachers to update their science knowledge and skills.

> We wanted to have a scientist who could come in with their expert knowledge and teach the teachers as well through their presentations, which is invaluable. [FG2, T3 primary]

> Being a primary teacher, it has updated my own skills because I lag behind. [FG5, T primary]

> Need to have scientists who have expertise to show students and also teachers about real science. [FG2, T2 secondary]

A scientist who ran the entire science program in her child's primary school devised integrated lessons for each term and said

> At the end of each plan I work up, I give the teachers a folder and they can do it on their own next time. [FG4, S2]

Another scientist commented on primary teachers' lack of science knowledge. She thought,

> I think they really have no idea where to start with science, an experiment or the content, especially the content. Teaching isn't a problem, because that's what they do, it is teaching the content. Like for the crazy scientist day I made up two sheets which explained very simply about chemical reactions and why the vinegar and carb soda launched the corks. They just thought that was wonderful. They are very keen, but they just have no idea what to teach. [FG4, S1]

Professional development does not occur unless teachers are willing. Scientist 4 in Focus Group 1 described how she talked to the art teacher who was doing “the volcano experiment” and asked how it worked. She spoke about chemical reactions and how it could be explained to the children, using changing clothes as a metaphor, and the teacher passed it on to her class. However, another teacher, who also was doing that reaction, just used it as “a pretty explosion”.

Range of benefits for participants

Apart from the professional development benefit for teachers, there were benefits for students as well. Having a scientist in the classroom provided variety for students; someone else to listen to! Teachers spoke about scientists being “the real thing”, and using them as role models.

> A lot of the kids who don’t have parents who are very scientifically literate, don’t have much idea about science knowledge and investigation. Students get some broader experiences watching crime shows on TV, the other place they get science is at school. . . . To help students get that experience, they need to have scientists who have expertise to show students and also teachers about real science. [FG2, T2 secondary]

Scientists also described the benefits of exposing students to “real science”.

> [Students] get an insight into industrial problems. [FG3, S1]

Teachers also found the SiS project provided a welcome resource, particularly when funds were short.

> We treat this like a free incursion. Because we are a low socioeconomic school we can’t go out to lots of things, and its great having this (SiS) like a free incursion for the children. [FG5, T primary]

The key benefit for scientists in successful partnerships, mentioned by both scientists and teachers, was their enjoyment in working with the children.

> I also was feeling de-motivated at work, and wanted to be around people who would get enthusiastic about science; so the kids have been good for that. [FG5, S1]

> I don’t really want to gain anything for myself, I just enjoy working with the kids and exposing them to science. [FG4, S1]

> It is good fun. One of the little kids asked me for my autograph! I was surprised at the level of interest the Grade 5s had. Great spectrum of knowledge. Some of them are absolutely amazing. Yeah, it’s been good. [FG3, S4]

Some scientists remarked that their involvement could assist their career path by indicating they were doing something for the community.

> I am an early career researcher so I thought it couldn’t hurt to have some other involvement on my CV; a nice thing to have. [FG1, S3]

Scientists commented on their activities assisting their own knowledge.

> Having students come to the lab and explain your research in terms they understand helps your own understanding of what you are doing. [FG1, S2]

A major benefit for some scientists was the ability to make a positive contribution to their own child’s school.

> It is a better use of my time to teach science than to go on working bees, so I don't feel guilty because I am involved in the school community and they are getting value out of me. I am enjoying it immensely. [FG4, S2]

2. What kinds of things have assisted your partnership to progress?

Progress in establishing and maintaining a partnership was heavily dependent on effective communication between the partners, their ability to be sufficiently flexible to accommodate restrictions on the time and availability of each other, and support within the school for the teacher, from the scientist's line manager, and from the SiS project team.

Effective communication

The most important criterion for a successful partnership was good communication. Effective interaction between the scientist and the teacher resulted in realistic expectations of each other and therefore a workable and mutually beneficial program. Teachers attributed their successful progress to

> The communication by email and planning by email discussion. [FG5, T1 primary]

> Discussing the timetable with my scientist. If she has a clash on some time then we reschedule it. We do this by email. We have a very good email communication relationship going on between the two of us. We plan a term in advance – around a 10-week period of time. [FG5, T primary]

Good communication was also a way of building trust between teachers and scientists. One scientist noted

> It is dependent on the teachers, whether or not they are willing to let go control, particularly because the teachers don't know how the kids will react, are they going to be rowdy? participate? . . . There is very much a trust issue going on between, and the more times teachers can meet with them [scientists] without that sales job of I will come into your classroom and do stuff with your kids, the easier it's going to be. [FG1, S4]

> I get the feeling that it is really cool having me along because I can answer questions that the science teachers can't and the kids are enthralled to have a real scientist there. [FG4, S4]

In contrast, a scientist who provided information to us by email had been restricted to talking only with the teachers, and not students, believed that the teachers felt they would be "shown up" if the scientist contradicted them, or could answer questions that they could not.

Flexibility: time and curriculum

There are two aspects to flexibility. The first is being able to find a mutually convenient time for the scientist's input to be made, and the second is finding a match between what the scientist is able to do and what the teacher can fit in to the class timetable. Both of these aspects are illustrated in the following quote from a teacher, which also illustrates the benefit of effective communication.

> [The scientist] came to us with his own idea of what he would do, which wasn't what we wanted, so we had an honest conversation about what the options might be, and we reached a compromise in the end. I don't think he had a realistic perception of what happens in schools. . . . He is working with one specific class, but only one of three sessions each week coincide with the time he is available, so I will often change my program so that when he comes we can make the best use of his time. But it can be a bit of a challenge. [FG2, T1 secondary]

Teachers at a primary school were delighted with the skill and willingness of their scientist to present to students on almost any topic, and he had talked to most year levels.

> [The scientist] was able to be flexible in both timing of his visit and the content he offered. [I10, T primary]

Support for the partnership

Effective partnerships were enjoyed by teachers and scientists who had a broad base of support within their institution.

> You really need a good principal to back you up if you are in SiS. You really need the principal to be right behind you all the time to agree with what you are doing and that flexibility. [FG5, T]

> I've had nothing but support, a true partnership with principal and teacher. They want it to be sustainable, to go on for more than one year. They have been very supportive. [FG5, S]

> My boss allows me to use work time to organize/meet/attend activities – very flexible. [FG5, S]

> Extremely positive support from the line manager. As long as this is seen as a strategically important thing for us to be doing within the university it will be supported. If it is seen as strategically important, then shouldn't it be factored into people's work loads? [FG5, S]

Several scientists were able to have their SiS participation written into their work expectations and this made it easier for them to get time release from their work place to participate in SiS.

> My boss was very excited. But my immediate manager wasn't very happy as he could see it taking time away from my work. And so we wrote objectives for my next year's work. He and I have to agree on my objectives. Once he read the objectives he got very excited and said, "That is going to look so good for our group". It was all about the glory for our group. It was all about "How much time is this going to take?" And now it is "How much time do you need?" [FG5, S]

> One of the things I have done is having it written into my feedback report and plan for the following year. So now I am obliged to do it. [FG4, S2]

Support from the SiS project team was a key factor in starting and maintaining partnerships. Assistance for scientists obtaining security clearances to work in schools was mentioned as something a teacher would not wish to request of a scientist. More important was the monitoring role of SiS.

> I certainly appreciated the introductions and the matching . . . [it] has been good to have the SiS people pushing, otherwise I might not have worked so hard to have a scientist in my school and reap those benefits. It would have been very hard to make those connections without help. [FG2, T1 secondary]

> I don't think we would ever have made contact with [our scientist] without SiS help. [FG2, T2 secondary]

Several scientists were in their second partnership and were grateful for a rematch organized by the SiS team. Some also were unsure about how to handle a shaky relationship without embarrassment.

> I started off with a primary school, but this year the teacher did not get back to me, and we had a SiS meeting and I told Margaret it wasn't working and she said she would ring her up and then she gave me a new school. [FG3, S3]

> I think the main thing to arise out of SiS, is who do you go to when things aren't going well. [FG3, S7]

> But the relationship has drifted a bit now, and if you asked them, they would probably say they want to keep it going, but you need a face-saving mechanism of ending the partnership. Maybe put a defined end date on it instead of making it open-ended. [FG3, S6]

Suggestions for additional support from SiS

Teachers believed that the key to SiS was successful communication and also networking, so that they could communicate with others outside their own partnership. They found the networking meetings helpful and suggested that they be once a term. An email newsletter was also suggested, to help keep SiS in mind and to update participants who could not attend networking meetings. Another suggestion was a list of scientists with their expertise, so there was a pool of experts available to assist in needed topic areas.

3. What kinds of things have hindered your partnership?

Not surprisingly, partnership progress was often hindered by a lack of the factors that assisted progress. Chief among these was poor communication (even basic manners), often resulting in a mismatch between partners' expectations of each other, lack of appropriate knowledge or skills, pressures of time, and lack of support from the institution.

Poor communication

Sometimes promising or even apparently successful partnerships foundered through poor communication; either failure to respond by one partner or the other, or such a slow turnaround in response that initial plans were no longer viable.

> We haven't heard back from our teacher. We wonder if they want to keep us involved. Does our age have anything to do with it? We are an elderly retired couple. We are very puzzled by this. [FG5, S]

> I've rocked up for appointments and the person hasn't been there and hasn't told me. That has happened to me three times in the last 8 months. [FG5, S]

> I got teamed up with a science coordinator at a primary school. He was very enthusiastic but then I got passed to a teacher and he is not as enthusiastic, and passed me on to a student in his class, so for the last few months I have been negotiating with an 11-year-old, excursions and visits, which has been a little bit surreal! I set up an excursion here, and everyone was excited about it, but nothing happened. It has been very confusing and I don't have a lot of time to follow-up. . . . I am trying to get out of them what they want me to do when I go to the school, how long they want me to talk for, and what do they want me to talk about? Because they just said the environment and the environment is a very big topic! [FG3, S7]

> I have found it frustrating trying to communicate with teachers, even though we both have email, because they are always in a class. And if I ring, he won't get back to me for three days because it takes a while for him to get the message and other things take priority, so I have learned not send an email that needs a quick response. [FG4, S1]

> It is hard to tell a volunteer scientist what is needed to maintain an ongoing partnership. [I14, T secondary]

A mismatch between what scientists could do and what teachers wanted them to do, was often an issue when expectations of each other were unrealistic.

> I went to a primary school science group meeting. It was like I was talking another language and we couldn't really get into the conversation, about what I could provide and what they wanted, I couldn't see that there was a link. . . . It seemed to me they were going through a period when they had to come up with a new curriculum from kindergarten through to fifth class, and they weren't sure what they could do and they wanted someone to help them out with that, but my experience is completely different from pedagogy, so I couldn't help them. [FG1, S2]

> [The scientist] had little to offer beyond career experiences and general helping, rather than adding value to the science curriculum. [I14, T secondary]

Some scientists were keen to assist but did not know how, and schools did not seem to know how to use them.

> I have only recently been able to get in contact with the school. The teacher was slow to organise a meeting, possibly too busy. About three weeks ago they asked me to give a presentation last week to Years 5 and 6, about my work, which I did, and I am still not sure how they want to use me. The teacher I am working with is trying to work out how they want to go forward. I am going there this afternoon to get some more information. They did mention some projects, but I need to find out what they intend to do. . . . They seem to have some general ideas but don't really know what they want. Seems to be more up to me to decide what can be done. . . . I think the way that it started, I was relying on the teacher to work something out, I didn't push it. I did correspond with them a number of times but left it up to them. [FG4, S3]

Lack of partner's appropriate knowledge or skills

As most scientists are not trained teachers, they often lack knowledge about what is appropriate for students of different ages, and the skills of classroom management. In effective partnerships, these problems are overcome as the partners work together, but in other partnerships, they are not.

> He is very willing to be involved, and he is very good at what he does, but I can't find how to fit him into the curriculum. . . . Basically you need someone who can talk to teenagers – if so, teacher will find a way. [I13, T secondary]

> Some teachers tend to leave the students to my control. I'm not a trained teacher and have found it difficult to teach 30 odd loud and enthusiastic Year 4/5's when the teacher hasn't helped with discipline of the class. This isn't easy!! [FG5, S1]

> At my school, the teachers on a whole aren't interested in science. They don't like science and are not comfortable with it. I feel used by that. They want me to do their job, and that squashes my enthusiasm. [FG5, scientist]

> The teacher expected me to come up with ideas suitable for the kids. I don't know what kids at that age (Year 2) are up to. I'm not a teacher, and that comes back to communication and support again. I'm the scientist in my career and also in personality. I box things. I'm a nerd. I'm a scientist. I had a child drink my experiment! [FG5, scientist]

One scientist was concerned to find the required scientific method to be used by students in a high school class was in no way connected with the way the scientists in his laboratory worked. This made him uncertain about the use of accepted terminology in the classroom:

> The science teachers are telling the students that to do an experiment you need to write down explicitly in a certain format what your hypothesis is going to be and I don't know how they do that, so you get a little bit worried about getting caught out and looking foolish. Here's a scientist who doesn't know what is the scientific method. [FG1, S3]

Finding time and finding space in the curriculum

Finding time to communicate, time for scientists to get into a class, and time to fit the scientist into a crowded curriculum; all made lack of time a major hindrance in a majority of partnerships. In secondary schools the lack of flexibility in teachers' timetables and apparently rigid curricula, particularly at the senior secondary level, were considerable barriers.

> [Teachers] are keen to do stuff, and I would like to do more activities, but we are both stretched for time, finding time to meet, finding time to plan what we are going to do, and then after funding so we can buy equipment all takes time. I could do more things if I had more time to talk to them and they had more time to talk to me. I could do something weekly, but it is getting it all organised. [FG4, S1]

> I visited with [my teacher], and I am supposed to go back, but we are having trouble finding the time. High school teachers seem more frazzled. I went there, had a chat. We are trying to get something going. [FG3, S4]

> Teachers are reluctant to let you interact with students. They have got so much content to cover they couldn't see where to fit you in. [FG1, S2]

To overcome some of the problems of fitting in to senior curricula, one scientist suggested an assessment aspect of SiS be integrated into a course.

> But the secondary schools – the latter years, their curriculum is so jam-packed. Very assessment driven. Is there a way to get a program like this into one of those assessment units? Can SiS, or whoever is responsible for VTS assessment, go to the government and say that kids do three days, one week, whatever is equivalent to a VCAT unit, or what ever they do now, I don't know, but some sort of unit that the scientists can take part in, that actually counts, rather than you turning up, and the school has to squeeze you in, which is very hard for them but if it is some defined curriculum unit, that is much easier for the school, because they are used to it. Then it is integrated and the students get a mark. Primary schools are much easier, but if you are targeting career students, at Year 11 and 12, they really need a curriculum unit rather than just a visit or a project which means nothing. Their teacher can assess it. [FG3, S4]

Lack of support for the partnership

Effective relationships required support for the scientists from their employers and for the teachers from their schools. Several scientists were "engaged" by enthusiastic school deputies or department heads, but were then passed to other teachers (or an 11-year-old student in one case) who were less enthusiastic. These partnerships usually struggled through poor communication. Although some partnerships were successful, despite the odds, they were characterized by struggle. One scientist was told by her supervisor that she could only visit schools in her own time, but of course schools are in operation during working hours. Another said,

> I fought tooth and nail to get onto this program, I wasn't supported by my immediate boss, but I was able to get support from the higher level. [FG4, S5, who had a child at her school]

A second scientist from the same, large institution said,

> I had no problem. I took out some hats and sticky notes and things for the kids I got from the front desk. [FG4, S1]

An interviewee, whose partnership had stalled, pointed out that with a new principal the priorities in her primary school had shifted and science was no longer a priority.

> If participation in these projects is not valued, enthusiasm and passion get worn out. [I1, T primary]

One hindering factor, mentioned in several focus groups and some interviews, was lack of resources or financial support.

> I think resourcing is an issue. I have got a vested interested in the school, so use personal money to buy resources for the school and bring things in, so I never ask the Principal for money. Because I am on the school board I know the finances are not there, so I do what I can to make things happen. I think resourcing is a huge problem, because if I didn't have that vested interest in the school I probably wouldn't be so keen to spend my money getting things up and going. [FG4, S5, who had calculated that she had spent over $300 of her own funds]

Summary

Even though it was clear from the focus group discussions and interviews that participants had very varied relationships, the themes identified above were common across all of these groups. As a way of emphasising this consistency, Table 8 summarises the themes and the occasions where they arose.

Table 8. Themes Identified in Focus Group Discussions and Interviews

Theme	Focus Group					Interviews
	1	2	3	4	5	
Benefits of SiS						
Increasing profile of science at school	✓	✓	✓	✓	✓	✓
Opportunities for professional development for teachers	✓	✓	✓	✓	✓	✓
Benefits for participants	✓	✓	✓	✓	✓	✓
Things that assist partnerships						
Effective communication	✓	✓		✓	✓	✓
Flexibility: time and curriculum	✓	✓	✓	✓	✓	✓
Support for the partnership	✓	✓	✓	✓	✓	✓
Things that hinder partnerships						
Poor communication	✓		✓	✓	✓	✓
Lack of partner's appropriate knowledge or skills	✓	✓	✓		✓	✓
Finding time and space	✓	✓	✓	✓	✓	✓
Lack of support for partnership	✓		✓	✓		✓

Clearly, there are benefits from the SiS program for all groups of participants: scientists, teachers and, of course, students. In terms of the issues that assist and hinder partnerships, the same matters were evident: effective communication between partners, time for communication and planning, and flexibility to fit scientists into school programs. Where these things were evident, partnerships worked well. When they were not, the partnership was strained and sometimes could not survive.

Findings from the Case Studies

A total of 12 case studies were completed, and descriptions of these are provided in Appendix 12. These were constructed from data collected during 2008 from the focus group discussions and interviews, together with notes made during school visits, and student surveys, where available. Details of the data used to construct each case study are included in Appendix 12. Data from the students are reported in the next section. Each case study focused on one scientist-teacher partnership, even though some scientists were partnered with more than one school, and some schools had more than one partner. In 2009, towards the end of first term, each member of the partnership was sent an email to determine the current status of the partnership. Of the 24 partners emailed, only one teacher (who had already advised she had moved to a new partnership) and one scientist failed to respond. An overview of the case studies is provided in Table 9, which also reports the partnership status on two occasions.

Table 9. Overview of Case Studies

Case #	Name	Location	Sector	Type	Partnership Status	
					October 08	April 09
1	Sharing the scientist	ACT	Gov’t	Primary	Active	Active
2	Tuesday science club	ACT	Gov’t	Primary	Active	Active
3	“SiS is not a labour saving device”	ACT	Gov’t	P-10	Active	Inactive
4	Doing good for people	Vic	Gov’t	Primary	Active	Active
5	“Science has changed my life!”	Vic	Gov’t	Primary	Active	Active
6	The WOW factor	Vic	Catholic	Primary	Active	Active
7	“It’s a human thing”	Vic	Gov’t	Secondary	Active	Active
8	The need to add value	Vic	Indep’t	All Years	Inactive	Inactive
9	“I want to be happy with my career”	Vic	Catholic	All Years	Inactive	Withdrawn
10	Raising the profile of science	WA	Gov’t	Primary	Active	Active
11	Collaboration, communication and enthusiasm	WA	Gov’t	Primary	Active	Active
12	“I saw one swimming!”	WA	Indep’t	All Years	Active	Dormant

A description of each case study is included in Appendix 12. In addition, a full description of Case Study 11 is provided in Appendix 13. In this section a synthesis of the findings from the case studies is provided. At least one of the partners (and in most cases, both partners) had been interviewed. Their data contributed to the discussion in the previous section about the three themes of benefits to participants, factors assisting partnerships and factors hindering them. In this section, the diversity of the case studies is summarised and the determinants of their progress analysed.

Nature of the Case Study Partnerships

Each partnership was unique, with its own kind of scientist-teacher interactions and activities, as well as covering a variety of topics or content with the students. There was also a variety of expectations, means of communication and frequency of activities among the partnerships. The most active partnership was in Case Study 2, where the scientist ran a science club most Tuesdays, assisted by one of the teachers and another parent at the school who was also a scientist. The topics and activities were planned jointly by this group of three. The program was well-supported by the school's Deputy Principal, and listed on the school's website as one of their specialist activities.

The least active partnerships were in Case Studies 3 and 9, where the scientist had visited once to make an invited presentation about a particular science topic to a Year 1 class (Case Study 3) or a Year 11 class (Case Study 9). Neither of these partnerships survived. In Case Study 3, communication lapsed, and in Case Study 9, both partners independently decided to request a rematch. Case Study 8 was inactive and communication between the partners had lapsed by October 2008 and had not been resumed by April 2009.

Progress of the Partnerships

A particular purpose of the case studies was to track the partnerships over a period of time to see how they progressed, what underpinned their success, and what problems or barriers they faced and overcame. The progress of the partnerships varied, as might be expected given their diverse nature. As shown in Table 9, in April 2009, two of the twelve partnerships were inactive, one was withdrawn, and one dormant (and is expected to resume). The strongest partnerships were those where the partners had a good relationship and had become friends who could work together respectfully and professionally, allowing the flexibility each needed to perform their normal job and to fit in partnership activities where and when it was mutually convenient.

On the one hand, these partnerships were fortunate because the participants were able to become friends, so that meeting, planning and delivering SiS activities was a pleasure rather than a chore. On the other hand, this mutually respectful partnership did not develop without effort from both partners. Central to this understanding was effective communication. Unless there was a clear understanding of what the scientist could do that would fit into the class activities, and the constraints attributable to time and curriculum were considered, partnerships tended to fade away, as each waited for the other to make decisions, make contact, or otherwise keep the partnership alive. Regular monitoring by the SiS team can assist this process, act as an intermediary when required, keep everyone involved, and if things aren't working, intervene.

Findings from the Student Surveys

Data from students were obtained from nine of the twelve case study schools. Four other interviewees from secondary schools were asked to provide some data, but because of end-of-year pressures for the classes involved in the SiS program, these data did not eventuate. An overview of the data obtained is presented in Table 10. Because each school had a different program, each of the data sets was analysed separately and the findings are described in the following sections.

Table 10. Number of Students and Location of Schools Submitting Data

Case Study #	Name	Location	Sex	Year Level		
				K – 3	4 – 7	11
1	Sharing the scientist	ACT	NA	2	-	-
2	Tuesday science club	ACT	Girl	-	1	-
4	Doing good for people	Vic	NA	17	-	-
5	"Science has changed my life!"	Vic	Boy	-	9	-
			Girl	-	12	-
6	The WOW factor	Vic	Boy	-	11	-
			Girl	-	16	-
9	"I want to be happy with my career"	Vic	Girl	-	-	18
10	Raising the profile of science	WA	Boy	8	6	-
			Girl	9	11	-
11	Collaboration, communication and enthusiasm	WA	Boy	-	11	-
			Girl	-	11	-
12	"I saw one swimming!" Set 1	WA	Boy	8	-	-
			Girl	13	-	-
	"I saw one swimming!" Set 2		Boy	11	-	-
			Girl	19	-	-
	Total students			87	88	18

Lower Primary School Students

Case Study 1: Sharing the Scientist

In Case Study 1, the scientist was shared amongst most year levels. He was very flexible and, although his specialisation was in global warming, according to the science coordinator, "he has been doing other things with the Kindy, doing what science is, like matter, magnetism, right up to the Year 5s doing global warming.” [FG2 T3 primary]

As part of their reflection on the activities performed with the scientist, the children were asked to draw their favourite activity, what they had learnt and what they would like to learn more about. The researchers were able to obtain copies of two of the Kindergarten children’s work which had been done earlier in the year. These were on A3 sized sheets and the teacher had written anecdotal comments on these drawings. The responding children’s favourite activities were magnetic repulsion and making biscuits. The students had learnt that “a balloon expands when we blow it up” and that “magnets stick together”. Both students also stated they would like to learn more about train tracks expanding and contracting. One of the teachers explained in interview that this comment referred to an activity the scientist had done which, even at the end of the year, many students still remembered [I9, T primary].

Case Study 4: Doing Good for People

In Case Study 4, the Year 1 class’s second activity, having met their scientist, was an excursion to CSIRO. During the excursion the students observed safety signs, were introduced to aspects of their scientist’s research into aeronautical material and had a lesson on air and weather by another scientist. On their return to school, the students each created a page for a book about their CSIRO excursion. This included word processing their comments and drawing a picture. Images of 17 students’ pages were available to the researchers. Twelve students wrote about, and drew pictures of, the experiments they performed. All except one student described a specific experiment, such as tornado in a bottle, breaking a ruler, ping-pong ball or tissues. One student’s drawing and explanation is shown in Figure 2.

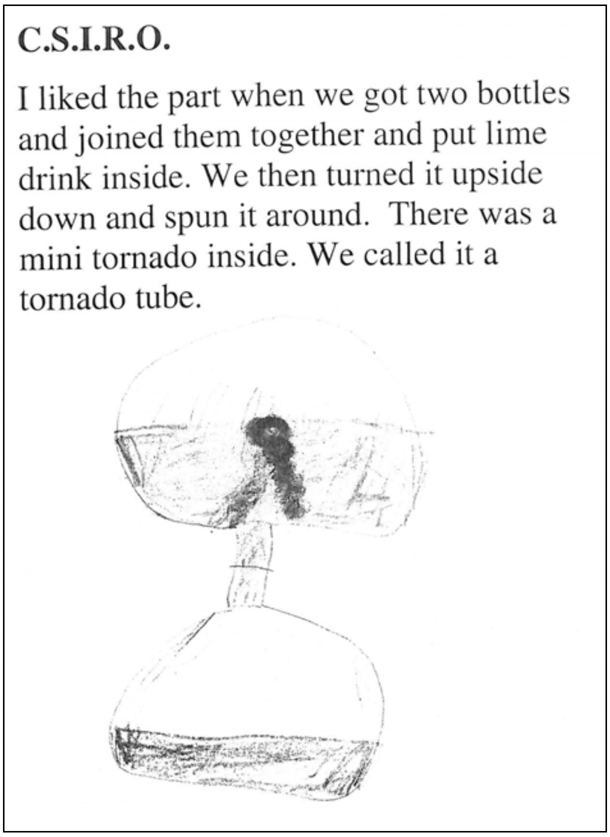


Figure 2. A Year 1 child’s report on a favourite part of the excursion

Three students wrote about the materials used in the aeroplanes, while two students wrote about the signs. Within their comments, word processed onto their page, three students stated that they would like to be a scientist when they grow up. Figure 3 shows one student's drawing, to which the student had added "Dr [our scientist] is cool!". One student who did not want to be a scientist when grown up already had career plans.

> The best part was the bottle experiment when [another scientist] made a mini tornado. I would not like to be a scientist because I want to go on stage and be a rock star. I like Dr [our scientist] because she knows a lot of science. [4 1 08, sex unknown] [3]

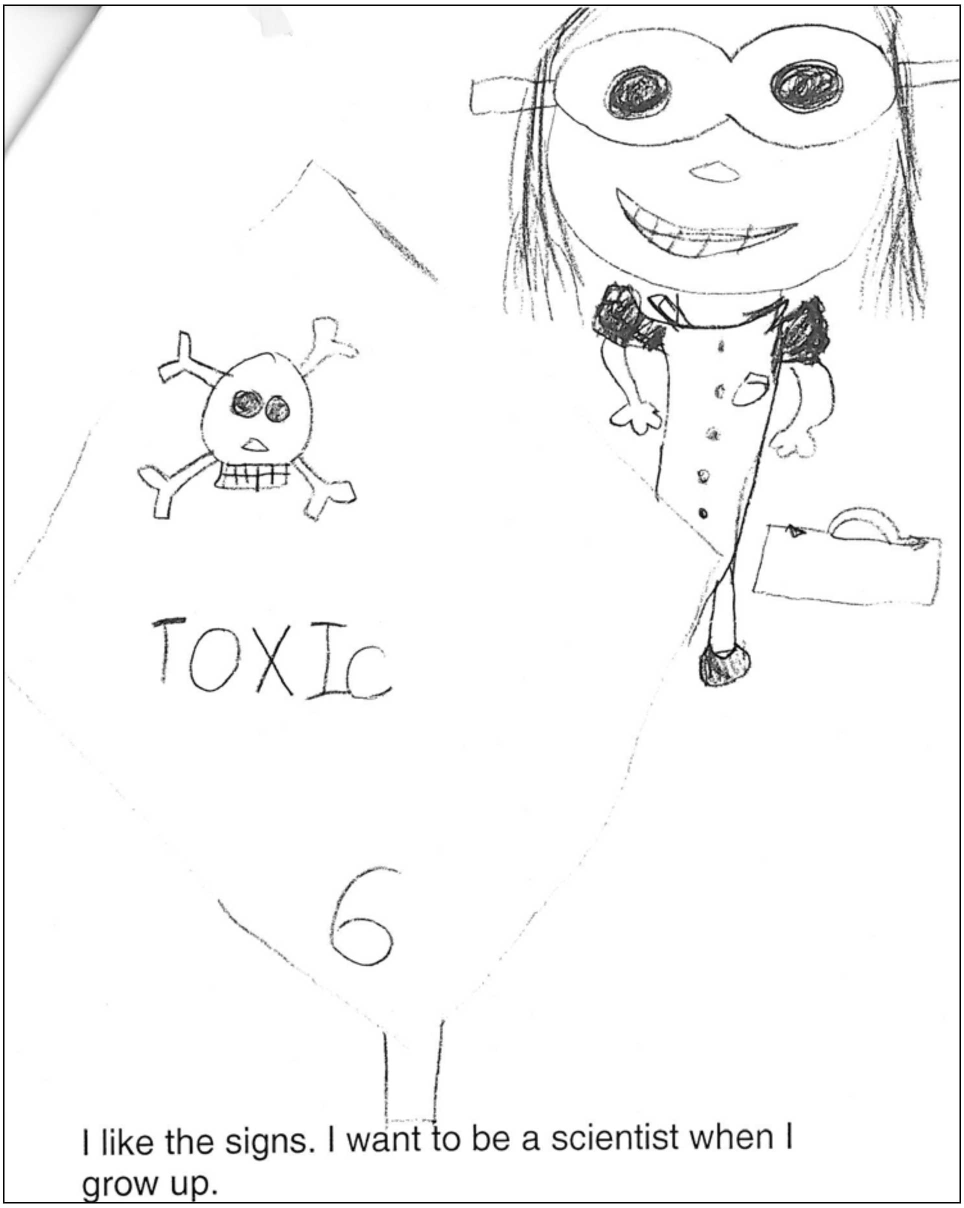


Figure 3. A Year 1 child's drawing of a favourite sign and the scientist

[3] Students are identified by number codes for the case study school, the year level, their ID within their class, respectively, and their sex, if known.

Case Study 10: Raising the profile of science

The scientist visiting the primary school in Case Study 10 presented various sessions addressing the curriculum strand of Natural and Processed Materials. This fitted her particular interest (she was a chemist) and her main emphasis was to introduce the students to some basic chemical reactions. She demonstrated the volcano experiment using bicarbonate of soda and vinegar which a combined Year 1/2 class found to be very exciting. She also performed an activity in which she changed the colour of a candle, which the students (and the researchers) found rather mysterious.

A total of 17 students (9 girls and 8 boys) drew a picture to represent their experience with their scientist. A breakdown of the drawings indicated the following: 14 drawings included a picture of a volcano exploding activity, 9 drawings had a picture of the student and the scientist, and 4 drawings included a picture of the candle activity. Figure 4 shows one girl's drawing of the volcano activity. Her detailed drawing clearly shows the chemicals that were placed inside the volcano to make it erupt and she labelled her drawing: "Ms [scientist] and me and a volcano. It spat lava out. It was very hot"

Figure 4. A Year 2 girl's drawing of the volcano experiment

Case Study 12: "I saw one swimming! I saw one swimming!"

In Case Study 12, data were provided from two different visits by the scientist to two Year 1 classes. The first visit centred on investigations and the second was based around microbiology. Each visit is reported separately.

Investigation

In the Investigation visit, children from the two classes rotated around four different investigations. Three investigations encouraged children to use a predict-observe model of investigation. These investigations involved predicting and then observing what would happen if

marshmallows and jellies were placed in a microwave oven,

different coloured smarties were placed in a bowl of water, and

food colouring was dropped into a bowl of milk and then detergent added.

The fourth investigation involved making and flying an O-wing and then changing a variable to make it fly better.

Responses were obtained from one class of 21 students. The students were asked to draw their favourite investigation and write why they liked it. A breakdown of the drawings revealed that 14 drawings included a picture of marshmallows (generally inside the microwave oven), 3 drawings had a picture of smarties in a bowl, 3 drawings included a picture of food colouring in milk, and 1 drawing had a picture of an O-wing. All but one student described their favourite investigation. One detailed response included the following, with the child's original spelling.

> Teacher poot a lolly in the microwave and it popt when she poot her finger on the lolly.
> [12 1 05 girl]

Only nine students gave a reason for their favourite investigation. Five stated that the marshmallow investigation was the best because "I got to eat the marshmallows." Two students liked the smarties investigation because the parent helper was either their parent or their friend's parent. Two students stated they liked the food colouring and milk investigation because "it was interesting" and "I liked the colours mixing together". Both of these students attempted to draw the equipment used in their investigation including the containers of food colouring, the eye droppers with different colours, and the bowl of milk. One of these pictures is shown in Figure 5.

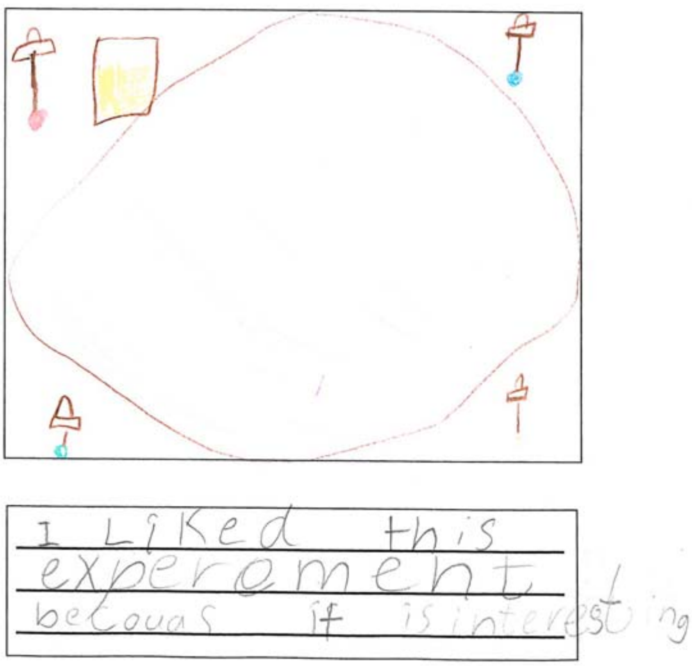


Figure 5. A Year 1 child's drawing of an investigation dropping food colouring into milk

Microbiology

During the scientist's second visit the children from both classes were introduced to Microbiology. The scientist gave a general introduction to all the students about small things and how microscopes could be used to see them. Both classes then moved to the senior school science laboratory. One class was given an introduction to microscopes and laboratory safety and then had the opportunity to look through the microscopes to observe the cells in the skin of an onion and then some live *Euglena* (single-celled algae) in pond water. The other class had a tour of the secondary science block by a secondary teacher and a basic introduction to electric circuits using wire, battery and a light bulb. After 30 minutes the classes swapped over.

One of the researchers attended the afternoon visit and made field notes of the classes' activities. The children were very excited to be looking into the microscopes and found the live, green algae very interesting. One child was so excited by what he saw, he suddenly began running about shouting, "I saw one swimming! I saw one swimming!"

To record their afternoon's activities, the students were asked to draw a picture about what they did in the laboratory, and describe their picture. Responses were obtained from both classes giving a total of 30 students. A breakdown of the drawings revealed that all students drew what they saw in the microscope. The drawings represented what could have been an individual *Euglena* or a full, circular picture of what they saw in the microscope. Twenty four students wrote the word "*Euglena*" as part of their picture. ("*Euglena*" was written on the whiteboard.) Twenty students drew circuits, with some students labelling the parts such as "battery", "light" and "wire". Six students drew a picture of a microscope or themselves looking down a microscope. One student listed some of the safety rules of the laboratory, including "no running" and "no shouting". Nineteen students drew pictures of both the *Euglena* and the circuits, often using both sides of their sheet of paper. Sixteen of the students attempted to label their pictures. Figure 6 shows one child's comparison of *Euglena* and onion skin, as seen through the microscope. This child has also labelled the diagram.

A variety of responses were obtained in the students' descriptions of their pictures. Eleven students provided a description of the *Euglena*, with most of these noting the movement of the *Euglena*. Some students described the colour or mentioned that the *Euglena* looked like a skeleton. Original spelling is retained.

> There are green and yellow. They half one black dot. [12 1 08 girl]
>
> I saw lots of algae it moved about. Its half plant half animal. I loved it. [12 1 13 boy]
>
> I love seeing threw the microscope and I saw algae and it moved. [12 1 27 boy]

Six students only mentioned algae or *Euglena*, without any further description.

> I saw algae. [12 1 17 girl]

In describing their picture, three students mentioned only using the microscopes.

> When we used the microscope. [12 1 07 boy]

Fourteen students expressed their fondness of the activities either through the use of the word "like" or "love", and one student only wrote about the circuits.

> I like algae becaes it was cool [12 1 11 boy]
>
> I love the electricity when we built it you tonrd a switch [12 1 26 boy]

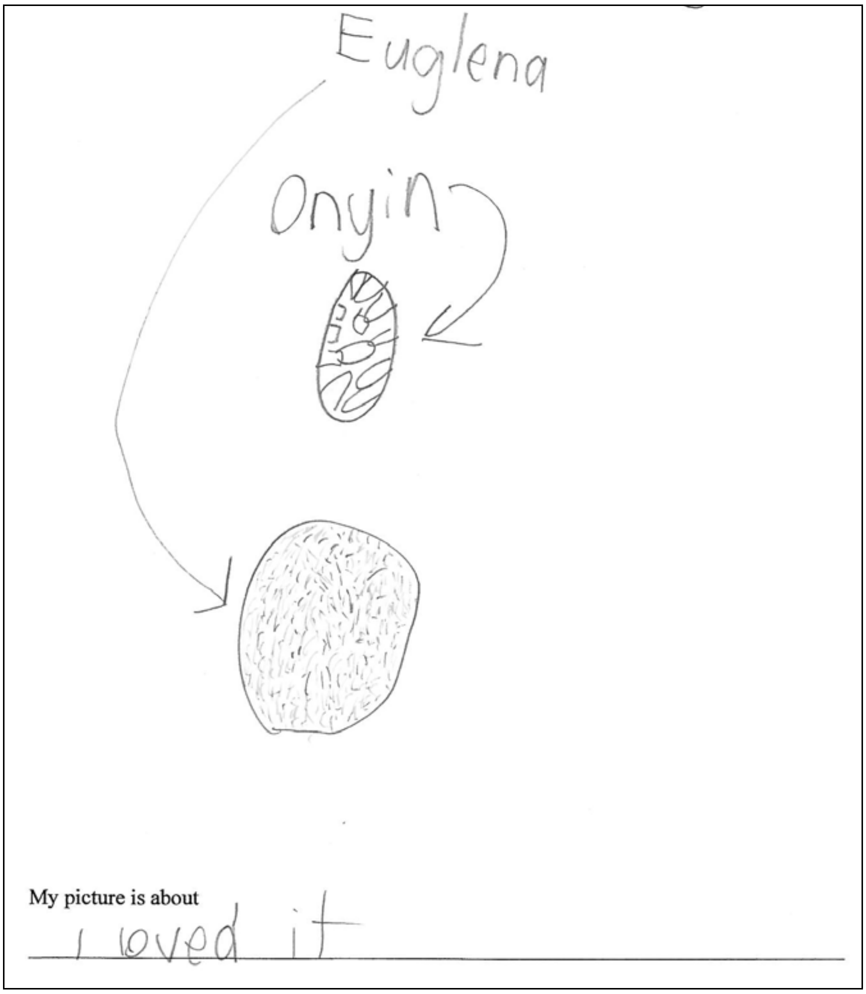


Figure 6. A Year 1 child's drawing comparing onion skin and *Euglena* under a microscope.

Upper Primary School Students

Four case study primary schools returned survey data from their students. Table 10 shows the numbers of students, their year level and location of their schools. Just one girl from Case Study 2 wrote about her experiences in the Tuesday Science Club and these are summarised separately. The students from the other four schools all completed a student survey (see Appendix 5), and although they had quite different experiences with their scientist, their results are considered together. The Year 5-6 students from Case Study 5 had experienced a heart dissection with their scientist. The Year 4s from Case Study 6 had experienced a sequence of lessons with a scientist who specialised in potatoes. As part of their activities in 2008 they planted 15 types of potatoes which were harvested in April 2009. Year 7 students in Case Study 10 had a series of chemistry sessions with acids, bases and indicators. Finally, the Year 6-7 students from Case Study 11 worked on a project about forensic science.

Case Study 2: The Tuesday Science Club

The scientist and a classroom teacher from Case Study 2 run a weekly lunchtime science club for students in Year 4 and above. Approximately three weeks are spent on activities for any given topic in the club.

Only one response was obtained from this school. When asked what she had learnt, the Year 5 girl wrote information on four different topics (growing beans, head lice, acids and bases, and ice cubes and oil). The descriptions for the latter two were quite detailed, as illustrated in her comment about acids and bases.

> We can use cabbage water (an indicator) to help us decide if something is an acid or base. It turns red if it is an acid (like lemon) and turns blue/green if it's a base (like washing powder).

The student responded positively about working with a scientist, indicating her enjoyment in the science club, doing new things, learning new things, and remarking on the scientist's knowledge.

> It was fun because we did new experiments every week and learnt lots of new things. It was good to work with (a scientist) because you could ask her questions and she could answer them.

In response to what different science careers the student had learnt about, she wrote only one word: "research". The student stated she was more interested in becoming a scientist because there was a lot of scientific equipment that can be used, and that "I like to test things".

Case Studies 5, 6, 10 and 11: Responses to the Student Survey

The first survey question asked students "what did you learn from the scientist?" All of the students in these four case study schools were able to write about at least one thing they had learned, and many wrote quite comprehensive paragraphs. Two students wrote

> [Our scientist] taught us about all the different varieties of potatoes and all the different colours of potatoes and all the different diseases and the last thing he taught us was how to grow potatoes. [5 4 2 boy]

> I learnt the three most common fingerprints loops, whorls and arches and how to print your fingers. I learnt lip printing, and how to find evidence and secure them to find the criminal. We learnt about how chromatography works for different pens. [11 6 06 girl]

The second survey question asked students "What was it like working with a real scientist?" Students replied with a variety of comments, some making two or three separate points. These were coded and the results are summarised in Table 11.

There is no doubt that students enjoyed their experiences. Many students made positive comments about their scientist, not only in terms of their expertise, but how kind and interesting they were as people. The following comments reveal students' range of reactions.

> It was really fun working with a real scientist because she knows the answer to all my questions. I can also say that it's cool because she has more experience than other people involved in any science things. [10 7 02 girl]

> At first I found it scary because I thought that she would say all different confusing words but it was really fun and easy. [6 5 06 girl]

> It was really fun because she knew all about our body. It was cool to feel like I was a scientist. [6 6 19 boy]

> He is kind, he tells interesting stories He can answer in great ways. He does amazing things, he is really smart. He is very engaging. [5 4 20 boy]

Table 11. Upper Primary Students' Views about Working with a Scientist

Responses	Percentage of students			
	Case Study 5 (potatoes)	Case Study 6 (heart)	Case Study 10 (chemistry)	Case Study 11 (forensics)
Interesting, fun, exciting	100	78	53	50
Learned new things	57	37	18	45
Liked experiments, hands-on	19	19	24	55
Scientist knows a lot	19	41	41	9
Different to normal lessons	-	11	6	18
I felt like a scientist	-	4		5
Total comments (n)	41	51	24	34
Total students responding (n)	21	27	17	22

Note. There were 150 comments from 87 students.

Students were next asked "What different science careers did you learn about?" All but six students were able to name or describe at least one science career. The kinds of careers mentioned usually related to the career/speciality of the scientist with whom they had worked. Those from Case Study 5 had discussed different science careers and mentioned an average of 4 quite diverse careers. One boy wrote:

> I learnt a lot about science careers. You can become a conservationist, a marine biologist, a pathologist, an entomologist and an astronaut. I now know that you don't have to work in a lab to be a scientist. [5 4 01 boy]

The final survey question asked "Did the scientist make you more interested in becoming a scientist? Yes/No Why/Why not?" Almost all students responded yes, and usually gave at least one explanation for their answer. Tables 12 and 13 summarise the reasons given for yes and no choices, respectively.

Table 12 reflects the high degree of interest students experienced in the SiS activities. The main reasons for increased interest in science as a career related to finding those activities interesting and enjoyable and learning more about science. Some example responses follow.

> Because I learnt things that I didn't know before. There is probably a lot more things to learn about science. [10 7 05 boy]

> Now I look forward to science. I used to think science was for geeks. [5 4 11 boy]

> It was really fun for me and I want to know more and discover more and pass down the information I learnt from it. [11 6 06 girl]

Two girls who said yes, were ambivalent in their response:

> It did help me to want to be a scientist more but didn't really make me want to be a scientist for a job, thanks anyway. [6 5 10 girl]

> It did interest me more in becoming a scientist but not one that dissects hearts! [6 5 27 girl]

Table 12. Upper Primary Students' Reasons for Increased Interest in Science as a Career

Reasons	Percentage of students			
	Case Study 5 (potatoes)	Case Study 6 (heart)	Case Study 10 (chemistry)	Case Study 11 (forensics)
Interesting, fun, exciting	80	64	54	54
Understand more about science	35	36	46	31
Did real experiments	5	14	31	31
Scientists discover new things	15	-	8	-
Science, scientists important	5	-	-	8
Lots of different jobs, opportunities	-	7	-	-
Always wanted to be scientist	5	-	8	-
Ambivalent		14	8	-
Total reasons (n)	29	19	13	16
Total students responding yes (n)	21	14	13	13

Note. There were 72 reasons from 61 students.

Students gave several reasons for not becoming more interested in science and these are noted in Table 13. Most were just not interested in science or the topic and some did not like science. Others mentioned they already had a career chosen, and some were already planning to consider science. This did not mean that they did not enjoy the scientist's visit however, as a couple of ambivalent responses show.

Some examples illustrating the range of responses follow.

> Well, I don't really like working with insides and organs. I find it really disgusting. [6 5 04 girl]

> Because that's not the job I want. I want to be a ranger. [10 7 17 boy]

All Case Study 5 students became more interested in becoming a scientist, but only about half of the Case Study 6 students did, even though they enjoyed the heart dissection. This seemed to be attributable to the nature of the activity; it was fun to put one's fingers into arteries and veins, but not frequently! One boy wrote "you have to do a lot of disgusting things." [6 6 03] The experience drew some ambivalent responses, such as the following comment from a boy responding no.

> It did gross me when we dissected the heart. It was very fun but I don't think I would like to study human parts but maybe a different type of scientist. [6 6 17 boy]

Table 13. Upper Primary Students' Reasons for NO Increased Interest in Science as a Career

Reasons	Percentage of students			
	Case Study 5 (potatoes)	Case Study 6 (heart)	Case Study 10 (chemistry)	Case Study 11 (forensics)
Not interested in topic	-	31	25	33
Don't like science	-	46	-	-
Already chosen my career	-	8	75	33
I'm not good at science	-	-	-	33
Ambivalent	-	15	-	-
Total reasons (n)	-	13	4	9
Total students responding no (n)	-	13	4	9

Note. There were 26 reasons from 26 students.

Secondary School Students

The school in Case Study 9 ("I want to be happy with my career") provided data from 18 students whose participation in SiS involved a session working on the properties of paper. The students listened to a powerpoint presentation, used instruments to measure paper gloss and prepared graphs of the outcomes. The survey for secondary students (see Appendix 6) asked whether or not working with the scientist increased students' knowledge or understanding of science and to provide a specific example(s) of something they had learned. Thirteen of the 18 students indicated that their knowledge had increased, and most wrote something about their surprise at the variety and/or properties of paper. One wrote that although she had not learned anything new, she had been exposed to some new equipment.

In response to a question asking them to describe how the scientist worked with them, students gave a general description of the activities undertaken: that the session involved a powerpoint presentation and using some equipment.

Students were next asked, "Did working with the scientist increase your interest in having a career in science?" Only four students responded yes, and their reasons referred to their experience being interesting or that there was more to being a scientist than they had thought. Fourteen students replied "no" to this question. Eight of the 11 students who gave a reason (8) wrote that they were not interested in paper. "Paper isn't my passion", wrote one. Another student wrote "because he seemed so sad when he was doing it and I want to be happy in with career". Two thought it seemed rather boring, and one had other plans.

Summary

The findings from the students' data indicate a range of responses. For the most part, students have been active and interested in the things they experienced with their scientists and enjoyed them greatly. All of the primary students have been involved in hands-on activities that practised science investigation skills and many had also practised recording what they had done. Some of the lower primary students' drawings were quite sophisticated. The upper primary students' survey responses were also very positive, and most reported a positive change in their thinking about science and science-related careers. It is unfortunate that there was only a small amount of data from the secondary schools but, in part, it is a reflection of the much greater difficulty of fitting SiS into the more structured secondary science curriculum. The rather cool response to the scientist's presentation in Case Study 9 ("I want to be happy in my career") also reflects this, and perhaps a low key presentation by the scientist in a partnership that subsequently lapsed.

Findings from the Online Surveys

Demographic Information

The composition of the samples of scientists and teachers who responded to the online survey are provided in Tables 14 to 18. The data refer to the location and type of schools where the responding scientists and teachers were partnered. Although the patterns are reasonably similar between scientists and teachers, and it is certain that both halves of some partnerships responded, it is not possible to match the responses of any scientist to the corresponding teacher. The response rate to the survey was approximately 30% for both scientists and teachers.

The final columns of these tables report data provided by the SiS team as at January 15, 2009, after the survey was closed on January 11 (although nearly all responses were submitted before the end of December). The distributions of both scientists and teachers compare well with the overall distribution of partnerships. This suggests that even though the survey sample is voluntary, it is proportionally representative of the national distribution of partnerships, in terms of the numbers of partnerships in each state or territory, and the sector and geographic location of schools involved in partnerships.

Table 14. Respondents in Schools Involved in Partnerships by State/Territory

State/Territory	Scientists		Teachers		Total SiS Partnerships	
	Number	%	Number	%	Number	%
ACT	10	3.9	11	4.0	44	5.2
NSW	58	22.7	66	23.7	203	23.9
NT	3	1.2	5	1.8	14	1.6
Qld	74	28.9	87	31.8	241	28.3
SA	13	5.1	17	6.2	51	6.0
Tas	17	6.6	13	4.7	47	5.5
Vic	51	19.9	48	17.5	157	18.4
WA	30	11.7	28	10.2	94	11.1
Total	256	100.0	274	100.0	851	100.0

The final columns of Table 14 show that, in total, 851 SiS partnerships had been formed by January and the SiS data indicate that these partnerships were spread over 737 schools.

As shown in Table 15, about two-thirds of schools are government, and a majority of the remainder belong to the Catholic sector. Again, the proportional distribution between respondents and the total number of SiS schools in partnerships is very similar.

Table 15. Schools Involved in Partnerships by Sector

Sector	Scientists		Teachers		Total Schools	
	Number	%	Number	%	Number	%
Government	171	67.1	197	71.9	493	66.8
Independent	34	13.3	33	12.0	100	13.7
Catholic	50	19.6	44	16.1	144	19.5
Total	255*	100.0	274	100.0	737	100.0

* One scientist did not respond, commenting that he had not yet been assigned to a school.

Just over 60% of respondents were located in capital cities, about 20% in regional cities and only 2% in remote areas, as shown in Table 16. The most noticeable disparity between these tables occurs in Table 16, which shows the smaller proportion of responding scientists (13%), compared to teachers (21%), who are working in rural schools. Nevertheless, this represents a pleasing level of participation in schools where geographic location limits their ability to be involved in such outreach programs.

Table 16. Schools Involved in Partnerships by Geographic Location

Geographic Location	Scientists		Teachers		Total Schools	
	Number	%	Number	%	Number	%
Capital city	158	61.7	164	59.9	457	62.0
Regional city	60	23.4	47	17.1	}	
Rural area	33	12.9	58	21.2	} 280*	38.0*
Remote area	5	2.0	5	1.8	}	
Total	256	100.0	274	100.0	737	100.0

* SiS data do not distinguish amongst country schools.

To obtain a picture of the spread of teachers and scientists across types of schools and regions, Tables 17 and 18 present cross tabulations of scientists' and teachers' schools, respectively. In both cases, just over half of the schools are primary and about one-third are secondary schools. About 6% of scientists and 3% of teachers were working in senior colleges (Years 10 and/or 11 and 12). Schools which catered for all years were in partnership with 9% of scientists and 13% of teachers. Remote primary schools with a lower secondary top were involved in about 2% of partnerships represented.

Table 17. Type of School by Location for Scientists

Location	Primary School	Secondary School	Senior College	Combined Primary + Secondary	Total
Capital city	87	43	12	15	157
Regional city	31	25	2	2	60
Rural area	13	13	2	5	33
Remote area	3	1	0	1	5
Total	134	82	16	23	255*
Percentage	52.5	32.2	6.3	9.0	100.0

* One scientist had missing data.

Table 18. Type of School by Location for Teachers

Location	Primary School	Secondary School	Senior College	Combined Primary + Secondary	Total
Capital city	89	50	6	19	164
Regional city	18	21	2	6	47
Rural area	33	16	0	9	58
Remote area	2	1	0	2	5
Total	142	88	8	36	274
Percentage	51.8	32.1	2.9	13.2	100.0

The representation of primary schools to secondary schools is interesting. National data[4] indicate that 68% of Australian schools are primary, 15.5% are secondary, and 12.5% are combined primary and secondary. The remainder (3.9%) are special schools. The data in Tables 17 and 18 for the samples of scientists and teachers responding to the online survey represent a lower ratio (about 1.4:1) of primary to secondary schools (including senior colleges) than the ratio for the national data (about 4.4:1). It seems that a greater proportion of secondary schools, compared to primary schools, have taken up partnerships. The number of combined primary and secondary schools in partnerships is proportional to the national data. These data suggest that, proportionally, there are almost one and one-half times as many secondary schools as primary schools involved in SiS partnerships.

[4] National Report on Schooling in Australia 2007, Schools, Table 3. See www.mceetya.edu.au/mceetya/anr.

Reasons for Participation in the SiS Project

Participants' reasons for joining the SiS Project are of interest because whether or not they achieve the purpose of their partnership is likely to determine their satisfaction with it and their willingness to continue. Respondents to the online survey were asked why they decided to join SiS. Their responses were coded into themes which, perhaps not surprisingly, turned out to be very similar to the themes identified in responses given to the same question in the online survey used in the SiS Pilot Project. Because of the differences between the patterns of reasons for scientists and teachers, they are reported separately, in Tables 19 and 20 respectively. Most participants gave several reasons, and in the following tables, the themes are clustered for ease of reading. Each reason is illustrated by a quotation from a respondent.

Table 19. Reasons Given by Scientists for Participation in the SiS Project

Reasons for Participation	Scientists		Example Response
	Number	%	
Desire to improve science in schools			
Alert students to career opportunities in science	62	24.2	I want to inspire young students to become scientists. We need more scientists. [S219]
Make science interesting, relevant, exciting for students	43	16.8	A chance to encourage students to enjoy science. [S252]
Enjoy helping young people in science	31	12.1	I had some spare time and I really enjoy teaching science and interacting with the children. [S165]
Raising the profile of science in school	31	12.1	Interest in getting biological science, particularly ecology, into primary schools. [S24]
Improve the teaching of science in schools	30	11.7	To improve exposure of the kids to the scientific process and to broaden the scope of science topics that the school can offer. [S77]
Offer access to resources and skills	15	5.9	Keen to assist with maths and computing in schools, especially with spreadsheets. [S250]
Convey the importance of science to students	14	5.5	I would like to promote the importance of medical research to young people. [S244]
Concern about poor state of science education	9	3.5	My main motivation is founded in a concern that science is being seen as unimportant and that anti-intellectual views are becoming mainstream. [S54]
Total reasons about improving science education	235	91.8%	

Table 19 (cont'd). Reasons Given by Scientists for Participation in the SiS Project.

Reasons for Participation	Scientists		Example Response
	Number	%	
Contribute to the community			
Engage in community service	29	11.3	I wanted to participate in the program as I am interested in doing community work where ever possible. [S202]
Increasing science awareness in the community	22	8.6	Wanted to make science in the community more visible, less intimidating. [S187]
Increase links with local institutions	13	5.1	An interest in education plus a plan by our company to promote our industry at all educational levels. [S80]
Good PR for scientists and their institutions	7	2.7	To interest prospective students in our science program [S5]
Scientists have a role to play in promoting science and science education	7	2.7	I strongly believe that scientists at all levels should make more effort to engage the community. [S251]
Total reasons about contributing to the community	78	30.4%	
Sharing my passion/personal reasons			
Wanted to share my love/passion for science	28	10.9	To show children the excitement, the logic and the thinking involved in science. [38]
For fun	20	7.8	Seemed like a potential buzz [S140]
Family member at school	15	5.9	Former teacher. I have two sons at the College [S46]
I like to teach	9	3.5	Interest in teaching science to [students] and imparting knowledge. [S243]
Improve my communication skills	4	1.6	To gain experience in a class room situation. [S89]
Total reasons about sharing passion	76	29.7%	

Table 19 (cont'd). Reasons Given by Scientists for Participation in the SiS Project.

Reasons for Participation	Scientists		Example Response
	Number	%	
	Other reasons		
Seemed like a good idea	25	9.8	Agreed with the objectives and have the time. [S181]
Formalised previous involvement	13	5.1	Already had contacts at school. Had a good project to involve school kids. [S153]
Approached to be involved	11	4.3	I was "pressured" into it because I was the only Chemist in the region that might volunteer. [S86]
Support from workplace	3	1.2	My work is happy to have staff teaching our work to others (though I think they would prefer my audience to be university students). [S209]
Blank, or no contact yet	15	5.9	
Total other reasons/responses	67	26.3%	
Total reasons overall	456	178.2%	

Note. Most of the 256 scientists' responses contained more than one reason.

The results in Table 19 show that scientists stated a range of reasons for their participation in the SiS Project. The greatest number of reasons was associated with a desire to improve science education and encourage students into science. Almost a quarter of scientists (24.2%) mentioned something about alerting students to science careers. Other reasons in this section related to improving science education, giving students more access to resources and making science at school more interesting and exciting.

The second cluster of reasons related to scientists' desire to contribute to the community; indeed some remarked that it was a scientist's responsibility to do so. A few had specific reasons, for example giving something back to their old school, but others gave more general reasons relating to the promotion of science and links between the community and their institutions.

A further cluster of reasons expressed scientists' passion for science, having fun, and personal matters such as helping the school their children attended or improving their teaching skills. The final cluster of other reasons was quite diverse. Some simply thought SiS was a good idea, 5% had formalised partnerships which pre-dated SiS (often when they had children at the school), and a few participated because they were asked to do so. Finally, 5.9% of scientists either did not provide a reason or had not yet formalised their partnership.

Table 20 provides an overview of the reasons teachers gave for their participation in the SiS project. The reasons are clustered into two categories which are ranked according to their frequency of mention.

Table 20. Reasons Given by Teachers for Participation in the SiS Project

Reasons for Participation	Teachers		Example Response
	Number	%	
Promoting Science and Improving Science Education			
Access to a scientist, science in the real world	97	35.4	It was a great opportunity to get some real life interaction with the scientific world. [T238]
Increase student understanding of up-to-date science	41	15.0	To keep up to date with research and to give my students opportunities. [T176]
Increase interest and engagement of students	37	13.5	We thought it would be an interesting opportunity to inspire students in their science. [T232]
Professional development for teachers	37	13.5	Feeling personally not that well equipped to teach science. [T39]
Links between science and society	36	13.1	Needed to bring some context into the classroom. [T98]
Raise the profile of science	35	12.8	I was looking for another avenue in which Science could be shared with children. [T21]
Alert students to possible careers in science	34	12.4	To ensure children were aware of the varieties of opportunities available through a science career. [T204]
Access to material and intellectual resources	19	6.9	He was able to bring real science equipment to our lessons and this engaged the students. [T141]
Science is an important part of the curriculum	15	5.5	Because science is a key curriculum area and voted by parents to be as important as literacy and numeracy. [T155]
Challenge students' understanding	15	5.5	To extend high achievers or students with an interest in science. [T274]
Making connections with local institutions	14	5.3	Formation of a relationship for students with the local university. [T33]
Total reasons about promoting and improving science education	380	138.9%	

Table 20 (cont'd). Reasons Given by Teachers for Participation in the SiS Project.

Reasons for Participation	Teachers		Example Response
	Number	%	
		Other Reasons	
General statement of benefit	46	16.8	To expand the opportunities for both students and staff in another area of science. [T220]
Heard about program, seemed a good idea	19	6.9	Sounded like a wonderful opportunity. [T91]
Approached to form partnership, or formalized one already	14	5.1	After a conversation with a past student who had become a scientist, we decide to form a partnership. [T67]
Involved parent as scientist	9	3.3	Seek expertise knowledge in Science and foster parent partnerships. [T35]
Requested/advised to participate	8	2.9	Decision made by head of department. [T214]
Blank or not matched	12	4.4	
Total other reasons	108	39.4%	
Total reasons	488	178.3%	

Note. Most of the 274 teachers' responses contained more than one reason.

More than three-quarters of reasons given by teachers for their participation in SiS were clustered into a group focused on promoting science and improving science education. By far the most frequent reason teachers gave, mentioned by over a third of teachers, was to obtain access to real scientists and hence real science in the real world. Other reasons were variations upon the theme of improving science education by increasing student engagement and enjoyment and improving their own teaching skills. Other reasons in this cluster referred to the promotion of science and science careers.

The second cluster contained a more diverse range of reasons, ranging from a general statement of the program's benefits, formalising an earlier partnership, involving a parent or being advised to participate. Only 12 of the 274 teachers left the question blank or indicated they did not yet have a partner.

Information Relating to the Nature of Partnerships

Current Partnership

Respondents were asked whether or not their current partnership was their first. For most respondents it was, with 95% of both scientists and teachers responding “yes” to this question. Most of the respondents for whom this was not their first partnership, explained that they had previously arranged their own partnerships. Only three scientists and four teachers had previous partnerships that had failed and they had been rematched.

Length of Current Partnership

SiS formally began in the second half of 2007, so by the end of 2008, when the online survey was opened, some SiS partnerships would have been in place for up to 18 months. As some were already in operation when SiS began, they would have been even older. To obtain an overview of the lengths of partnerships, respondents were asked how long their partnership had been running, and whether or not activities related to the partnership had begun. The results are shown in Tables 21 and 22. Around 10% of partnerships were up to 2 months in length and another fifth were between 2 and 6 months old. About a quarter had been in operation for over a year, and the remainder between 6 and 12 months.

Table 21. Length of Partnerships

Length	Scientists		Teachers	
	Number	%	Number	%
Up to 2 months	21	8.5	29	11.6
2 – 6 months	53	21.5	49	19.6
6 – 12 months	114	46.3	110	44.0
One year or longer	58	23.6	62	24.8
Total*	246	100.0	250	100.0

*10 scientists and 24 teachers did not respond.

Table 22. Number of Partnerships That Had Started Running Activities

Started Activities?	Scientists		Teachers	
	Number	%	Number	%
Yes	182	71.1	190	69.4
No – not made contact	13	5.1	19	6.9
No – still planning	57	22.3	62	22.6
No – made contact, did not continue	4	1.6	3	1.1
Total	256	100.0	274	100.0

The online survey data from the Pilot Project evaluation were collected only about five months after SiS began. These data indicated that only one third of partnerships had had sufficient time to begin their activities and many of those were planning towards 2008. The data from the 2008 survey indicated that most of those partnerships were now underway. Around 70% of partnerships were underway, and about 22% were active in planning. Those that had not made contact tended to be the most recent matchings, and the few that did not continue usually explained that they had experienced an unexpected interruption to their plans.

Year Level and Content Areas of Partnerships

The Pilot Project evaluation determined that the partnerships covered all school year levels, and all subject areas. The data reported in Tables 23 and 24 indicate that in 2008 the same level of coverage had occurred. Note that most partnerships involved students at more than level, and many topics are multidisciplinary, so scientists and teachers usually indicated more than one year level and/or content area, so the total percentages in the tables exceed 100%. As for the Pilot Project, the most common year levels involved were upper primary and the most common content area was Living Things. In 2008, the skills area of Working Scientifically was included as a potential "content area", and this was listed as a focus in every year level, particularly in the primary years.

Table 23. Subject Areas and Year Levels for Scientists Involved in Partnerships (%)

Content Area	Lower Primary	Middle Primary	Upper Primary	Junior Secondary	Senior secondary	Total (%)
Earth and Space	14	16	20	7	9	66
Living Things	22	19	25	13	19	98
Energy and Force	13	12	18	5	6	54
Matter	8	6	10	6	6	36
Mathematics	4	3	7	4	5	23
Engineering and Technology	6	8	11	6	10	41
Working Scientifically	21	23	28	13	19	104
Total (%)	88	87	119	54	74	422

Note. Percentage based on 256 scientists.

Table 24. Subject Areas and Year Levels for Teachers Involved in Partnerships (%)

Content Area	Lower Primary	Middle Primary	Upper Primary	Junior Secondary	Upper secondary	Total (%)
Earth and Space	11	14	14	10	9	58
Living Things	18	21	23	11	15	88
Energy and Force	13	13	17	9	8	60
Matter	10	12	12	7	8	49
Mathematics	3	5	5	5	4	22
Engineering and Technology	7	11	16	12	12	58
Working Scientifically	20	26	27	16	18	107
Total (%)	82	102	114	70	74	490

Note. Percentage based on 274 teachers.

Contributions of the Scientist to the SiS Partnership

Respondents to the online survey were asked to describe how the scientist contributed to the partnership. These data were analysed only for those respondents who reported that their partnerships were running activities. After consideration of the kinds of contributions reported in the evaluation of the SiS Pilot Project, a range of likely contributions were listed for both scientists and teachers, who were asked to respond “yes” or “no” to each listed contribution. A final, open-ended question asked for “any other contribution”. Percentages reported in the following tables are calculated based on the number of participants who reported that their partnership was active. Contributions are ranked according to the frequency with which scientists responded “yes”.

Table 25. Nature of Contribution Made by Scientist in the Partnership

Nature of Contribution	Scientists		Teachers	
	Number	%	Number	%
Visit classroom to interact with students	164	90.1	154	81.1
Assist teacher with science content	95	52.2	106	55.8
Make presentation to students in classroom about careers in science	81	44.5	102	53.7
Supervise student(s) in a project	44	25.4	49	25.8
Presentation to parents or teachers about science	36	19.8	42	22.1
Participate in excursion with students	33	18.1	41	21.6
Answer students’ email questions	29	15.9	40	21.1
Judge a science competition	18	9.9	14	7.4
Support a science club	8	4.4	13	6.8

Note. Analysis based on responses from 182 scientists and 190 teachers.

The data in Table 25 indicate that the most common contributions made by scientists were to visit the classroom and interact with students, assist teachers with science content, or make presentations to the students about science careers. A number of respondents described these as autobiographical presentations. Around 20% of scientists also made presentations to parents and teachers about science. Other contributions included supervising students’ projects, participating in excursions, and communicating with students by email. A few participants judged a science project or helped with a science club. Respondents who made comments in the “other contribution” space usually enlarged on what was done by providing particulars about lesson content or the context of an excursion. Another activity by some scientists was participation in a science fair or science day at their school.

Benefits of the Partnership to Students

A central aim of SiS is to benefit students. Scientists and teachers were both asked about the benefits they perceived for students from the SiS partnership. Again, a list of possible benefits was suggested in light of the responses to a similar question in the evaluation of the SiS Pilot Project. Scientists were also offered the choice of "unsure of benefit to students". In Table 26, the percentage of scientists and teachers who responded "yes" to each item has been calculated according to the number who indicated their partnership was active and made a response to this section of the survey. Perceived benefits are ranked according to the frequency with which scientists rated the perceived benefit.

Table 26. Perceived Benefits of Partnership to Students

Perceived Benefit	Scientists' View		Teachers' View	
	Number	%	Number	%
Opportunity to see scientists as real people	175	96.7	183	97.3
Increased knowledge of contemporary science	153	84.5	174	92.6
Having fun	147	81.2	152	80.9
Opportunity to experience science with practicing scientists	143	79.0	160	85.1
Increased ability to recognise and ask questions about science-related issues in the world around them	139	76.8	141	75.0
Increased awareness of science-related careers	129	71.3	155	82.4
Increased awareness of the nature of scientific investigation	128	70.7	162	86.2
Increased understanding of the importance of scientific evidence for decision-making in society	78	43.1	107	56.9
Willingness to look to science to make decisions about their own lives	76	42.0	103	54.8
Access to science equipment and/or facilities	72	39.8	102	54.3
Increased willingness to question unsupported claims about health and the environment	71	39.2	75	39.9
Unsure of benefit to students	7	3.9	NA	

Note. Analysis based on responses from 181 scientists and 188 teachers.

Table 26 shows that 7 of the 11 listed benefits were agreed to by at least 70% of scientists and 75% of teachers. Opportunities to get closer to scientists and contemporary science and have fun, ranked very highly. Some of the less frequent agreed benefits tended to be some of the skills that take considerable time to develop, such as understanding the role of scientific evidence in decision-making and willingness to suspend judgement. The few respondents who made additional comments generally expanded on benefits they had already indicated.

Benefits of the Partnership to Partners Themselves

Benefits to the SiS partners were ascertained using a similar list of possible benefits, again derived form the results of the SiS Pilot Project evaluation. Because the benefits were expected to be different for scientists and teachers, the lists of potential benefits were different, and hence the results are reported separately in Tables 27 and 28. In each table, the perceived benefits are ranked according to the frequency with which participants responded “yes”.

Table 27. Scientists’ Perceptions of the Benefits of Partnership to Themselves

Perceived Benefit to Scientist	Number	%
Opportunity to communicate with students	169	92.9
Enjoyment in working with students	166	91.2
Opportunity to communicate with teachers	152	83.5
Enjoyment in working with teachers	148	81.3
Opportunity to promote public awareness of science	147	80.8
Improved skills in communicating with students	138	75.8
Opportunity to promote science-related careers	129	70.9
Increased understanding of the community’s awareness of science	114	62.6
Improved skills in communicating with teachers	106	58.2
Increased understanding of the community’s perceptions of scientists and their work	101	55.5

Note. Analysis based on responses from 182 scientists.

Table 27 shows that scientists reported high levels of agreement about most of the perceived benefits for themselves. The opportunities and enjoyment in working with students and teachers were ranked very highly, and the opportunity to promote public awareness of science also captured “yes” responses from more than 80% of scientists. Opportunities to promote science-related careers and science in the community were considered important by more than half of the scientists.

The results in Table 28, reporting teachers’ perceptions of the benefits to themselves of participating in SiS, show very high levels of agreement. Opportunities to communicate with and enjoyment in working with scientists, and the opportunity to increase students’ engagement with science, were perceived to be the greatest benefits. The ability to update their own knowledge of science and scientific practice, and increased motivation were also benefits valued by more than 70% of teachers.

Table 28. Teachers' Perceptions of the Benefits of Partnership to Themselves

Perceived Benefit to Teacher	Number	%
Opportunity to communicate with scientists	180	96.8
Opportunity to increase engagement of students in science	173	93.0
Enjoyment in working with scientist	166	89.2
Ability to update current scientific knowledge	153	82.3
Ability to update knowledge of scientific practices/methods	146	78.5
Increased motivation to teach science	136	73.1
Opportunities to communicate with other teachers about the project	117	62.9
Increased awareness of science-related careers	110	59.1

Note. Analysis based on responses from 186 teachers.

Teachers Confidence and SiS

One of the benefits of SiS that became evident in the evaluation of the SiS Pilot Project, and also arose during interviews and focus group discussions, was that participation in SiS enhanced teachers' confidence to teach science. To measure this effect, teachers were asked to rate their confidence about teaching science before their involvement in the SiS program and how confident they were now (at the time of responding to the survey). More than two thirds of teachers responded. The results are shown in Table 29 and it can be seen that, overall, teachers believed that their confidence had improved through their involvement with SiS.

Table 29. Teachers' Ratings (%) of Their Confidence Before and After Involvement in the SiS Program

Time	Negative end point	1	2	3	4	Positive end point	Number responding
Before	Not very confident	4.1	14.9	36.1	44.8	Very confident	194 (71%)*
After	Not very confident	0.4	3.6	35.8	60.1	Very confident	193 (70%)*

* Percentage in brackets is the response rate of teachers.

Another way to examine these data is to compare the responses from teachers in primary schools, whose confidence might be expected to improve most, with teachers in secondary and senior secondary schools. These data are reported in Table 30. The sample size is reduced to 168 as teachers in K-12 schools have been omitted because it was not clear whether they taught at the primary or secondary level.

Table 30. Primary and Secondary Teachers' Ratings of Their Confidence Before and After Involvement in the SiS Program (%)

Level Taught	Time	Confidence rating				Mean Rating	SD
		1	2	3	4		
Primary	Before	5.7	25.7	48.6	20.0	2.84	0.81
	After	-	5.8	51.9	42.3	3.37	0.59
Secondary	Before	-	3.1	21.5	75.4	3.73	0.52
	After	-	-	18.5	81.5	3.81	0.39

Note. Analysis based on 104 primary teachers and 64 secondary teachers.

Table 30 shows clearly that primary teachers do report lower levels of confidence than do secondary teachers, and that the involvement in the SiS project has resulted in teachers perceiving that their confidence has increased. The percentage of primary teachers responding in the most confident category (rating 4)has more than doubled, from 20.0% to 42.3%. Dependent *t*-tests determined that these differences were statistically significant, with $t = 8.26$ ($p < .0001$) for primary teachers and $t = 2.31$ ($p = .024$) for secondary teachers. The change for primary teachers is especially notable.[5]

[5] The effect size is large for primary teachers, d=.72, meaning that the average mean confidence score has improved by .72 of one standard deviation.

Examples of What Worked Well and What Did Not

As a way of determining some of the highlights (and possible lowlights) of the SiS project, respondents to the online survey were asked, in open-ended questions, to provide a specific example of something that was "working really well in the partnership" and also a specific example of something that was "not working well in the partnership". Table 31 reports the responses of 112 scientists and 158 teachers who chose to give an example of what worked well. Many gave more than one example. The examples were clustered into categories which are ranked according to the number of scientists giving each example.

Table 31. Examples of What Worked Well in SiS

Example of what worked well	Scientists' Example		Teachers' Example	
	Number	%	Number	%
Enthusiasm, enjoyment, fun	39	34.8	51	32.3
General positive statement	25	22.3	29	18.4
Benefit of a partnership per se	23	20.5	16	10.1
Example of particular activity	22	19.6	30	19.0
General description of activities undertaken	19	17.0	44	27.8
Email contact	8	8.0	6	3.8
Promotes career interest for students	6	5.4	12	8.2
Promoting kids asking questions	5	4.5	16	10.1
Pleased to have support for participation	2	1.8	-	-
Seeing science and scientists as part of real life	-	-	22	13.9
Teacher development	-	-	15	9.5

Note. Analysis based on 150 examples from 112 scientists and 242 examples from 158 teachers.

Inspection of Table 31 shows that a major positive outcome perceived by respondents is the enthusiasm and enjoyment of the various SiS activities.

> The students loved holding a zero degree jar that was full of vigorously swimming Antarctic krill. [S135]

> Students enjoyed using diffraction grating to calculate the speed of light. [T10]

Many responses were general, simply stating a positive benefit, such as the scientist's willingness to be involved, or gave a description of a particular activity or series of activities without an evaluative component. Some teachers remarked on the benefit of seeing "real science and real scientists", and also their opportunities for personal development.

> Someone to explain things when I need some help. [T172]

Around 40% of scientists and teachers provided an example of something that did not work well in SiS. The responses of 109 scientists and 93 teachers are documented in Table 32, ranked according the frequency given by scientists.

Table 32. Examples of What Did Not Work Well in SiS

Example of what did not work well	Scientists' Example		Teachers' Example	
	Number	%	Number	%
Either teacher or scientist too busy	33	30.3	21	22.6
Difficult finding time that works	23	21.1	27	29.0
Communication difficult	22	20.2	16	17.2
Tried but it didn't work/not working	15	13.8	11	11.8
Difficulty fitting into the curriculum	11	10.1	17	18.3
Teachers do not know how to make use of scientist	10	9.2	-	-
Scientist didn't communicate well to students	8	7.3	7	7.5
Distance hinders interaction	5	4.6	8	8.6
Cost/equipment is an issue	3	2.2	4	4.3
Problems associated with SiS being voluntary	3	2.8	-	-
Employer not supportive	3	2.8	-	-
Problems getting permission to work with students	1	0.9	2	2.2
Feeling alone	1	0.9	-	-
Wish could have more time with scientist	-	-	8	8.6

Note. Analysis based on 138 examples from 109 scientists and 121 examples from 93 teachers.

Table 32 shows that the two major problems for both scientists and teachers both concern time. Either one or both partners are busy, or it is difficult to find a mutually convenient time for activities, or even meetings, to take place.

> Both the school and scientist have busy schedules and it can be difficult to arrange visits that both parties can commit to. [T188]

> Possibly not enough time to discuss lessons and demonstrations with the teachers – it's a reality in their lives and mine! [S124]

The next most problematic issue was poor, or lack of, communication between partners. Often this was coupled with the partnership breaking down and not working. Another issue was trying to fit the scientist, whose expertise was sometimes viewed as very narrow, into the teacher's curriculum. In a similar way, some scientists felt that their teacher partner did not know what to do with them! As the quotes below indicate, this can be a matter of ineffective communication, and possibly a place where the SiS Project Team could assist.

> Teachers are a little suspicious of “outsiders” and do not really understand how to integrate the skills into their curriculum. [S231]

> I feel science teachers do not know how to make use of an available scientist. I suspect there is a difference between what the education department thinks I should do, what I think I should do and what the teacher thinks I should do. [S223]

Success of Partnership

Respondents were asked whether or not, in their view, they regarded their partnership as successful, and asked to make a comment to explain their response. Table 33 summarises the ratings given for the success of partnerships. Approximately 85% of the scientists and teachers regarded their partnership as successful or partly successful, with around 15% viewing their partnership as not successful. In the evaluation of the pilot study, more than a quarter of participants in the online survey did not respond, possibly because their partnership was so new they could not make a judgement. In 2008, very few respondents omitted this question. Just over 60% of respondents made a comment about the perceived success or otherwise of their partnership, and these are summarised in Table 34.

Table 33. Participants' Perceptions of the Success of Their Partnership (% of row).

	Partnership is successful		
Participants responding	Yes	Partly	No
Scientists (n=251)	51.0	33.9	15.1
Teachers (n=258)	61.6	24.4	14.0

Note. 5 scientists and 16 teachers did not respond.

Table 34. Participants' Reasons for the Success of Their Partnership (% of column).

	Scientists (n=251)			Teachers (n=258)		
Reason given for success or not	Yes	Partly	No	Yes	Partly	No
No comment	63	17	8	44	25	16
Positive comment	23	6	-	45	5	-
Communication failed	-	8	34	-	6	33
Lack of enthusiasm, motivation	2	7	24	-	-	11
Tried, but it just didn't work	-	7	18	-	3	22
Just too busy to make it work	-	18	8	2	21	19
Hoping for better in the future	6	15	5	3	11	3
Too early to say	5	18	5	6	25	-
Teacher/scientist absent	-	1	3	1	3	3
Distance is a problem	1	2	-	2	3	6
General	2	13	3	-	-	-
% total of columns*	102	112	108	103	102	113
% of respondents	51	34	15	61	24	14

* Some respondents gave more than one reason so percentage totals exceed 100%.

Table 34 reports the percentage of comments made by scientists and teachers classified according to how they rated their success. As the reasons were similar, both scientists and teachers are shown in the same table. Table 34 also shows the distribution of the 39.1% of scientists and 35.7% of teachers who made no comment. Many respondents who regarded their partnership as successful either made no comment or a general, positive comment, such as “I think our partnership has been very successful. The students are very keen but so are the teachers.” [S208]. Other comments have been clustered into similar reasons and a few comments included two reasons, so percentages in each column of the table exceed a total of 100%.

About 15% of partnerships were perceived as unsuccessful (see Table 33), and the main reasons related to failure to communicate effectively, a perceived lack of enthusiasm by the other partner, and some respondents said they had tried but the partnership did not work, often related to lack of communication or enthusiasm. Example responses follow.

> The teacher that I partnered with made absolutely no effort. I don’t think he saw the value in the program at all, and actually I think he just saw it as another task to organise. I repeatedly asked for class numbers, suitable times, etc, and even proposed activities, and I got nowhere. He made very positive noises about the program, but just seemed completely incapable of organising anything slightly off his normal curriculum. [S191]

> The partnership did not begin due to unanswered emails and not being able to make contact from the start. [T54]

> I contacted the two schools in [regional city] that were given to me as potential partners. I got no response from either. I think there may not be the same level of interest by the teachers, than by the school administrators that registered with SIS. [S9]

> I am struggling to find a place to use the Scientist that has been assigned. Nothing against him, but it is difficult to see where we could make use of his services. I tried to make some suggestions but he did not seem interested. I think he lacked confidence. It would have been good if he accepted the invitation to come to see some sessions in action and then decide. He did come to the school so that we could meet but nothing eventuated from there. I don’t know where to go from here. [T271]

The lack of time available to many scientists and teachers meant that they were too busy to make the partnership work, or work as well as they would have liked. Some hoped for a better outcome in the future.

> I have not been able to plan with my partner is often away and we are busy. Something has to change to make this partnership work. [T44]

> To be honest; I was not able to actively participate in the SIS program this year. Every few weeks I intended re-establish the relationship then another five things came onto my to-do list, which is something that I regret. I was able to do a number of ‘educational’ activities during the year but nothing under the SIS; but this shall be rectified in 2009. [S11]

A few comments related to the absence of one of the partners, and to problems due to the distance between partners.

> My scientist was absent a great deal on leave so we hope to have greater interaction next year. [T63]

Some scientists, particularly those in partnerships they regarded as partly successful, wrote general comments. Most wanted to do more than they had been able to do, so far, or believed they could do better.

> Good start, but we haven’t done a lot together. The school is very, very well set up with second to none facilities and excellent teachers. I feel my effort may be better utilised at a more needy school. [S14]

> The partnership is clearly of more interest to the school (which is a rural two-classroom 34 student primary school) than it is to my uni (this activity is very much a diversion from anything that provides $ to the institution). [S140]

A teacher who pronounced the partnership to be partly successful, wrote

> The scientist appointed to us has taken leave while working elsewhere. We have not got around to asking for a “replacement”. [T148]

Usefulness of the SiS Events, Website and Other Support

When matched, scientists and teachers were sent a package of materials which provided suggestions for working with their partner. In addition, SiS provided a range of events, including the three symposia discussed earlier and a series of networking events, which also served as recruiting grounds. The website contained a range of ideas for activities, examples of what other partnerships had done, and links to other relevant sites. The online survey requested information from participants about their use and participation in these support mechanisms.

Attendance at SiS events

Three symposia and a number of networking events had been organised during 2008 for SiS participants. Some of the networking events were also recruitment/information sessions, where members of current partnerships often made presentations. Respondents were asked whether or not they had attended any events, and if so, what kind of event. Their responses are reported in Table 35. It can be seen that about 40% of scientists indicated that they had attended at least one event, usually a networking/information session. About a third of the teachers indicated attendance at an event, most often a symposium. A few of the teachers referred to other, non-CSIRO organised events, such as workshops for *Primary Connections*, where SiS had been mentioned.

Table 35. Attendance of Scientists and Teachers at SiS Events

Event Attendance	Scientists		Teachers	
	Number	%	Number	%
Responding Yes	102	40% of 256	95	35% of 274
Kind of event attended				
Symposium	31	30.4	52	54.8
Networking/information	69	67.6	31	32.6
Other	-	-	6	6.3
No response	2	2.0	6	6.3
Total Attending event(s)	102	100.0	95	100.0

Respondents were asked to rate the usefulness of the SiS events to them. As Table 36 shows, more than half rated the event at the positive end of the scale. The similarity in the pattern of responses for scientists and teachers suggests that the SiS events were equally useful for both, as might be hoped in a program built on partnerships.

Interestingly, more scientists and teachers rated the usefulness of the events (see Table 35) than indicated they had attended events (see Table 36). Discussions with participants in focus groups, and some responses to questions on the online survey suggested that a number of participants had not attended events (due to distance or other commitments) but would like the opportunity to attend. Thus a possible reason for the discrepancy is that participants expect, rather than know from experience, that the events could be useful.

Table 36. Scientists' and Teachers' Ratings of the Usefulness of SiS Events (%)

Respondent	Negative end point	1	2	3	4	Positive end point	Number responding
Scientists	Not useful	3.4	10.3	28.2	58.1	Useful	117 (46%)*
Teachers	Not useful	5.5	9.5	23.6	61.4	Useful	127 (46%)*

* Percentage in brackets is the response rate.

Usefulness of the website and support materials

Two questions on the survey sought information from respondents about the contents of the website and the usefulness of the support materials sent to them when partnered.

Only 52 scientists and 33 teachers indicated that they had used the SiS website. Scientists who gave explanatory comments wrote about looking for ideas, finding out what other partnerships were doing, or just gaining a general overview of SiS. Teachers who offered a comment about their use referred to looking for activities and using links to other sites. A few wrote that they had "a general look around".

The usefulness of the support materials provided when partners were matched was rated by respondents on a 4-point scale. The results are reported in Table 37 and show that only a little more that half of the respondents provided a rating. Teachers found the materials more helpful than did scientists, with over two-thirds of respondents rating the materials in the top two positive categories of the 4-point scale.

Table 37. Scientists' and Teachers' Ratings of the Usefulness of Support Materials (%)

Respondent	Negative end point	1	2	3	4	Positive end point	Number responding
Scientists	Not useful	10.7	19.9	45.0	24.4	Useful	131 (51%)*
Teachers	Not useful	5.0	21.7	34.8	38.5	Useful	161 (59%)*

* Percentage in brackets is the response rate.

Additional Support for the SiS Project

The final support question on the online survey asked, “What additional support would you like for your partnership?” A total of 88 scientists and 100 teachers made suggestions for support. Their suggestions were summarised into several headings which are reported in Table 38.

Table 38. Scientists’ and Teachers’ Suggested Additional Support for the SiS Project

Suggested Additional Support	Scientists		Teachers	
	Number of suggestions	% of Scientists	Number of suggestions	% of Teachers
Time Issues				
More time to be involved	9	10.6	16	16.0
Would like more than one scientist	-	-	4	4.0
Resource Issues				
Funding for equipment, travel, resources	22	25.9	19	19.0
Pedagogical support materials	16	18.8	-	-
Support materials, ideas for what scientists can do	-	-	15	15.0
More PD or networking sessions	-	-	5	5.0
Partnership Support Issues				
More info about what others are doing	10	11.8	9	9.0
A school who knows how to use me /a scientist who wants to help me	8	9.4	5	5.0
More partnership contact, communication	7	8.2	6	6.0
Someone to monitor progress	7	8.2	5	5.0
More recognition for participants	7	8.2	2	2.0
Need a new scientist, renegotiate	-	-	6	6.0
Other comments				
None needed	9	10.6	9	9.0
General comment	3	3.5	9	9.0

Note. Analysis based on 98 suggestions from 88 scientists and 110 suggestions from 100 teachers

The items noted for additional support referred to the need for more time for participation, which was a common theme throughout much of the data collected. The two major resource issues were some funds for travel and/or equipment, and some pedagogical ideas for the scientists, or ideas for what the scientist could do. Teachers mainly requested funding for travel for students to meet with their scientist, or to reimburse their scientist whom they knew was supporting the program from his/her personal funds.

Funding is problematic, because given the diverse nature of the partnerships, it is difficult to devise an equitable way that any funding, should it be available, could be distributed equitably. Nevertheless, there are some partners who suffer significant personal costs and could possibly be assisted on a case-by-case basis. As the following quotes show, differential support is available for scientists, particularly for travel, and also use of equipment.

> Travel to remote schools (University will not support financially). [S193]

> Petrol funding. I have to travel 120 km to visit my school. Luckily I can get my faculty to support my visit. [S266]

> Funds to be able to justify taking the time off during work hours to interact. Schools are stretched for resources and were unable to provide any resources and the activity was not considered core to my position as an environmental officer in [my] industry. [S40]

A considerable number of ideas for the kind of support requested by scientists and teachers is available on the SiS website. However, only 3 of the 14 scientists requesting pedagogical support had looked at the website, and 6 claimed they did not receive any support materials when partnered. Similarly, 7 of the 15 teachers looking for ideas about what scientists could do claimed not to have received support materials and not one of them reported using the website.[6]

Scientists and teachers suggested a range of ideas for support for SiS partnerships. Most of these were concerned with partnerships that were not working well and very likely could be "mended" with help from the SiS Team. It is likely that the respondents have forgotten, or did not realise, that the SiS Project Team is available to provide this kind of support.

Finally, a few participants simply noted that they did not need additional support, and some others wrote general, descriptive comments about what they were doing. One scientist working in a regional secondary school was clear about what was needed.

> A chair, the kids are enthusiastic but exhausting! [S135]

[6] The researchers are reminded of the saying "you can lead a horse to water but you can't make it drink!"

Findings from the Scientists in Schools Project Officers (SiSPOs)

Employment Statistics

Scientists in Schools Project Officers (SiSPOs) were employed across the nation as a means to regionalise the SiS project and provide local support to partnerships. An overview of their regional distribution was given in Figure 1. The location and time fraction worked by the SiSPOs is an important determinant of the contribution they can make to the SiS Project. The dates of appointment of the SiSPOs, and the fraction of time they were employed, are presented in Table 39. The first SiSPO was employed on July 1, 2008. Three SiSPOs have resigned since the start of the project, one each in the Northern Territory, Victoria and Western Australia. Only the Victorian SiSPO has been replaced to date. Replacements in the Northern Territory and Western Australia will be dependent on the project receiving ongoing funding.

Table 39. SiSPO Employment Statistics, as at May 4, 2009

SiSPO Region	Date of Employment	Time Fraction Worked
ACT	1/7/08 on	0.2
New South Wales (2)	21/7/08 on	0.6
	24/2/09 on	1.0
Northern Territory	3/9/08, resigned 22/4/09	0.2
Queensland-south	21/7/08 on	0.6
Queensland-north	4/9/08 on	0.2
South Australia	8/1/09 on	0.4
Tasmania	2/10/08 on	0.3
Victoria	24/7/08, resigned 9/1/09	0.6
	Replacement 9/1/09 on	1.0
Western Australia	1/9/08, resigned 11/3/09	0.4

Target Partnerships

The major role of the SiSPOs is to make and manage partnerships, so at the workshop in November, 2008, each was allocated a target number of partnerships to be achieved by June 2009. The target number was based upon 15% of the schools within the state or territory, and this figure was adjusted according to the current (that is, late September) number of partnerships. The total target number of partnerships for June 2009 was 1500, and the target distribution for each region is recorded in Table 40.

Table 40. SiSPO Regional Partnership Targets

SiSPO Region	School Statistics for SiSPO Region			Partnerships at 26/9/08	Target Number of Partnerships
	% Schools	Number	15% of Schools		
ACT	1.4	133	20	35	60
New South Wales (2)	32.4	3078	462	180	420
Northern Territory	1.9	181	27	9	30
Queensland-south	14.0	1330	200	196	270
Queensland-north	4.0	380	57	40	60
South Australia	8.4	798	120	45	120
Tasmania	2.9	276	41	44	60
Victoria	23.9	2271	341	140	320
Western Australia	11.1	1055	159	86	160
Total	100.0	9500	1425	775	1500

Findings from the SiSPO Training Workshop

The 2-day Training Workshop in November 2008 aimed to assist the SiSPOs to become part of a national team, and to have the confidence and skills needed to perform that role. All eight SiSPOs who were employed at that time attended the Workshop. (The South Australian SiSPO was not employed until 2009.)

The course was evaluated using an evaluation form that asked if attendance was worthwhile, the usefulness of the sessions, and the main points the SiSPOs would take away. Additionally, field notes were taken by the researcher who attended the Workshop.

Analysis of the evaluation forms showed that all participants considered the Workshop was worthwhile. Similarly, all participants regarded the sessions as “useful” or “very useful”. There were five main points that the SiSPOs expected to take away from the Workshop.

1. Useful strategies in counselling and facilitation to assist them in their role.
2. An acknowledgement that they were not alone; that there were other SiSPOs in a similar situation also coming to terms with their role, and that assistance from the Project Team in Canberra was a phone call away.
3. A greater understanding of the whole project and their place within the project.
4. The showcases which provided different examples of successful partnerships.
5. A better understanding of their own role.

There were also five issues that SiSPOs expressed concern about during the Workshop.

1. Roles. SiSPOs wanted more time to talk with other SiSPOs about their roles and experiences.
2. Priorities. SiSPOs were unsure about how to juggle making partnerships, supporting partnerships and administrative tasks. “How do I keep track of the existing partnerships and keep them happy and also establish new partnerships?”
3. Educational background. Those SiSPOs who did not have a teaching background felt uncertain about curriculum and pedagogy due to a lack of educational understanding.
4. Dealing with different groups of people. SiSPOs felt uncertainty about how to bring together two different groups of people, namely scientists and teachers.
5. Targets. There was a wide range of feelings towards the targets, from feeling totally overwhelmed by the challenge and thinking it was unrealistic, to feeling that it was “doable”, once the SiS message gets out into the community.

These comments and issues were a reflection of the newness of the SiSPOs in their role as well as the newness of the actual roles in the SiS program. It was important therefore, as part of the evaluation, to look again at the SiSPOs and their role later in the project to determine how they had progressed.

Progress in the SiSPO role

The investigation of how the SiSPOs managed their role, and how they made and sustained partnerships, was based on interviews with the SiSPOs during March and April, 2009. Interview questions (see Appendix 11) were emailed to the SiSPOs prior to interview. At the time of the interviews there were nine SiSPOs employed (see Table 39) as the Western Australian SiSPO had resigned. Eight of these nine SiSPOs were able to be interviewed. Six interviews were conducted by phone, with written notes taken. Two SiSPOs, who were unable to be contacted by phone, emailed their answers back to the researcher.

The comments from the interviews were synthesised, and common themes identified. From this synthesis, five key issues were identified: the role of the SiSPOs, making partnerships, sustaining partnerships, issues in their roles, and regionalisation of the SiSPOs. In the following sections, these five issues are explained and illustrated with quotes from the eight SiSPOs who were interviewed.

Managing the SiSPO role

The backgrounds of the SiSPOs included working as a teacher, scientist or science communicator. All but two SiSPOs had a background which was a combination of either teacher and science communicator, scientist and science communicator, or all three. The SiSPOs considered their backgrounds to be very useful in their role as it provided them with knowledge of how scientists and/or teachers worked.

In describing their work, the most common role SiSPOs mentioned was supporting partnerships and developing new partnerships. Other roles involved contacting organisations/schools, holding information sessions, registering or recruiting scientists and teachers, considering themselves a resource, facilitating networking sessions, and reporting to the central SiS Project Team. The report of the SiS Pilot Project Evaluation was also referred to by one SiSPO as a source of better understanding of their actual role.

> SiSPOs are the glue trying to hold everything together in the beginning. As partnerships develop they begin to sustain themselves and need less input from SiSPOs but we need to stick to the partnership to ensure their success through various means of support and be there in case it falls apart. [SiSPO1 Email]

> [SiSPOs are a] resource to sustain and support the partnership in good and bad times. [SiSPO4 Interview]

In managing their time, the SiSPOs tended to group their tasks into promoting or making new partnerships and supporting current partnerships. They commented on the need to manage time effectively, especially when they only worked one or two days each week. Mechanisms to achieve this included prioritising work, and finding times when teachers were available so that they could be contacted at those particular times. Flexibility in working days and times was a major factor in how the SiSPOs managed their time. In particular, being aware of upcoming events as a source of promoting the program, and having the flexibility to attend such events, even if it was not their scheduled work day, was considered an essential part of the job. Similarly, having the flexibility to participate in regional tours as a mechanism to promote the program was considered essential. Providing follow-up was also considered an important component of their routine, especially after promotional events. Developing and sticking to an action plan was considered another effective means of managing time.

Materials relating to counselling, facilitation and problem solving that were part of the SiSPO Training Course were found to be a useful resource for most SiSPOs. These materials assisted the SiSPOs to build initial self-confidence and assisted them in communicating with SiS participants. When SiSPOs became more confident in their role, these materials remained a resource to refer to when required.

Making partnerships

Personalised contact was considered to be the most effective technique in establishing a partnership. As there are more teachers registered than scientists, the latter become the limiting factor in establishing partnerships. Thus, when scientists registered they were likely to be contacted promptly, and in person, to discuss the project and what they were looking for in a school and a teacher. The teacher (or school) was then contacted, in person, to discuss what they were looking for in a scientist. Informing each of the participants what the other was looking for in a partnership was considered necessary, so that each had realistic expectations. The SiSPOs believed that this nurturing role was essential to developing a successful partnership.

> Conversation with both about what options are available. What each other is looking for. Works most of the time. [SiSPO6 Interview]

> Consult before partnering. What do you want to get out of partnership? Talk them through the potential partnership. [SiSPO7 Interview]

Two specific approaches to making partnerships were mentioned by the SiSPOs: targeting a scientist from a particular field when a teacher registers, and contacting schools in an area specified by the scientist. Each of these approaches is outlined below.

Targeting a scientist from a particular field when a teacher registers

When teachers register, science organisations within the specified area are targeted, either through established contacts or with a "cold call", and contact is made with an outreach/education/marketing person. The SiS Project is explained to the organisation. If the organisation is willing to participate, then specific areas or persons within the organisation are contacted. The school's ideas are then discussed with the scientist. If the scientist is prepared to participate, the SiSPO will then contact the teacher to ensure the scientist's ideas and background are suitable. Once both partners agree a partnership can be established.

Contacting schools in an area specified by the scientist

Some scientists provide details of a teacher or school with whom they would prefer to work. If the scientist has previously made contact with the school, the process is relatively straight forward. If the scientist has not made contact with the school, the principal or science coordinator is contacted, the SiS Project explained, and the manner in which the scientist would prefer to work with the school is outlined. Through the principal or science coordinator a teacher is identified who would like to partner with the scientist. The teacher is contacted to discuss the scientist's ideas and background. The scientist, in turn, is contacted to discuss the teacher's ideas. Once both partners agree a partnership can be established.

Current partnerships

An update of the target partnerships for each state is presented in Table 41. Only two states/territories (ACT and Queensland-north) have exceeded their targets, with Tasmania being very close to its target. All other states/territories were a considerable number below their targets.

Table 41. Number of Target and Actual Partnerships, as at May 4, 2009, for Each Location.

SiSPO Location	Target number of Partnership	Actual Partnerships	Percentage Difference
ACT	60	63	+ 5
New South Wales	420	271	- 35
Northern Territory	30	15	- 50
Queensland-south	270	199	- 26
Queensland-north	60	75	+ 25
South Australia	120	77	- 36
Tasmania	60	59	- 2
Victoria	320	240	- 25
Western Australia	160	104	- 35
Total	1500	1106	- 26

Sustaining partnerships

Sustaining partnerships relates to monitoring ongoing partnerships (both new and established) to ensure that they are progressing satisfactorily and dealing with broken partnerships. Characteristics of a great partnership, as perceived by the SiSPOs, are also discussed in this section.

Monitoring ongoing partnerships

In relation to monitoring new partnerships, the majority of SiSPOs mentioned follow-up emails or phone calls to both halves of a partnership approximately 4-6 weeks after establishment as their major form of monitoring. Opportunistic monitoring was mentioned by several SiSPOs. In these situations, when the SiSPO was visiting a school, they would take it upon themselves to catch up with the partnered teacher. Similarly, many SiSPOs are located with scientists (in a CSIRO Science Education Centre), so were in a position to meet with scientists at a convenient time. This form of monitoring was more prevalent in smaller communities. A further method of monitoring partnerships was through network sessions. Within these sessions partnerships had the opportunity to meet each other face to face (maybe for the first time) and to meet other participants in the program.

> My office is at a university. I can meet up (with scientists) at the office and have a face-to-face meeting. Can you show me what you have been up to? I am there if they need me. [SiSPO4 Interview]

> If I happen to be at a school (where I am involved in Science Communication) then I can check up in the SiS Partnership. [SiSPO7 Interview]

Being contacted by a participant when something had gone wrong was another form of monitoring. In this situation the mediation role of the SiSPOs would come into play, as they would attempt to resolve the issues and get the partnership back on track.

> Those who contact me get high priority. [SiSPO3 Interview]

> Very little monitoring unless issues are brought to our attention. [SiSPO6 Interview]

Table 42 lists some of the more common problems the SiSPOs found arising in partnerships, and how they endeavoured to resolve them. Common problems related to lack of communication, non-responding participants, teachers having unrealistic expectations of scientists, partners not knowing what to do once started, were not happy with their experience, one partner had moved on, and the highly mobile population in some regions. As can be seen from Table 42, SiSPOs had developed a range of possible solutions to address these problems. Most of these required some form of mediation which involved reminding participants what the program was about and that both participants had equal responsibility within the partnership.

> I have found that some teachers have unrealistic expectations of what scientists can do in this program and some teachers seem to feel that the communication should come from the scientist while not making the effort themselves. This damages the reputation of the program as it becomes a story that spreads about how they registered for the program and then their scientist never contacted them. I've been trying to make participants aware that the onus is on both participants to contact one another and maintain regular contact even if it is social contact rather than setting up a time for a visit. [SiSPO1 Email]

There was little formal monitoring of established partnerships – a point noted by all SiSPOs. It was acknowledged that this was a weakness of the program, and that plans were underway to address this problem. This process would involve working backwards through old partnerships that had not been followed up before. Various forms of regular electronic contact (such as an electronic newsletter or bulk update) were mentioned by many SiSPOs as another potential form of monitoring partnerships. Such electronic contact could serve as a reminder to some participants – to contact their partner, to share a positive outcome with a SiSPO, or to contact a SiSPO if something was not working in the partnership.

Table 42. Common Problems Arising in Partnerships and SiSPOs Solutions to Them

Problem	Possible Solutions
Lack of communication once partnership established	More regular follow-up to check on partnership. Speaking with each participant about the other before creating the partnership. Emphasise that the onus is on both participants to maintain regular contact. Understanding each other's working conditions and times.
Non-responding participant	Act as a mediator and get in contact with partner to check what is happening. Encourage communication.
Teachers have unrealistic expectations of scientists	Remind both participants they have equal responsibility. Providing more structure as to the roles of each participant.
Not knowing what to do once partnered	Be present at first meeting. Provide possible ideas like CREST.[7] Refer to SiS website case studies. Encourage participants to attend workshops or networking session.
Not happy with experience	Discuss, then dissolve partnership. Reassign each partner as soon as possible.
One partner has moved on	Find out what has really happened (for example, teacher moved school, teacher had a baby, scientist overseas). Finding out whether or not the other partner wishes to continue with SiS and be re-partnered.
Highly mobile population in some regions or schools	Partner the scientist to the school, instead of an individual teacher. Partner the teacher to the organisation, instead of an individual scientist.

Dealing with broken partnerships

In the situation where a partnership is about to break, the SiSPOs assumed a mediating role. The SiSPOs would discuss with each partner what they were looking for in the partnership, and look for ways to continue the partnership. If this mediation failed, the partnership would be dissolved. The SiSPOs would then talk to each participant and ask them if they wished to continue in the SiS program. If the reply was affirmative, a rematch would be organised. In some

[7] CSIRO's CREativity in Science and Technology Awards program, which supports students to undertake open-ended science and technology investigations.

cases, the participants were still enthusiastic about the SiS program, but wished to have a break from it. Such participants would be marked for contact at a later date.

> Try to mediate between both participants. If this still fails then dissolve the partnership and speak to the participants about continuing the program with a new partner. There have been a couple of participants who have had two partnerships fail and in this case I discuss the program again with the participant to ensure they are aware of how it works or suggest they have a break for a little while before deciding as to whether they want to try again. [SiSPO1, Email]

> Not laying the blame on either side. Usually one partner hasn't done anything. Both sides identify things they could have done to help the partnership. Enthusiastic partner still has faith in program – still wants to be part of the program. [SiSPO7, Interview]

Characteristics of great partnerships

When asked what they considered to be the characteristics of a great partnership, the SiSPOs rated communication between the partners as the most important. This was followed by a compatible match between the partners, flexibility in how the partners worked together, and a partnership that was built upon respect and concern for each other.

> Communication - stay in contact even if not doing anything. Flexibility – an open mind about what you can use a scientist for. [SiSPO7, Interview]

> Good match of skills to requirements. Both conduct themselves in a professional manner. [SiSPO5, Interview]

> Enthusiasm. Commitment to keep partnership going. Liking each other. Communication. Willingness to look outside the square. Scientist to try things not in their expertise. Teacher to look at different ways to teach to bring in the scientist. [SiSPO6, Interview]

Issues in the SiSPO roles

The SiSPOs identified four major issues in performing their roles. These related to the dilemma in making partnerships at the expense of monitoring partnerships, targets, isolation, and dealing with different groups of people.

The dilemma of making partnerships at the expense of monitoring partnerships

This was the most frequent issue mentioned by the SiSPOs. Many SiSPOs felt that the necessity to make partnerships, and thus achieve their target, was done at the sacrifice of sustaining partnerships. Some SiSPOs found this to be frustrating and made them feel like "salespersons". They found this role challenging and very "different to being a science educator".

> Long term viability (of the program) will be compromised. Getting partnerships affects sustainability of the partnerships. Need to operate like a salesman. This can be challenging. [SiSPO4, Interview]

> Under pressure to meet target it becomes less of a priority to follow-up on them. Right thing for me is to achieve targets. Right thing for program is to follow up on partnerships. [SiSPO7, Interview]

Targets

The target number of partnerships was considered both an advantage and a limitation to the program. Some SiSPOs saw their target as an attainable goal that kept them motivated, and were looking at the bigger picture of the national target. Others saw their target as unattainable, and tried to deal with it by breaking it down into weekly targets. However, when these weekly targets were not realised the goal became even more insurmountable.

> Targets can be very motivating. I have almost reached my target and nearing my target has kept me motivated. This motivation will continue as I need to maintain the number of partnerships and increase the number to help other states and territories. [SiSPO1, Email]

> I need 12 partnerships per week. I still don't think it is feasible. [SiSPO6, Interview]

> I have to make 11 partnerships per week. I have made 5 per week. So [I am] currently running at half of what is required. I already spend approximately 70% of my time contacting people for new partnerships so the chances of doubling the number of new partnerships are slim. [SiSPO8, Email]

Isolation

Even though they were based in CSIRO Science Education Centres, many of the SiSPOs felt isolated due to the regionalisation of the program. Although involved in telephone hook-ups and being sent weekly electronic newsletters, the SiSPOs still felt a certain degree of isolation.

> It becomes a very personal role. We have so much contact with the participants that when something goes wrong or goes right it can really affect our day. It can be difficult when working alone to deal with the ups and downs but having the meeting in November has really helped to establish a team mentality where I can call other SiSPOs or Margaret or Liz to debrief. [SiSPO1, Email]

Dealing with different groups of people: Scientists and teachers

The SiSPOs commented on the different paradigms which scientists and teachers inhabit. Thus, they had to become familiar with wearing quite "different hats" when communicating with each group, and had to become familiar with both the language and the jargon associated with each group. Similarly, the SiSPOs had to develop certain written and verbal skills for a given audience. They also had to develop an awareness of the differences in how each group worked – scientists tended to work in small groups while teachers were constantly surrounded with students and fellow teachers. Unless the SiSPOs came into the program with a background in science and education, these skills and knowledge had to be learnt on the job.

> I have learnt about how scientists work and am becoming more familiar with the curriculum and other programs that teachers use for their science. [SiSPO1, Email]

> Scientists feel threatened by the open-ended nature of the project. They need to be able to schedule times in. They want to be organised. [SiSPO2, Interview]

Three of these four issues are similar to those mentioned during the SiSPO Training Course six months earlier: the dilemma in making partnerships at the expense of monitoring partnerships (labelled priorities), targets, and dealing with different groups of people.

Regionalisation of the SiSPOs

Regionalisation of the SiSPOs was seen as an excellent move for promoting the SiS program and for making and sustaining partnerships. According to the SiSPOs, local knowledge was seen as the greatest advantage of regionalisation. Local knowledge could be interpreted in many different ways, as outlined below.

1. Locals partnering locals. Regionalised SiSPOs have a greater opportunity to contact local participants, develop and support relationships with these participants, and network at the

regional level. This individualised approach makes participants feel more valued and important.

2. Greater familiarity with the local region in terms of locations and distances. Regionalised SiSPOs have a greater knowledge of the region and the local area, are more aware of what is going on at this level, and have a greater understanding of times and distances involved in travelling.
3. Greater links with local organisations. Regionalised SiSPOs can use their local links through CSIRO Science Education Centre and colleagues to promote SiS. They are more aware of local businesses, science organisations and education offices; the existing collaborations between local organisations; and how these can be incorporated into the SiS program. Further, regionalised SiSPOs have greater potential for opportunistic promotion and recruitment simply by being there, by driving past a science institution, or talking to scientists at their workplace.
4. Incorporating local themes. Regionalised SiSPOs have a greater ability to run information and networking sessions within localised areas, with an emphasis on a local theme.

Summary

Although the target of 1500 partnerships had not been attained, the regionalisation of the SiSPOs was considered an integral part in the continued evolution of the SiS program. SiSPOs had developed a range of methods to make and sustain partnerships, and an even wider range of methods to deal with common problems arising in partnerships. Many had adapted their role to the specific environment in which they were located. The lack of formal monitoring of partnerships was recognised as a major challenge to the long term sustainability of the program. Four main issues were identified by the SiSPOs in performing their roles: the dilemma in making partnerships at the expense of monitoring partnerships, targets, isolation, and dealing with different groups of people. Three of these (excluding isolation) were noted as concerns by the SiSPOs during the training workshop six months previously, and thus represent a significant focus for further attention.

Trends in SiS Partnerships

Examining trends in the numbers of partnerships in a program that is endeavouring both to increase the number of partnerships and maintain those that already exist, provides an overview of past successes and also, in the context of staff available, to foreshadow what might be reasonable targets for the future. As the interviews with the SiSPOs revealed, it takes time to make partnerships and effort to sustain them. Further, unless constant contact is maintained with each partnership, it is difficult to obtain an accurate number of active partnerships at any particular time. As the data from the focus groups, case studies and online surveys indicated, some partnerships may not necessarily be active even if their status on the SiS database is recorded as "active". Consequently, in order to maintain a reliable picture of the state of the program, monitoring must be an integral part of the SiS Project.

The following trend graphs were prepared from data supplied by the SiS Project Team. Figures 7 and 8 provide an overview of the number of partnerships in place since the beginning of the SiS Pilot Project. The data represent the net new partnerships in place at the end of each month of the project since its inception. The operation of the database began in August 2007, therefore July 2007 shows zero. Net partnerships include partnerships with the status of "assigned", "active", "closed" and "dormant", but does not include partnerships that have been withdrawn.

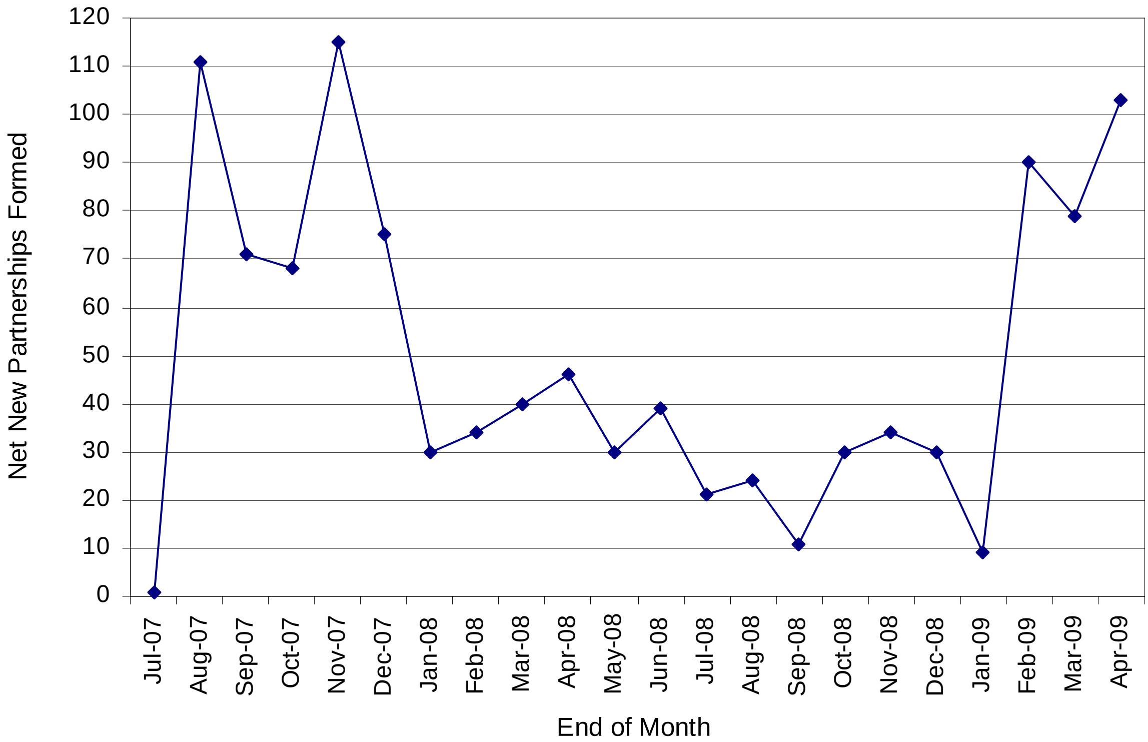


Figure 7. Net new partnerships formed by month

Figure 7 shows the variable trend in partnerships formed. It can be seen that the numbers of partnerships formed in the first six months of the program, even during December, 2007 were the highest until the beginning of 2009, when around 170 partnerships were formed in February and March, 2009. Figure 8 shows the cumulative total of new partnerships, and it can be seen that progress was relatively steady during 2008, with an increase in 2009.

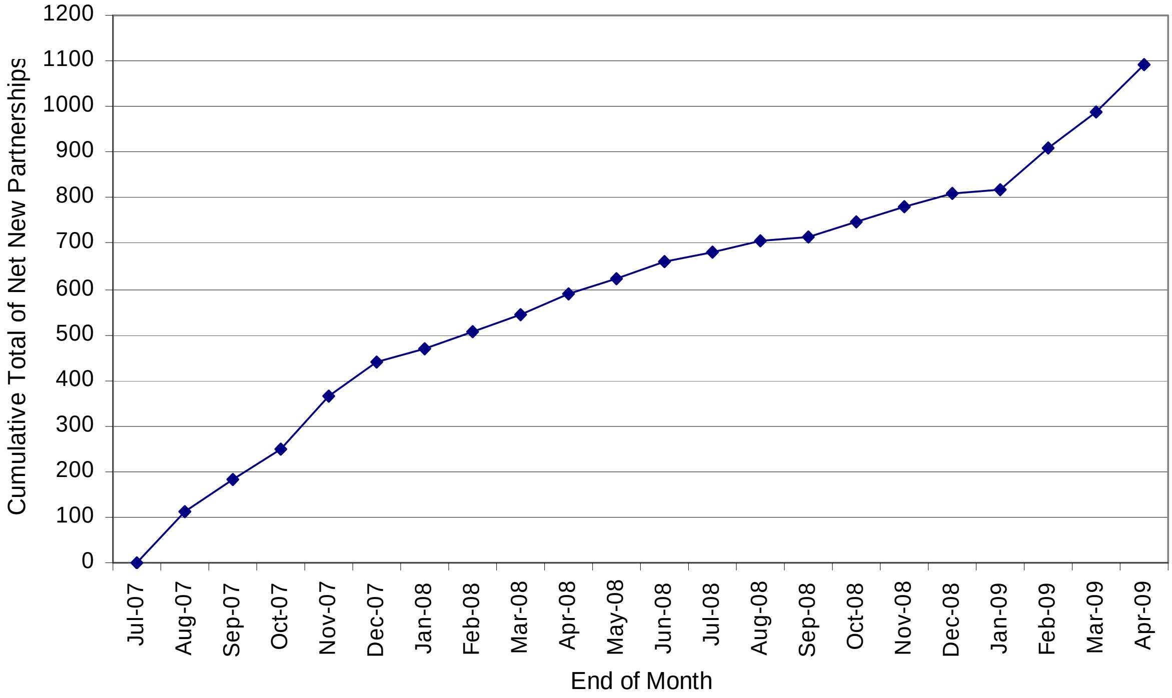


Figure 8. Cumulative monthly total of net new partnerships formed

For various reasons, some of which have been discussed in earlier sections, participants withdraw from the program as well as register in it. Figure 9 maps the numbers of scientists and teachers who have withdrawn since November, 2007, when there was the first recorded withdrawal of one scientist. Interestingly, scientists seem to withdraw at about twice the rate of teachers, on average. The increase since the beginning of 2009 is likely to indicate the SiSPOs discovery of partnerships that have lapsed rather than a sudden increase in withdrawal of scientists.

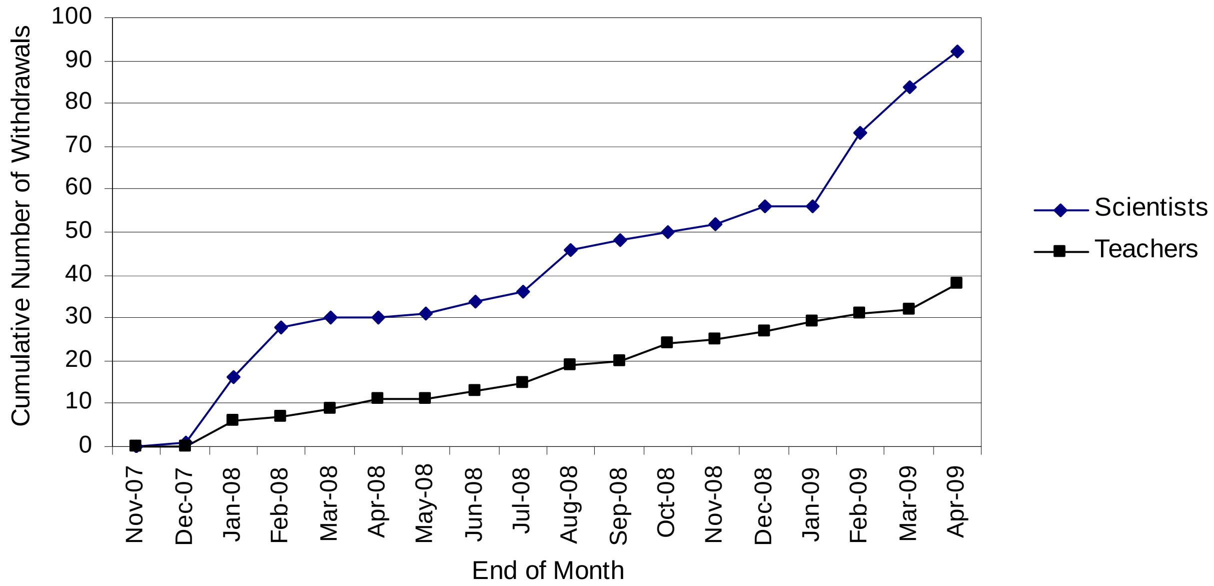


Figure 9. Cumulative number of partner withdrawals by month

At the end of April, 2009, there were 1052 scientists and 1410 teachers registered. This means that it can be difficult to find a scientist to match with every teacher. Some scientists have more than one partnership (there were at the end of April 1052 scientists in 1107 partnerships) and some teachers share a scientist. These are the main options for matching all registrants, but their success requires careful monitoring.

The clear message from these data, which support data collected from other parts of this evaluation, is that partnerships can be stable or transitory. As new ones are formed, older ones lapse, so constant monitoring is required. The critical number of partnerships that can be made and sustained depends not only on the numbers of scientists and teachers registered and therefore willing to be involved, but the number of partnerships that can be sustained by the staff available. Based on the data above, and the results of the SiSPOs efforts, with the current workforce, this number is unlikely to exceed 1500.

Summary, Conclusions and Recommendations

The Scientists in Schools Project began in July, 2007. After a successful Pilot stage in 2007, it was continued into 2008 and 2009. The expanded project retained the same aims as the Pilot Project, which were to

1. bring the practice of real world science to students and teachers,
2. inspire and motivate teachers and students in the teaching and learning of science,
3. provide teachers with the opportunity to strengthen their knowledge of current scientific practices,
4. enable scientists to act as mentors or role models for students,
5. broaden awareness of the types and variety of careers available in the sciences,
6. enable teachers and scientists to share ideas and practices with other teachers and scientists, and
7. increase scientists' engagement with the broader community, thus raising public awareness of their work and its social and economic importance.

The evaluation of the extended SiS project was based on data collected from a range of sources. These included information gathered through the analysis of evaluation forms completed by participants at the three regional symposia held by SiS during 2008 in Hobart, Townsville and Melbourne; five focus groups and 34 interviews with a total of 34 scientists and 30 teachers, together with 12 longitudinal case studies of SiS partnerships in Canberra, Melbourne and Perth; student data collected from 9 of the case study schools; and feedback from an online survey held at the end of 2008. The online survey achieved a proportionally representative national sample of 256 scientists and 274 teachers from every Australian state and territory, every school type, and from schools located in capital and regional cities, rural and remote areas. These data were supplemented by two additional sources of information. First, interviews with the SiS Project Officers provided information relating to the regionalisation of SiS partnership management, including the making, sustaining and monitoring of partnerships. Second, through close liaison with members of the central Project Team, the effectiveness of the SiS website and database, and trends relating to the number of partnerships, were examined.

The findings from the analyses of these data were presented in the preceding pages. In the following sections, the progress of SiS is described in terms of its response to the recommendations from the evaluation of the Pilot Study[8]; conclusions are drawn in terms of the nature of the SiS partnerships established; the effectiveness of the management of SiS, including the database and website, events and use of SiSPOs; the main challenges experienced and steps taken to overcome them; significant outcomes and achievements; and recommendations made for the future effectiveness and efficiency of the SiS Project.

Conclusions

Progress of SiS Following the Pilot Evaluation

The evaluation of the SiS Pilot Project made the following four recommendations (see Howitt & Rennie, 2008, p. v). These are restated below with a short summary of the response of the SiS Project Team.

[8] See Howitt & Rennie, 2008.

Pilot Project Evaluation Recommendation 1
The SiS project be continued with support from the Project Team.
Many partnership activities will not begin until 2008 and without the support of the Project Team, a proportion of these partnerships are unlikely to realise their potential.

Response

Significantly, the SiS project was continued and many of the partnerships assigned in 2007 have continued, including those whose planning entailed beginning in 2008. Further the extended time frame allowed partnerships to mature and develop into stable, effective relationships. As would be expected, there were also a number of partnerships that did not work out, for a range of reasons explored in this report. At May 1, 2009 a total of 1107 scientist-teacher partnerships in 891 schools were in place, and the position now is one of a viable, supported project which has significant benefits for the great majority of its participants.

Pilot Project Evaluation Recommendation 2
The SiS website be maintained and extended.
Additional information and resources for both teachers and scientists are required, including detailed case studies of successful partnerships, testimonials, electronic communication between scientists and teachers, resources, concise guidelines for scientists on a variety of topics to increase understanding and communication with school aged students.

Response

The website has been extended, refined and refurbished since the end of the Pilot Project. It contains a wealth of supportive guidelines, resources, useful links and examples of successful partnerships. An e-list has been established and is available for use by partner scientists and teachers.

Pilot Project Evaluation Recommendation 3
Additional support be provided to the partnerships.
To maintain and strengthen partnerships, additional support is required, for example, in the form of increased promotion of the program, opportunities for face-to-face networking, regular monitoring of the partnerships, and examples of the workings of successful partnerships.

Response

During 2008, three regional symposia were held and networking/information meetings were held in each state in several venues. Usually at these meetings, successful partnerships were showcased with presentations by the partners, and the feedback collected by the symposia evaluation forms indicated that these were helpful, especially to new participants.

Pilot Project Evaluation Recommendation 4
Further evaluation in 2008, to allow time for the real outcomes of the project to become evident.
As the majority of partnerships have yet to begin, further evaluation should occur towards the end of 2008 to assess the success of the project on a wider basis, the longevity of the partnerships, and the factors that influence longevity.

Response

This document reports the results of the further evaluation and, as foreshadowed, provides considerable information about the longevity of partnerships and the determinants of their longevity.

Nature of SiS Partnerships Established

Description of partnerships

By May, 2009, over 1107 scientist-teacher partnerships were registered in 891 schools. The schools were located in every state and territory, in every school sector, and in all kinds of geographical areas. Data from the online survey reveal that proportionally more secondary than primary schools were involved in SiS. Activities tended to occur predominantly at the upper primary level, in the content area of living things. The least covered content area was mathematics. Further, activities that promoted the curriculum theme of working scientifically (which covers all content strands) was a major focus, particularly in primary schools.

By the end of 2008, at the time of the online survey, about 70% of partnerships had started running activities. This is more than double the number of partnerships actually working at the time of the Pilot Evaluation. At the end of 2008 about 22% of partnerships were involved in planning, and around half of these were less than 2 months old. By far the most common activities involved the scientists visiting schools to interact with students. The two other most common activities were assisting the teacher with science content, and raising students' awareness about careers in science.

As discovered in the Pilot Project evaluation, there is no one, typical kind of partnership. The 12 case studies included in Appendix 12 are testimony to this diversity. What actually happens in a partnership depends on a range of contextual factors. The scientist's speciality and location, the year level of the students and the content area of the curriculum are important, but so are the structure of the school and the flexibility allowed by its timetable, facilities and enthusiasm of its staff, and the circumstances of the scientist's employment. The researchers reiterate a key finding of the Pilot Project evaluation: The ability of the SiS project to allow such flexibility and variation in activities is a strength, because it allows the scientist and the teacher to take ownership and control of their partnership.

Partnership targets

The nominal target number of partnerships for SiS was 1500 by the end of June, 2009. At the end of April, 2009, there were 1107 partnerships recorded as assigned, active, closed or dormant. The focus group, interview and online survey data all provided information that indicated that some partnerships considered by SiS as active may have lapsed. This highlights the need for constant monitoring of partnerships and the ability of the SiS Project Team, especially the SiSPOs to keep in touch with what is happening in partnerships. A major challenge for the SiSPOs was managing the dual tasks of making new partnerships to meet their assigned target, and monitoring the partnerships they already had in their region to keep them active. Table 41 revealed that only three of the nine SiSPO regions had achieved or were close to their target. Six were between 25% and 50% under target. This suggests that targets need to be examined carefully to ensure that they are realistic, not only in terms of being achievable, but also able to be maintained in the amount of time SiSPOs have to work with them. It is likely that the notional target of having SiS partnerships in 15% of schools in each region requires adjustment, taking into consideration the number and location of scientists potentially available in each region.

Effectiveness of SiS Management

The management model which had proved effective in the SiS Pilot Project was retained for the continued project. The major change was the devolution of partnership management to the SiSPOs, beginning in July, 2008. In this section, conclusions are drawn about management in terms of website and database, the events run, and the extension of the management model to include the SiSPOs.

Website and database

The website was expanded in line with the recommendations of the Pilot Project, and has also been refined and refurbished. It remains the means of registration, but although it provides a range of relevant information about the SiS Project, it is not well utilised. Apart from initial registration, only a minority of respondents to the online survey admitted using it. They gained a general overview of the project, looked at what other partnerships were doing, looked for ideas or activities, and found useful links to other websites. The website deserves greater use, and needs continued promotion. Although it has an FAQ site, it is not straightforward to find out what to do when the partnership is not going well. During focus groups and interviews, it became apparent that some participants were unaware that they could seek help and advice when their relationship was not progressing as expected. Such information could be placed onto the website.

The database that forms the basis of the SiS registration and matching process was continually updated over 2008 to allow for the increased number of participants and access for SiSPOs. It seems to be working effectively.

Contribution of SiS events

The two main kind of events run by SiS were the regional symposia held in Townsville, Melbourne and Hobart, and the networking/information events run locally, now often by SiSPOs. The symposia were well received by both scientists and teachers, who reported that attendance at the symposia increased their self knowledge, provided opportunities to find out about other partnerships, resources/ideas for teaching, excellent networking opportunities, and inspired and enthused them. The symposia also provided an opportunity for scientists to better understand teachers and their role, and for teachers to better understand scientists and how they work. The symposia continue to play an important role in providing both scientists and teachers with up-to-date information on a specific science topic, and face-to-face contact between teachers and scientists. Similarly, based upon feedback from the focus groups and interviews, the networking and information sessions were also found to be important for making contact between scientists and teachers, and providing examples of successful partnerships.

Symposium attendees made suggestions about how to improve the symposia. These included adjusting the format of the sessions so that scientific discussions (invited speakers or panel sessions) were pitched at an appropriate level for teachers to understand, allowing more question time, and providing short presentations on the research of various SiS scientists. Other suggestions related to giving more time for partners to build their relationship and/or more time with other teacher-scientist partners to share ideas and activities, and finding ways to bridge the gap between the contemporary scientific content being presented and teaching that science in school. Clearly, networking, the pragmatics of partnerships, and the relevance of cutting-edge scientific research to the classroom stand out as significant issues to participants. It is important that the symposia retain the educational focus associated with the overall goal of SiS, for the benefit of scientists, teachers and students.

Regionalisation of SiS management by the SiSPOs

As a national initiative with partnerships occurring across the country, effective management is crucial to the success of SiS. The regionalisation of the SiSPOs was successful in promoting the SiS program, and for making and sustaining partnerships. SiSPOs believed that their ability to make personal contact with participants and their local knowledge were their greatest assets. Many SiSPOs had adapted their role to the specific environment in which they were located, and developed a range of methods to make and sustain partnerships, along with methods to deal with common problems arising in partnerships. As one SiSPO stated, they had become the “glue” that held the SiS Project together.

However, as identified in their interviews, four main issues restricted the SiSPOs from performing their roles more effectively. First was the dilemma inherent in making partnerships at the expense of monitoring partnerships. Rather than having to “fix” broken partnerships, SiSPOs thought they should be monitoring ongoing partnerships and assisting where required so that they did not “break”. A second and related issue was the pressure to meet targets. SiSPOs required clear direction about balancing the importance of the making and monitoring roles. A third issue was isolation, and ways of reducing the feeling of isolation must be considered. One proposal involves the SiSPOs in a national meeting, such as the SiSPO Training Course, where they have opportunities to clarify their role, find out how other SiSPOs operate, and learn more about exemplary partnerships and how to promote them. The role of the Training Course for the SiSPO may become the equivalent of the symposium or networking session for the partnerships. Finally, SiSPOs experienced some difficulty in dealing with both scientists and teachers, who work in quite different ways. Learning to deal with different groups of people comes with experience. However, until they gain that experience, SiSPOs require advice and assistance from the SiS Project Team.

Challenges Experienced and Steps Taken to Overcome Them

Once the management structure was in place by the end of the Pilot Project, most of the remaining challenges related to making and sustaining successful partnerships. As the number of partnerships increased, the SiS management team was stretched to meet these challenges. The appointment of SiSPOs has gone a long way towards overcoming the challenges created by the size of the project. Only some of these challenges to success in partnerships can be overcome by the management team, however, others depend on the goodwill of the people involved.

Challenges to successful partnerships

Taken together, the data suggest that two overarching factors determine whether or not a partnership will be successful. The first is effective communication and the second is flexibility.

Effective communication

Effective communication operates at three levels. At the first level, teachers and scientists must talk to each other frequently, either face-to-face or by email. Unless this happens, each will not have realistic expectations of what the other wants and is able to do. Many struggling partnerships reported either that communication was unresponsive, had been lost, or that one partner didn’t quite know what to do with the other. Partnerships with effective communication did have realistic and respectful expectations of each other, were able to make mutually satisfactory plans for activities and were able to make those plans happen. At the second level, principals must communicate with teachers, and scientists’ employers must communicate with scientists, to ensure that participation in the partnerships is not only endorsed but supported, so the time involved is allowed for in the partner's work load. At the third level, scientists must be able to communicate with students. Human nature determines that some people have more effective communication skills than others, and sometimes scientists need the support of the teacher in the classroom to help keep students on track, and also to help the scientist to present at an appropriate cognitive level. Some partnerships were at risk because there were communication problems at this level.

Flexibility

A successful partnership requires flexibility. Because of the demands of their normal working life, both scientists and teachers need to be flexible about fitting their communication and planning into their busy work schedule. Further, the partnership activities must be able to fit into the school day. Primary schools have two advantages here: their timetable is more flexible because students do not move from teacher to teacher in a fixed schedule as do secondary students, and the content of their curriculum is more flexible. Primary teachers frequently plan their curriculum around themes, so science can be integrated with other subjects. Secondary teachers are usually required to plan around subject disciplines, with a great deal more content to be covered. This reduces flexibility to fit in SiS partnerships at the secondary level. As data from the focus groups and interviews revealed, the senior secondary level is additionally difficult, because the focus on assessment leading up to post-school options can place significant pressures on teachers. This reduces flexibility in terms of fitting in a scientist to do activities that may not necessarily contribute to the assessment regime.

Challenges in sustaining partnerships

That most partnerships succeed, at least for some time, is testament to the effort of the people involved. Due to factors such as lack of time and limited flexibility in their workplace situations, stress is placed on many partnerships and they need support to survive. Avenues of support include action by the SiS Project Team, now usually the SiSPOs, and promotion of SiS as a worthwhile and significant program, with recognition for partnerships.

Support from the SiS team

When partnerships are stressed, sensitive counselling by the SiSPOs can assist, even by rematching if the partnership cannot be salvaged. The SiSPOs provide support because they are knowledgeable about the project, can offer ideas of alternative activities that might better suit the work circumstances of participants, and act as intermediaries when communication has broken down. The focus group and interview data showed that, sometimes, partners just needed a bit of a "push" to make the effort to reconnect, so SiSPOs also are a source of motivation and inspiration to partnerships.

Regular opportunities for networking and occasional email newsletters help partners to keep in touch with SiS and maintain their enthusiasm.

Promotion of SiS and recognition for participants

Some scientists and teachers battled to maintain their partnership because they were not supported by their employer. Often this reflected a lack of importance attributed to SiS. Whilst the SiSPOs might be able to talk to some of the employers, it is important to maintain a positive community profile for SiS, through promotion by all possible means, including publicity, particularly by schools and employers showcasing the positive outcomes of their involvement. In cases of individual hardship, where participants are funding their own travel or buying needed materials, the possibility of applying for some funds, which might be granted on a case-by-case basis, could make a significant difference to sustaining the partnership. Recognition for partners by their employers, such as allowing time flexibility, or including community service in an employee's work objectives, such as has happened for some scientists, facilitates their involvement in SiS.

Significant Outcomes and Achievements

Both the SiS Pilot Project and its continuation had seven specific aims concerning the promotion of science, science education and interest in science careers. These aims were repeated earlier in the Summary section. Data from all of the sources used in this evaluation contributed to the following assessment of outcomes and achievements of the SiS project in 2008-2009. There was a convergence of data obtained from all sources to support the following conclusions.

Outcomes for students

Perhaps the most important achievements of the SiS project are associated with its impact on students. Scientists and teachers were agreed that students benefited primarily from the opportunity to see scientists as real people, and to increase their knowledge of contemporary science. The third ranked benefit by both scientists and teachers was that students had fun, and given the widely perceived disaffection of many secondary students in science, this is an important outcome. Whilst it was clear from the data collected from primary students that they had fun with their scientist, the small amount of data from secondary students were equivocal. However, there is also a widespread belief that students' interest in science must be engaged at the primary level and SiS has been successful in achieving this. Most primary students also pointed out that their scientist promoted their interest in a science-related career, and this was also a benefit perceived by more than 70% of scientists and 80% of teachers (see Table 26).

A further outcome for students perceived by scientists and teachers was derived from the opportunity to experience science with practising scientists. According to scientists and teachers, students increased their ability to recognise and ask questions about science-related issues and awareness of the nature of scientific investigation.

Outcomes for teachers

Teachers enjoyed communicating and working with scientists, and also the opportunity SiS gave them to increase their students' engagement with science. Of great benefit to many teachers were the opportunities for professional learning, in terms of updating their knowledge and current science and scientific practices and methods. Around 80% of teachers agreed with these benefits (see Table 28). Perhaps even more important for many primary teachers was their increased confidence. Primary teachers reported educationally significant improvements in their confidence in teaching science (see Table 30) through their involvement with SiS.

Outcomes for scientists

The data from the online survey show that more than 90% of scientists considered it beneficial to them to communicate with students and they enjoyed working with them. Scientists in focus groups and interviews frequently stated that they "were blown away" by students' questions, and remarked on what fun they were having. The next two self-ranked benefits for scientists were the opportunity to communicate with teachers, and their enjoyment in working with them. Scientists also thought that benefits to them included opportunities to promote public awareness of science and also to better understand the community's awareness of science, scientists and their work. They also thought their participation in SiS increased their skills in communicating with students (71%) and teachers (58%, see Table 27).

One of the outcomes suggested by both teachers and scientists in the evaluation of the symposia was appreciating more about how the other group worked. This kind of two-way communication is an important outcome of SiS.

Recommendations

Continuation of the SiS Project

The synthesis of the evaluation findings indicates that SiS is a project which continues to achieve demonstrable benefits for scientists, teachers, and students.

Recommendation 1
SiS should be continued and the following recommendations should be considered to ensure that it remains effective and efficient.

Setting Realistic Targets

Recommendation 2
SiS targets need to be examined carefully to ensure that they are realistic, in terms of being both achievable and sustainable.

The notional SiS partnership target based on 15% of the schools in each region should be re-examined. Consideration must be given to the potential number of scientists available in each region, and their location, and this information used to refine the targets.

In terms of sustainability of partnerships, valuable information may be gained by analysis of the reasons why scientists and teachers withdraw from SiS. When the reason is not personal, but SiS related, lessons may be learnt that can enhance sustainability of other partnerships. As scientists seem to be withdrawing at twice the rate of teachers (see Figure 9), and they are in short supply, it is particularly important to examine their reasons for withdrawal.

In addition, it is suggested that the experiences of the current SiS Project Team, including the SiSPOs, be used to predict what realistic targets might be in terms of the number of partnerships that can satisfactorily be managed given the time available to do so. It would seem that a realistic number is one within which partnerships can be assisted to remain active where required, and new matches made, or additional partners sought, when partnerships reach the end of their “natural life”, as they no doubt will as circumstances change. With the current staff resources a realistic total number of partnerships is unlikely to exceed 1500.

Maintaining the website and database

The website and database have served the SiS project well. The website has been considerably extended and both have been refined since the Pilot Project.

Recommendation 3
The website should be updated as required, but not greatly expanded.

The SiS website should continue to provide a range of relevant and up to date information on the SiS Project. It remains fundamental to the registration process, and thus should be kept up-to-date in order to reflect the latest information relevant to the project. The website also performs an important communication function in publicising the SiS Project. It is also recommended that advice to participants on what to do if their partnership is not progressing well be included under the Frequently Asked Questions section for easy reference.

Recommendation 4
The database must be kept up-to-date in terms of its monitoring role and also to reflect technical advancements.

The database should continue to provide rapid and current information relating to registration and monitoring of partnerships.

Supporting Partnerships

Regionalisation of the SiSPOs has been successful in promoting the SiS program, and making and sustaining partnerships. However, various issues were recognised as inhibiting the SiSPOs in their roles and these can be ameliorated to some extent by continuing their support.

Recommendation 5
The regionalisation of the SiS Project should continue, and the SiSPOs be continually supported in their roles.

The current SiS Project Team should work together to address the identified issues facing SiSPOs. As part of this process, it is recommended that SiSPO Training Workshops be held annually.

Recommendation 6
The symposia and networking sessions should be continued but their structure refined to ensure they address networking, partnerships, and maintain a focus on education.

Symposia and networking sessions achieved many positive outcomes. However, at times their structure did not provide the greatest benefits to scientists and teachers. Science topics chosen for symposia must be relevant to teachers and their classrooms. Thus, a move away from theoretical contemporary scientific sessions to a more applied approach is recommended. As there are many different ways to develop partnerships, the symposia should provide frequent opportunities for small-group sessions to work through partnership pragmatics. These recommendations suggest the symposia should shift its balance a little from scientific lecture to partnership discussions.

It is suggested the SiS Project Team look for alternative ways to present partnerships that are not solely based on outstandingly successful relationships. For example, deconstructing a successful partnership to identify the key characteristics, presenting a short video of a partnership, discussing a case study of how a partnership has been fixed up when something went wrong, or “top 10 tips” for maintaining partnerships. Such information should reinforce the importance of communication and flexibility identified as determinants of partnership success.

Recommendation 7
Every opportunity should be sought to obtain positive publicity for the SiS Project and its outcomes.

Providing support to partnerships also requires promotion of the outcomes of the project. Publicity through various media outlets, including coverage of SiS activities by the local press, gives a boost not only to the students, teachers and schools, but also to the scientist and his/her organisation. The outcomes of SiS are positive and deserve attention.

Further Evaluation

Recommendation 8
Should SiS continue into the future, it is recommended that there be a further evaluation in the third year to ensure that the management and outcomes of SiS remain current and appropriate in the contemporary Australian educational context.

The findings of both the Pilot Project and this current evaluation have reached similar conclusions about the benefits and challenges to the success of SiS. The current evaluation has been able to throw more light on the challenges, and how they might be overcome, because SiS has been in operation for more than an additional year. It is unlikely annual evaluation would add significantly to these findings. Should SIS continue into the future, it is recommended that there be a further evaluation during the third year to re-examine the SiS project to ensure that its benefits are being maintained, its management remains effective, and the numbers and outcomes of partnerships are satisfactory.

Final Comment

Overall, it seems that there are three kinds of scientist-teacher partnerships. The first kind includes the strong, stable partnerships that move along with notable benefits for their participants because the teacher and scientist (who often has children at the school) work respectfully and flexibly together. These partnerships require little attention from SiS and most would exist with or without SiS (in fact some of them pre-date SiS). The second group of partnerships, and this is probably the largest group, generally work well. However, they are not spontaneous. Some needed SiS to effect the initial matching, and were able to grow from there. Others may have needed SiS intervention to get them onto a steady track and the occasional contact to keep them moving along. The third group includes the partnerships that don't work. This may be because of unfortunate matching, changes in circumstances of one or both partners, or lack of support from schools or employers. These partnerships need SiS intervention to dissolve them without embarrassment, rematch where possible, or allow participants to withdraw gracefully. It is the latter two groups where SiS has the most input, and it is the area where most of the effort of the SiS Project Team should be directed.

This evaluation has demonstrated that scientist-teacher partnerships can have enormous benefits for scientists, teachers, and students, but the majority of partnerships need, at least on occasions, support from SiS. SiS is about partnerships between people who are working voluntarily together to achieve outcomes both think are important. Partners must be able to enjoy their relationship and value its outcomes, otherwise there is little motivation to continue. Sometimes, pressures of work or other interruptions in people's lives can let the priority of the partnership slide, communication become less frequent, and the partnership become in danger of failing. This is where the SiS Project Team can help, re-enthuse partners and provide sensitive support. After all, as one interviewee put it, SiS is "a human thing".

List of Appendices

Appendix 1. Copies of the Symposia Programs

Hobart – Biotechnology Symposium

22 & 23 May 2008
CSIRO Marine Laboratories, Castray Esplanade, Battery Point, Hobart

The symposium is an initiative of the Tasmanian Science and Technology Council and is supported by Biotechnology Australia. *Scientists in Schools* is a partnership between the Australian Government Department of Education, Employment and Workplace Relations and CSIRO.

Thursday 22 May 2008

3.00-4.30	**Working with schools – a 'how to' guide for scientists** Session for scientists who are in Scientists in Schools partnerships CSIRO Marine Laboratories, Castray Esplanade, Battery Point, Hobart
5.30-6.30	**i-cubed event: Utilising our Biodiversity – Successes and Challenges and website launch** Followed by refreshments Hadley's Hotel, 34 Murray Street, Hobart
7.00	**Symposium dinner** Hadley's Hotel, 34 Murray Street, Hobart Guest speaker: Dr Jim Peacock AC Australia's Chief Scientist

Friday 23 May 2008

8.00	Registration and coffee

Session 1
Chair: Dr Jim Peacock, Australia's Chief Scientist

8.45	**Welcome** Office of the Chief, CSIRO Marine and Atmospheric Research
9.00	**Biotechnology – a Tasmanian overview** Associate Professor Anthony Koutoulis University of Tasmania
9.20	Questions and discussion
9.30	**Development of novel land-plant omega-3 oils** Dr Peter Nichols CSIRO Marine and Atmospheric Research
9.50	Questions and discussion
10.00	**Finding gene targets for the treatment of human disease** Dr Lucy Whittock Menzies Research Institute
10.20	Questions and discussion
10.30	**Morning tea**

Session 2
Chair: Dr John Volkman, Chair, Tasmanian Science and Technology Council

11.00	**Partnership presentation – teacher** **Adopt-a-Beach: A climate change program for schools** Rob McCammon and Year 9 students The Hutchins School
11.15	**Partnership presentation – scientist** **Science IS fun** Dr Jill Cainey Bureau of Meteorology
11.30	**Breakout discussion** 5 groups of 10 (5 teacher-scientist pairs with a facilitator/recorder) Each pair has 10 minutes to discuss what they're doing in their Scientists in Schools partnership. Questions to cover could include: What's worked (or planned)? What hasn't worked? How will the partnership be sustained? Further discussion question: How might we better integrate contemporary scientific research into our schools? What role can Scientists in Schools play in this?
1.00	**Lunch**

Session 3
Chair: Wendy Spencer, Director of Innovation, Science and Technology,
Tasmanian Department of Economic Development and Tourism

2.00	**What do the public really think about biotechnology, and why?** Alex Pelvin Biotechnology Australia
2.20	Questions and discussion
2.30	**Marinova – an overview** Dr Helen Fitton Marinova Pty Ltd
2.50	Questions and discussion
3.00	**Transforming the poppy industry** Dr Tony Fist Tasmanian Alkaloids
3.20	Questions and discussion
3.30	**Closing remarks** Rebecca Cross Australian Government Department of Education, Employment and Workplace Relations
3.40	**Close of formal symposium program**
3.45-4.30	**Tour of CSIRO Marine Laboratories (Optional)**

Townsville – Science in the Tropics Symposium

Science in the Tropics Symposium
5 & 6 September 2008
James Cook University, Townsville

The symposium is an initiative of the North Queensland Science Centre of Innovation and Professional Practice (SCIPP), Queensland Department of Education, Training and the Arts and is supported by James Cook University.

Scientists in Schools is a partnership between the Australian Government Department of Education, Employment and Workplace Relations and CSIRO.

Friday 5 September 2008
All Friday sessions held in the Medical School (Buildings 39 and 40)

1.30-2.30 **Concurrent sessions:**

Working with schools – a 'how to' guide for scientists
Seminar for scientists who are in Scientists in Schools partnerships
Building 39, Room 101 (DB39-101)

What would I do with a real, live scientist?
Seminar for teachers who are in Scientists in Schools partnerships
Building 39, Room 126 (DB39-126)

2.30-3.30 **Panel session:**
Professional perspectives – a sharing session for partnerships
Building 40, Room 103 (DB40-103)

3.30-4.00 **Afternoon tea**

4.00-5.00 **Breakout session:**
5 groups of 10 (5 teacher-scientist pairs share their ideas and experiences)
Building 39, Rooms 118-123

7.00 **Symposium dinner**
Southbank Convention Centre, Rydges Southbank
23 Palmer St, Townsville
Guest speaker: Professor Chris Cocklin
Pro Vice Chancellor, James Cook University

Saturday 6 September 2008

All sessions held in Room 101 in the Physics, Maths, Earth Sciences Building (Building 17)

8.00 Registration and coffee in the courtyard

Session 1

Chair: Steve Baskerville, Kirwan State High School

8.45 **Welcome to Country**
Associate Professor Gracelyn Smallwood, James Cook University

Welcome
Professor Jim Burnell, James Cook University

9.00 **Global climate change and tropical cyclones**
Professor Jon Nott, James Cook University

9.20 Questions and discussion

9.30 **Impacts of urbanisation on coastal cassowary populations**
Dr Nicky Moore, James Cook University

9.50 Questions and discussion

10.00 **Climate change and coral reefs: past present and uncertain future effects**
Dr Morgan Pratchett, James Cook University

10.20 Questions and discussion

10.30 **Morning tea**

Session 2: Showcasing Scientists in Schools

Chair: Felicity Roberts, Moranbah State High School

11.00 **Working with an Antarctic scientist**
Ms Petreah Carroll, St Joseph's School, Mundingburra

11.20 Questions and discussion

11.30 **A scientist in partnership with Kirwan State High School**
Professor Jim Burnell, James Cook University

11.50 Questions and discussion

12.00 **Tour of JCU facilities**
Choose from the School of Engineering, the Advanced Analytical Lab, Marine and Aquaculture Research Facilities Unit or the School of Medicine and Dentistry. There may also be a chance to visit the School of Veterinary and Biomedical Sciences and the Sports Science Heat and Humidity Chamber.

1.00 **Lunch**

Session 3

Chair: Professor Iain Gordon, CSIRO

2.00	**Statistics and data analysis: solving real-world problems** Dr Yvette Everingham, James Cook University
2.20	Questions and discussion
2.30	**IT in the New Millennium: How e-Research will change science and the world by 2020** A/Prof Ian Atkinson, James Cook University
2.50	Questions and discussion
3.00	**Aquaculture and sustainability** Professor Rocky de Nys, James Cook University
3.20	Questions and discussion
3.30	**Closing remarks** Prof Iain Gordon, CSIRO
3.40	**Close of formal symposium program**

Melbourne – Health and Medical Research Symposium

23 and 24 October 2008
Walter and Eliza Hall Institute of Medical Research (WEHI)
1G Royal Parade, Parkville, Melbourne
and
Gene Technology Access Centre (GTAC)
1H Royal Parade, Parkville, Melbourne

Thursday 23 October 2008
WEHI and GTAC

1.30-2.30	**Concurrent sessions** **Working with schools - seminar for scientists who are in Scientists in Schools partnerships** WEHI Conference Room **Working with scientists - seminar for teachers who are in Scientists in Schools partnerships** GTAC Conference Room
2.30-3.15	**Plenary session** **GTAC** Scientists in Schools partnerships. A chance for teachers and scientists to exchange ideas about the benefits of the program, the challenges and ways to overcome challenges.
3.15-3.45	**Afternoon tea**
3.45-5.00	**Breakout sessions** **GTAC** 10 groups of 10 (5 teacher-scientist pairs to discuss the way forward for their partnerships)
7.00	**Symposium dinner** Venue: Scienceworks Guest speaker: Dr Graham Mitchell CEO Foursight Associates Chief Scientist, Victoria MC: Mr Chris Krishna-Pillay

Friday 24 October 2008
Walter and Eliza Hall Institute of Medical Research

8.30 **Registration**

Session 1: Medical and Health Research in Victoria

Chair: Dr Jim Peacock

8.45 **Welcome**
Professor Suzanne Cory
Director
Walter and Eliza Hall Institute of Medical Research

9.00 **Investment in our BioFuture: Health research in Victoria**
Professor Peter Rathjen
Deputy Vice Chancellor (Research)
University of Melbourne

9.20 Questions and discussion

9.30 **Stem cells and regenerative medicine – the road ahead**
Dr Sharon Ricardo
Senior Research Fellow and Group Leader
Monash Immunology and Stem Cell Laboratories
Principal Researcher
Australian Stem Cell Centre

9.50 Questions and discussion

10.00 **Morning tea**

Session 2: Medical research, clinical practice and supporting technology

Chair: Dr John Floyd

10:30 **Autoimmune diabetes - perspectives of a clinical researcher**
Dr Spiros Fourlanos
Walter and Eliza Hall Institute
and Royal Melbourne Hospital

10:50 Questions and discussion

11:00 **Medical applications of nanotechnology**
Dr Michelle Critchley
Nanotechnology Victoria

11.20 Questions and discussion

11.30 **Progress in the diagnostics and prevention of Alzheimer's Disease**
Dr Jose Varghese
CSIRO Molecular and Health Technologies

11:50 Questions and discussion

12:00 – 13:30 Lunch GTAC
13:00 – 13:15 GTAC presentation Mr Brian Stevenson, Director GTAC

Session 3:

Chair: Ms Claudette Bateup

1.30	**SiS partnership presentation – teacher and students** Ms Joanne Roberts and students Templeton Primary School
1.50	Questions and discussion
2:00	**SiS partnership presentation - scientist** Dr Regina Crameri Defence Science and Technology Organisation
2:20	Questions and discussion
2.30	**Panel:** The future global medical research dollar – where should it be spent? Professor Bob Williamson – University of Melbourne Dr Amanda Caples – Dept Innovation, Industry, Science and Research Professor Sally Green - Australasian Cochrane Centre & Monash University Facilitator: Dr Betty Exintaris, Monash University
3.30	**Closing remarks** Ms Claudette Bateup Australian Government Department of Education, Employment and Workplace Relations
3.40	**Close of formal symposium program** **Possible tours**

Appendix 2. Symposia Evaluation Forms

Scientists in Schools (SiS)

Hobart Regional Symposium, May 22-23, 2008

Evaluation Form

I am a: registered SiS teacher / registered SiS scientist / other (please circle one)

1. Overall, did you enjoy the symposium? Yes / No

2. What were the best aspects of the symposium?

3. What suggestions/improvements do you have for the next symposium?

Scientists in Schools

Victorian Symposium
23 & 24 October 2008
WEHI and GTAC, Melbourne

Evaluation Form

I am a registered SiS teacher / registered SiS scientist / Other ____________________

1. Was your attendance at the symposium worthwhile? Yes / No / Partly

2. How useful were the Thursday sessions for you? Very useful / Useful / Not useful

Why was this?____

____

____

____

3. How useful were the Friday sessions for you? Very useful / Useful / Not useful

Why was this?____

____

____

____

4. What are the main points that you will take away from the symposium?

____

____

____

5. What could be improved next time?

____

____

____

Scientists in Schools

Science in the Tropics Symposium
5 & 6 September 2008
James Cook University, Townsville

Evaluation Form

I am a registered SiS teacher / registered SiS scientist / Other ______________________

1. Was your attendance at the symposium worthwhile? Yes / No / Partly

2. How useful were the Friday sessions for you? Very useful / Useful / Not useful

Why was this?____

____

____

____

____

3. How useful were the Saturday sessions for you? Very useful / Useful / Not useful

Why was this?____

____

____

____

____

4. What are the main points that you will take away from the symposium?

____

____

____

5. What could be improved next time?

____

____

____

Appendix 3. Focus Group Feedback Sheet

Scientists in Schools (SiS) Focus Group Feedback

Please provide us with an overview of your participation in SiS:

Your Name ________________________ (optional) I am a partner Scientist / Teacher

Scientist's organisation ____

Teacher's school ____

Type of school Primary [ ] Middle [ ] Secondary [ ] All Years [ ]

School Government [ ] Independent [ ] Catholic [ ]

Year Level(s) involved in partnership Year(s) ________ Topic __________________________

Date partnership began/will begin ____________ Planned length __________________________

Purpose of the Focus Group

The purpose of the focus group is to provide information for our evaluation of the SiS Project. Specifically, we are seeking information about three things:

1. What are the benefits of the project to you? To your partner? To the students?

2. What kinds of things have ***assisted*** your partnership to progress?

3. What kinds of things have ***hindered*** your partnership?

Please write any comment you wish below

Appendix 4. Interview Proformas

SCIENTIST Interview at Scientists in Schools "Gatherings"

Date of Interview ___________ Scientist's Name _____________________________

Scientist's Organisation ______________________________

Name of school(s) partnered with _____________________________

Type of school Primary [ ] Middle [ ] Secondary [ ] All Years [ ]

School Government [ ] Independent [ ] Catholic [ ]

Year Level(s) involved in partnership Year(s) ________ Topic _________________________

Date partnership began/will begin ____________ Planned length _________________________

1. What is/will be the nature of your partnership? Prompt: how do/will you help the teacher/students?	
2. Why did you want to become involved?	
3. Overall, how is the partnership progressing? Any comment?	OK [ ] Really well [ ] Not so well [ ]
4. What kinds of things have **assisted** your partnership to progress? In what ways?	
5. What kinds of things have **hindered** your partnership to progress? In what ways?	
6. What benefits have you seen/do you expect from the partnership? For you? For your partner? For students?	
7. Any advice for others or other comments?	

Willing to be part of a case study, if requested later? Yes [ ] No [ ]

TEACHER Interview at Scientists in Schools "Gatherings"

Date of Interview ___________ Teacher's Name ________________________

Teacher's School ______________________________

Type of school Primary [ ] Middle [ ] Secondary [ ] All Years [ ]

School Government [ ] Independent [ ] Catholic [ ]

Year Level(s) involved in partnership Year(s) ________ Topic _________________________

Scientist's Organisation ______________________ Location of Scientist __________________

Date partnership began/will begin ____________ Planned length _________________________

1. What is/will be the nature of your partnership? Prompt: how do/will the scientist help you and the students?	
2. Why did you want to become involved?	
3. Overall, how is the partnership progressing? Any comment?	OK [ ] Really well [ ] Not so well [ ]
4. What kinds of things have **assisted** your partnership to progress? In what ways?	
5. What kinds of things have **hindered** your partnership to progress? In what ways?	
6. What benefits have you seen/do you expect from the partnership? For you? For your partner? For students?	
7. Any advice for others or other comments?	

Willing to be part of a case study, if requested later? Yes [ ] No [ ]

Record of School Visit for Scientists in Schools Project

Date of Visit ____________ Teacher's Name __________________________

School ________________________________

Type of school Primary [ ] Middle [ ] Secondary [ ] All Years [ ]

School Government [ ] Independent [ ] Catholic [ ]

Year Level(s) involved in partnership Year(s) ________ Topic ___________________________

Scientist's Organisation ________________________ Location of Scientist ___________________

Date partnership began/will begin _____________ Planned length ___________________________

1. What is/will be the nature of your partnership? Prompt: how do/will the scientist help you and the students?	
2. Why did you want to become involved?	
3. Overall, how is the partnership progressing? Any comment?	OK [ ] Really well [ ] Not so well [ ]
4. What kinds of things have **assisted** your partnership to progress? In what ways?	
5. What kinds of things have **hindered** your partnership to progress? In what ways?	
6. What benefits have you seen/do you expect from the partnership? For you? For your partner? For students?	
7. Any advice for others or other comments?	

Willing to collect data from students? Yes [ ] No [ ]

Appendix 5. Student Survey Form – Primary Students

Upper primary students' evaluation of the Scientists in Schools Project

Year level: _______ Topic: ____________________ Sex: Male / Female

1. What did you learn from the scientist?

____

____

____

____

2. What was it like working with a real scientist?

____

____

____

____

3. What different science careers did you learn about?

____

____

____

____

4. Did the scientist make you more interested in becoming a scientist? Yes / No

Why / Why not?

____

____

Lower primary students' evaluation of the Scientists in Schools Project

We would like to collect some data about young children's experiences with the scientist. This can be difficult for children with limited writing skills. For your own interest you might like to try one of the following techniques. If you do, we would be delighted to receive a copy of the results. If you do send us any information, please also include the year level, topic studied, and the number of boys and girls in your class.

Method 1: Y-chart
Please complete a Y-chart with your class (i.e., divide your recording sheet into three sections). Ask the students to respond to the following three questions, and write answers directly onto the chart. Please feel free to modify these questions to suit your class.

1. What did you learn from the scientist?
2. What was it like working with a real scientist?
3. What different science careers did you learn about?

Method 2: Class brainstorm
Using a class brainstorm, please ask the students this question, and record all answers on a chart.

Do you want to be a scientist?   Why / Why not?

Method 3: Students draw a picture
Please ask the children to draw a picture of their favourite part of working with a scientist. Also ask them to describe what they have drawn. If necessary, please annotate the picture accordingly. Please indicate the student's age and boy/girl on the picture. Please send photocopies of the pictures to us.

Appendix 6. Student Survey Form – Secondary Students

Secondary Students' views of the Scientists in Schools Project

Year level: _______ Topic: ____________________ Sex: Male / Female

1. Did working with the scientist increase your knowledge or understanding of science?
Yes / No

If yes, please give specific examples of something that you learnt.

____

____

____

____

2. Please give an example of how the scientist worked with you and your classmates.

____

____

____

____

3. Did working with the scientist increase your interest in having a career in science?
Yes / No

Why was this?

____

____

____

4. Did working with the scientist increase your awareness of the variety of careers available in science? Yes / No

If yes, please give an example of a science-related career that you learnt about.

____

____

Appendix 7. Online Survey for Scientists

HOME GET INVOLVED CURRENT PARTNERSHIPS RESOURCES FOR PARTNERS CONTACT US

Online survey for scientists – 2008 activities

Please use this form to complete our online survey. If you are involved in more than one partnership, and you consider these partnerships to have worked in different ways, please fill in a survey for each partnership. For more details about Scientists in Schools, read the information for scientists.

Note: If you are a teacher, please use the teacher survey.
Your responses will be anonymous.

A. Description of school involved in partnership

State/Territory [select...]

Location [select...]

Type of school [select...]

Which best describes the year levels at school? [select level...]

B. Describing partnership

Why did you decide to participate in this project?

[ ]

Please indicate all the subject area(s) and level(s) that are involved in the partnership:

Subject area(s) of interest	Year level(s) of interest: Lower Primary	Middle Primary	Upper Primary	Junior Secondary	Senior Secondary
Earth & Space	☐	☐	☐	☐	☐
Living Things	☐	☐	☐	☐	☐
Energy & Force	☐	☐	☐	☐	☐
Matter	☐	☐	☐	☐	☐
Mathematics	☐	☐	☐	☐	☐
Engineering & Technology	☐	☐	☐	☐	☐
Working Scientifically	☐	☐	☐	☐	☐

Is this your first Scientists in Schools partnership?
- ○ Yes
- ○ No — If no, please comment: [ ]

How long since your current partnership was set up? [select...]

Have you attended an event related to the Scientists in Schools Project?
- ○ No
- ○ Yes — If yes, which? [ ]

Have you started running activities with your partner teacher yet?
- Yes
- No — Have not made contact.
- No — Still planning.

If no, please skip ahead to Section E.

Which of the following activities have been used during the partnership?

Contribution of scientist		
(1) Presentation to parents or teachers about science	Yes	No
(2) Make presentation to students about careers in science	Yes	No
(3) Visit classroom to interact with students	Yes	No
(4) Participate in excursion with students	Yes	No
(5) Answer students' email questions	Yes	No
(6) Supervise student(s) in a project	Yes	No
(7) Assist teacher(s) with science content	Yes	No
(8) Support a science club	Yes	No
(9) Judge a science competition	Yes	No
(10) Other activity: please describe		

C. Benefits of the partnership for students

Based on your observations of the students, what do you think are the main benefits for the students?

Benefit to student		
(1) Increased knowledge of contemporary science	Yes	No
(2) Opportunity to see scientists as real people	Yes	No
(3) Opportunity to experience science with practising scientists	Yes	No
(4) Increased awareness of science-related careers	Yes	No
(5) Increased ability to recognize and ask questions about science-related issues in the world around them	Yes	No
(6) Increased willingness to question unsupported claims about health and the environment	Yes	No
(7) Willingness to look to science to make decisions about their own lives	Yes	No
(8) Increased understanding of the importance of scientific evidence for decision-making in society	Yes	No
(9) Increased awareness of the nature of scientific investigation	Yes	No
(10) Access to science equipment and/or facilities	Yes	No
(11) Having fun	Yes	No
(12) Unsure of benefit to students	Yes	No
(13) Other benefit: please describe		

D. Benefits to you as a scientist in the Scientists in Schools

program

Are any of the following of benefit to you?

Benefit to you		
(1) Opportunity to communicate with teachers	Yes	No
(2) Improved skills in communicating with teachers	Yes	No
(3) Opportunity to communicate with students	Yes	No
(4) Improved skills in communicating with students	Yes	No
(5) Increased understanding of the community's awareness of science	Yes	No
(6) Increased understanding of the community's perceptions of scientists and their work	Yes	No
(7) Opportunity to promote science-related careers	Yes	No
(8) Opportunity to promote public awareness of science	Yes	No
(9) Enjoyment in working with teachers	Yes	No
(10) Enjoyment in working with students	Yes	No
(11) Were there any other benefits to you? Please describe.		

Please give a specific example(s) of something that is working really well in the partnership or the Scientists in Schools program.

Please give a specific example(s) of something that is not working well in the partnership or the Scientists in Schools program.

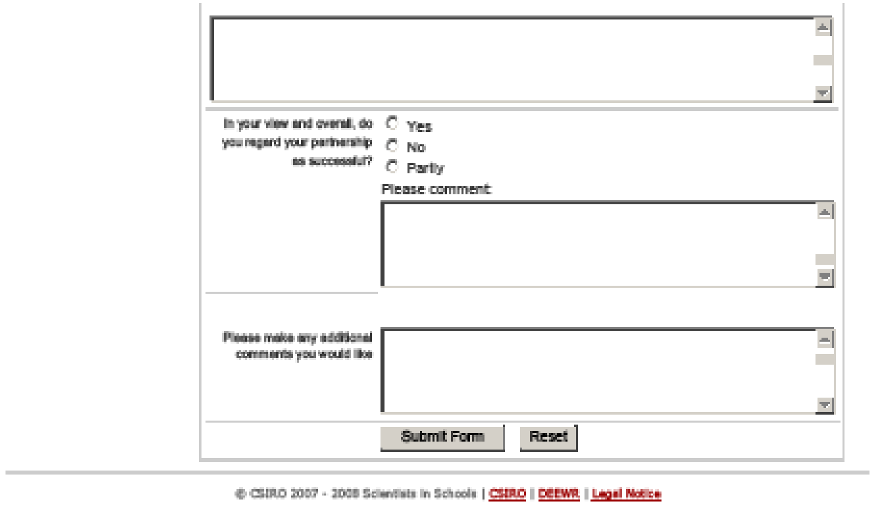
E. Resources and support

Apart from registration, have you used the website?
- No
- Yes — If yes, which parts were useful?

Please rate the usefulness of:

Scientists in Schools events	not useful	1	2	3	4	useful	Not attended
Support materials sent when partnered	not useful	1	2	3	4	useful	Not used

What additional support would you like for your partnership?



In your view and overall, do you regard your partnership as successful?

- Yes
- No
- Partly

Please comment:

Please make any additional comments you would like

Submit Form | Reset

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Appendix 8. Online Survey for Teachers

HOME GET INVOLVED CURRENT PARTNERSHIPS RESOURCES FOR PARTNERS CONTACT US

Online survey for teachers – 2008 activities

Please use this form to complete our online survey. If you are involved in more than one partnership, and you consider these partnerships to have worked in different ways, please fill in a survey for each partnership. For more details about Scientists in Schools, read the information for teachers.

Note: If you are a **scientist**, please use the scientist survey.
Your responses will be anonymous.

A. Description of school involved in partnership

State/Territory	select...
Location	select...
Type of school	select...
Which best describes the year levels at school?	select level...

B. Describing partnership

Why did you decide to participate in this project?

Please indicate all the subject area(s) and level(s) that are involved in the partnership:

	Year level(s) of interest				
Subject area(s) of interest	**Lower Primary**	**Middle Primary**	**Upper Primary**	**Junior Secondary**	**Senior Secondary**
Earth & Space	☐	☐	☐	☐	☐
Living Things	☐	☐	☐	☐	☐
Energy & Force	☐	☐	☐	☐	☐
Matter	☐	☐	☐	☐	☐
Mathematics	☐	☐	☐	☐	☐
Engineering & Technology	☐	☐	☐	☐	☐
Working Scientifically	☐	☐	☐	☐	☐

Is this your first Scientists in Schools partnership?
○ Yes
○ No — if no, please comment:

How long since your current partnership was set up? select...

Have you attended an event related to the Scientists in Schools Project?
○ No
○ Yes — if yes, which?

Have you started running activities with your partner scientist yet?

- Yes
- No — Have not made contact.
- No — Still planning.

If no, please skip ahead to Section E.

Which of the following activities have been used during the partnership?

Contribution of scientist		
(1) Presentation to parents or teachers about science	Yes	No
(2) Make presentation to students about careers in science	Yes	No
(3) Visit classroom to interact with students	Yes	No
(4) Participate in excursion with students	Yes	No
(5) Answer students' email questions	Yes	No
(6) Supervise student(s) in a project	Yes	No
(7) Assist teacher(s) with science content	Yes	No
(8) Support a science club	Yes	No
(9) Judge a science competition	Yes	No
(10) Other activity: please describe		

C. Benefits of the partnership for students

Based on your observations of the students, what do you think are the main benefits for the students?

Benefit to student		
(1) Increased knowledge of contemporary science	Yes	No
(2) Opportunity to see scientists as real people	Yes	No
(3) Opportunity to experience science with practising scientists	Yes	No
(4) Increased awareness of science-related careers	Yes	No
(5) Increased ability to recognize and ask questions about science-related issues in the world around them	Yes	No
(6) Increased willingness to question unsupported claims about health and the environment	Yes	No
(7) Willingness to look to science to make decisions about their own lives	Yes	No
(8) Increased understanding of the importance of scientific evidence for decision-making in society	Yes	No
(9) Increased awareness of the nature of scientific investigation	Yes	No
(10) Access to science equipment and/or facilities	Yes	No
(11) Having fun	Yes	No
(12) Other benefit: please describe		

D. Benefits to you as a teacher in the Scientists in Schools program

Are any of the following of benefit to you?

Possible benefit to you		
(1) Opportunity to communicate with scientists	○ Yes	○ No
(2) Ability to update current scientific knowledge	○ Yes	○ No
(3) Ability to update knowledge of scientific practices/methods	○ Yes	○ No
(4) Opportunities to communicate with other teachers about the project	○ Yes	○ No
(5) Increased awareness of science-related careers	○ Yes	○ No
(6) Opportunity to increase engagement of students in science	○ Yes	○ No
(7) Increased motivation to teach science	○ Yes	○ No
(8) Enjoyment in working with the scientist	○ Yes	○ No
(9) Were there any other benefits to you? Please describe.		

Please give a specific example(s) of something that is working really well in the partnership or the Scientists in Schools program.

Please give a specific example(s) of something that is not working well in the partnership or the Scientists in Schools program.

How confident were you about teaching science before involvement in the Scientists in Schools program?

Not very confident ○ 1 ○ 2 ○ 3 ○ 4 Very confident

How confident are you now about teaching science?

Not very confident ○ 1 ○ 2 ○ 3 ○ 4 Very confident

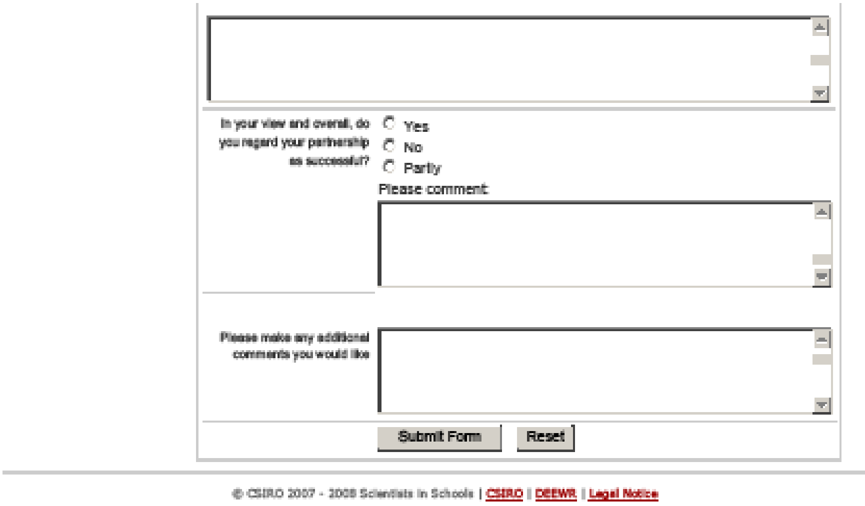
E. Resources and support

Apart from registration, have you used the website? ○ No ○ Yes — If yes, which parts were useful?

Please rate the usefulness of:

Scientists in Schools events	not useful	○ 1	○ 2	○ 3	○ 4	useful	○ Not attended
Support materials sent when partnered	not useful	○ 1	○ 2	○ 3	○ 4	useful	○ Not used

What additional support would you like for your partnership?



In your view and overall, do you regard your partnership as successful?

- Yes
- No
- Partly

Please comment:

Please make any additional comments you would like

Submit Form | Reset

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Appendix 9. SiS Project Officers Training Workshop Program

Scientists in Schools

SiS Project Officers Training

13 & 14 November 2008
CSIRO Corporate Centre, Limestone Av, Canberra

Thursday 13 November 2008

8.30 onwards	**Registration**
9.00	**Welcome** Dr Jim Peacock Chair, CSIRO Science Team
9.15	**How SiS fits into CSIRO Education** Ross Kingsland Manager, CSIRO Education
9.30	**SiS National Overview** Marian Heard SiS Project Manager
9.45	**SiSPO Showcases (4x10 – 40 talk + 5 Q&A)** Chair: Liz Yuncken Examples of SiS partnerships of various types such as distance, maths, scientist-teacher interactions, excursions, CREST, science fairs, Primary Connections, real research, Indigenous
10.30	**Morning tea**
11.00	**SiSPO session** Facilitator: Margaret Stephenson SiSPOs send in topics for discussion
12.30	**Lunch**
1.30	**Working with volunteers** Roger McFarlane, Volunteers Australia
2.30	**Counselling** Stephen Young
3.30	**Afternoon tea**
4.00	**Facilitation** Stephen Young
5.00	**Close**
7.00	**Dinner** Venue: The Ginger Room, Old Parliament House

Friday 14 November 2008

8.15	Coffee
8.30	**CREST** Vicki Stavropoulos, National CREST Coordinator
9.45	**SiSPO showcases (4x10 min; 5 min Q&A)** Chair: Margaret Stephenson Examples of SiS partnerships of various types such as distance, maths, scientist-teacher interactions, excursions, CREST, science fairs, Primary Connections, real research, Indigenous
10.30	**Morning tea**
11.00	**Roles, responsibilities and role plays – scenarios for discussion** Facilitator: Liz Yuncken
12.30	**Lunch**
1.30	**Discussion and wrap-up** **Future plans**
3.30	**Close**

Appendix 10. SiS Project Officers Training Workshop Program Evaluation Form

Scientists in Schools

Project Officer Training
13 & 14 November 2008
CSIRO Corporate Centre, Canberra

Evaluation Form

1. Was your attendance at the training worthwhile? Yes / No / Partly

2. How useful were the Thursday sessions for you? Please tick as appropriate below.

Session	**Very useful**	**Useful**	**Not useful**
Welcome			
How SiS fits into CSIRO Education			
SiS National Overview			
SiSPO Showcases			
SiSPO Discussion Session			
Working with volunteers			
Counselling			
Facilitation			

3. How useful were the Friday sessions for you? Please tick as appropriate below.

Session	**Very useful**	**Useful**	**Not useful**
CREST			
SiSPO Showcases			
Roles, responsibilities and role plays			
Future Planning			
Wrap-up			

4. What are the main points that you will take away from the training?

5. What could be improved next time?

Appendix 11. SiS Project Officers Interview Questions

Questions sent to SiS Project Officers prior to Interview in March-April, 2009.

1. Please provide an overview of your background and experience.
2. How do you define your role as a SiSPO?
3. How useful were the resources from the SiSPO Training Course in November 2008?
4. How do you manage your time as a SiSPO?
5. What procedures do you use to monitor partnerships?
6. What issues are you facing with the partnerships and how do you go about solving them?
7. How do you make a partnership happen?
8. What happens when a partnership breaks?
9. Was there anything in your background that you found particularly useful in your role as a SiSPO?
10. What is your target number of partnerships and how feasible is this number?
11. What have you learnt since the SiSPO Training Course in November 2008?
12. What are the advantages and disadvantages of having the SiSPOs located regionally rather than at SiSHQ in Canberra?
13. What do you think are the characteristics required to have a great partnership?

Appendix 12. Descriptions of Case Studies

Overview of Case Studies

Case #	Name	Location	Sector	Type	Partnership Status	
					October 08	April 09
1	Sharing the scientist	ACT	Gov't	Primary	Active	Active
2	Tuesday science club	ACT	Gov't	Primary	Active	Active
3	"SiS is not a labour saving device"	ACT	Gov't	P-10	Active	Inactive
4	Doing good for people	Vic	Gov't	Primary	Active	Active
5	"Science has changed my life!"	Vic	Gov't	Primary	Active	Active
6	The WOW factor	Vic	Catholic	Primary	Active	Active
7	"It's a human thing"	Vic	Gov't	Secondary	Active	Active
8	The need to add value	Vic	Indep't	All Years	Inactive	Inactive
9	"I want to be happy with my career"	Vic	Catholic	All Years	Inactive	Withdrawn
10	Raising the profile of science	WA	Gov't	Primary	Active	Active
11	Collaboration, communication and enthusiasm	WA	Gov't	Primary	Active	Active
12	"I saw one swimming!"	WA	Indep't	All Years	Active	Dormant

Case Study 1: Sharing the Scientist

The Nature of the Partnership in October, 2008

Who was involved

A K-6 government school, the Science Coordinator (SC), other teachers in the school, and a male earth scientist.

The school context

This is a well-established school of over 500 children with nice ambience. It is a well-resourced, multicultural school with about 20% of students with English as a second language. Science is generally taught for about 3-6 weeks in one term for the younger classes.

An earlier partnership with a scientist who was a parent at the school has ceased, at least for the time being, as she has taken a new position and her time is less flexible. She had two visits with Years 1-2, but her special area of content limits the ability to use her expertise. The SC therefore requested a scientist with a wider range of skills.

What happened

The SC has established a good partnership with the scientist who works throughout the school. He has specialised earth science knowledge and has given students talks about this, but is also very flexible and endeavours to fit in with the science topics the teachers are doing. For example, he repeated a session on ecosystems with all three of the Year 4 classes and also the Year 5s. When teachers are planning their science topic, the SC provides the link to the scientist, a planning session occurs and then he delivers a session on the topic. He also follows up with students' questions, for example, after the Year 4 session the students created a documentary and he was a resource person for this. He also had sessions with the K-level children, which they still remembered from Term 2.

The scientist's view

The scientist registered with SiS because he was saddened by the public ignorance of science and he felt this was a way to get students sufficiently interested to study science. The teachers at the school were very enthusiastic, but aware of their own limitations in getting science across to the students. He was away for two months, and this prevented the partnership from being more fulfilling. There are bits he believed he could have done better. He regards it as a privilege to work with teachers and in his view, "they head the list of the most undervalued members of society".

The teacher's view

The teachers are very pleased with the scientist's contribution; in fact, some suggested they found it more interesting and learned even more than the children. The new knowledge provided is used by them at a later date. The students have the experience of someone new, who can answer all their questions and be a follow-up resource. The scientist's flexibility, his rapport with the children, ability to judge what is working and what isn't, and ability to bring things down to the level of the children are reasons why this partnership is working so well.

What the future holds

This partnership is very successful, using the SC as a link person and having flexibility in both content and time from the scientist. Teachers hope it will last as long as possible.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remained active.

The scientist was disappointed to have made only one presentation this year. He believed he could be used much more by the school. He found the children responsive about what he does and wrote, “frankly, I consider I am under-utilized in the SiS program”. Whilst his association with the school was “OK” he was anxious to do more.

The SC has had limited time to arrange more sessions for the scientist, but hopes to establish a CREST program later in the year with the scientist’s help.

Assessment

The partnership has been active since early 2008 and is likely to continue whilst the SC retains contact for the school. Given the way the science program was structured at the school in 2008, it is likely there will be heavier demands on the scientist’s time later in the year.

Data sources

October, 2008: visit to school, interview with SC and three other teachers.

October, 2008: interview with SC as part of a focus group discussion.

Some children’s work from earlier in the year.

November, 2008: email “interview” with scientist

April, 2009: email exchange with scientist.

May, 2009: email exchange with the SC.

Case Study 2: Tuesday Science Club

The Nature of the Partnership in October, 2008

Who was involved

A K-6 government school, the Deputy Principal (DP), other teachers in the school, and a female scientist who was also a parent at the school and currently not working so she had time for involvement.

The partnership began in mid 2007.

The school context

This is a small, well-established primary school of about 200 students with pleasant surroundings. The school is generally well-resourced. There are a number of scientists among the parents, but according to the DP, not a great deal of science happens in the school program. The Science Club is a notable exception and it started before the SiS project.

What happened

The scientist and one of the classroom teachers run a science club on Tuesdays during lunchtime. They plan a term's activity around three topics, and each takes about three weeks. Although originally it was aimed at the older children, they tend to be more involved in sport, so it is attended by mostly Year 4 students. A parent also usually helps. Students in the Science Club made projects for the local science fair.

The scientist's view

The scientist is dedicated to the Science Club, adapting mainly ideas from the Double Helix and the CSIRO science emails. She tries them out on her daughter before using them more widely.

The teacher's view

The DP is pleased with the outcomes of the Science Club. It allows other teachers, who are generalists rather than science specialists, to gain more skills and knowledge. Further, the scientist provides access to equipment that the school does not have. The children love the Science Club. It provides an opportunity for "off-beat" kids to shine – their highlight of the week, and it also "extends the not-so-bright kids".

What the future holds

The DP is very happy with this partnership and hopes that it lasts.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remained active.

The scientist has continued working with the teacher to run the science club and they are again preparing projects for the science fair. A dedicated parent helper (who is also a scientist but not working) assists so between the three and the DP, there is always some one to run the Club. She feels there is the potential to do much more but time is an issue: "It has to be fitted into the "cracks in my life", she said.

The DP thinks the partnership is "fantastic". As well as continuing with the Science Club the scientist is also coordinating an evening program with a speaker once a term about science in the suburbs.

Assessment

The partnership has been active since mid 2007 and continues to work well. It is successful because the scientist is getting continued support from one teacher at the school and a parent helper.

Data sources

October, 2008: visit to school, interview with DP.

October, 2008: email “interview” with scientist.

October, 2008: a detailed description of the science club by a Year 4 student.

April, 2009: separate email exchange with both scientist and DP.

Case Study 3: "SiS is not a labour saving device"

The Nature of the Partnership in October, 2008

Who was involved

A K-10 government community school, the Head of Science (HOS), and a male physicist.

The partnership began in June, 2008.

The school context

This is a new school, only four years old, well-equipped and with a diverse enrolment of over 1300 students. The school has a full and innovative program and caters for students with learning difficulties as well as academically talented ones. The senior students run Double Helix activities for the younger students, and it was hoped the school could get a scientist to oversee this.

The school also has partnership with another scientist who is working with small groups of students running CREST investigations. This partnership was operating well at the time of interview but is not the focus of this case study.

What happened

The scientist came into the school once and gave a presentation to the Year 1s, about living and working in space. It was big group but they enjoyed it.

The scientist's view

This was the scientist's second school as he was first matched with one that wanted to do a biology topic. SiS moved him to this new school. He was happy with his sessions with the Year 1s, and as he has young children himself, is keen to work with them. However, he has not done more at the school. He thought the SiS team could help to "prod both sides of the partnership along".

The scientist is very experienced in outreach and has access to photographs and other resources that teachers do not have, so feels he can make a contribution. But inevitably, both he and the school are busy and outreach activities then drop in priority. He believes that "SiS is not a labour-saving device", it needs effort from both the teacher and the scientist to make it work.

The teacher's view

The scientist has come in only once, and he will make contact again, however, he is aware that the scientist has a relationship with another school where his own children go, so it is a shared arrangement. While he is grateful to have two scientists, the match is not very good. It is a long drive to the school for both scientists from their place of work, and this adds to pressures of time on them.

What the future holds

This partnership has been limited. The other partnership at the school is much stronger, with more frequent visits to the school. However, both the scientist and HOS hope that the partnership will continue, but both acknowledge that the scientist is busy and that limits his involvement.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership is inactive.

The teacher believes that the scientist has a greater interest in working with the school where his children go. He realises that the scientist is very busy and so is not concerned about allowing the partnership to lapse.

The scientist had not heard from the school this year and was too busy with his work to chase them up. He was relying on the school to invite him to do more. However, he was doing more with his children's school and has formalised this as a SiS partnership.

Assessment

The partnership was active since only early in 2008 and is unlikely to continue.

Data sources

October, 2008: interview with HOS as part of a focus group discussion.

October, 2008: interview with scientist.

April, 2009: separate email exchange with scientist and teacher.

Interrogation of SiS database.

Case Study 4: Doing good for people

The Nature of the Partnership in October, 2008

Who was involved

A K-6 government school, a Year 1-2 teacher, and a female scientist.

The partnership was new, having been established only a few weeks before the school visit.

The school context

This is a 50-year-old, timber-framed school in a long-established suburb. The school has about 300 children and a pleasant, friendly feel. The teacher involved is keen to improve her science teaching (she only studied science to Year 10 at school) and hopes that the scientist will give her some help and the confidence to be able to plan her own science units.

What happened

After a quick match following registration, the teacher and scientist have been in regular email contact. Both were rather nervous before they met, but the partnership has worked out well. The teacher prepared the children for the scientist's visit by asking them to draw a picture of their idea of what their scientist would look like. The first session, about tasting, was successful, and a visit to the scientist's work place was planned a little later. As she is then going overseas, partnership activities are expected to continue in 2009.

The scientist's view

The scientist decided to get involved in SiS partly as a way to learn about the Australian education system as she is an immigrant with a 3-year-old son. She also wanted to contribute to the community; "to do good for people," she said. She was delighted with the children's warm response to her visit, and "felt quite moved" when one told her afterwards that he wanted to be a scientist. She is pleased to be in the program and happy to continue.

The teacher's view

The teacher was very pleased with the ease of communication with the scientist and her class was very excited about their experience. They are looking forward to the visit to the scientist's workplace, although the cost of transport ($10 per child) has meant the teacher has had to subsidise it out of her teaching budget.

What the future holds

This partnership, although new, is very successful. The planned visit to the scientist's place of work occurred and children did activities with the scientist, had lunch and spent time looking at signage. They later drew pictures about their visit. The teacher and scientist are working out a means by which the children can ask questions and the scientist can answer them by email. Both partners are planning for the partnership to continue into 2009.

Follow-up in April, 2009: What happened in 2009?

The partnership remained active.

Both the teacher and the scientist remain enthusiastic about their partnership. They have had a beach excursion this year, and are looking into CREST to see if they can "get it going" at the school. The scientist and teacher remain very excited about the program and sees considerable benefit for the students as well as themselves.

Both partners said that they also gained benefit from the SiS networking activities and other CSIRO-education workshops, such as CREST. Regular email contact also helps maintain their progress.

Assessment

The success of the partnership can be attributed to the enthusiasm of both partners, their ease in communicating and willingness to be flexible in their expectations of each other. Both are enjoying the experience and the partnership is expected to continue.

Data sources

October, 2008: visit to school, interview with teacher.

October, 2008: interview with scientist and teacher during the SiS symposium.

November, 2008: letter from teacher with some children’s work following their visit to the scientist’s work place.

April, 2009: separate email exchange with scientist and teacher.

Case Study 5: "Science has changed my life!"

The Nature of the Partnership in October, 2008

Who was involved

A K-6 government school, the Science Coordinator (SC, a Year 4 teacher) and a male plant scientist.

The partnership began mid Term 3, 2008.

The school context

The school is about 30 years old with a mixed cohort of about 600 students. The school is generally well-resourced with a mixed socio-economic student body. The SC assumed her role in 2007 and has endeavoured to promote science. In 2008 she introduced a theme "make a scientist your hero", which raised students' interest and understanding about science. She decided to join SiS to get "a regular scientist".

What happened

The SC was matched to a scientist who was about to go overseas. They arranged for him to send post cards to her Year 4 class as a way of introduction (and also contributed to geography and other subjects). He has since visited the school several times to work with the children on his particular discipline. The children have undertaken a range of activities and wrote a rap song about their work which was performed at a school assembly. The students enjoyed their work. One girl was unequivocal: "[Our scientist] has changed my life, the way I think about scientists. I thought science was boring, but I was wrong. If you think about it, if you put your mind to it, science is quite cool. As I said before, science has changed my life!"

The scientist's view

The scientist has found it exciting to work with the enthusiastic teacher and amazed at the outcomes from the class. He enjoyed taking the rap song back to his work place.

The teacher's view

The SC wants her students to be passionate about whatever they want to do and both she and the scientist believe that an outreach program such as SiS is important in promoting passion in science. She thinks the SiS program is wonderful and next year plans to encourage teachers from the K-2 area to register and request a match for a scientist. She feels she is learning a great deal about teaching science better.

What the future holds

This partnership is very successful, with the enthusiasm of both partners likely to continue into the following year with a new class.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remained active.

The scientist has had planning meetings but he has been very busy at work. Activities are now organised and resources gathered. The scientist has met the teacher's new (2009) class and planned a program for the year. He also re-met with the 2008 class during a lunchtime visit. He finds the relationship easy going and flexible, and enjoys working with his teacher partner.

The teacher attributes the success of the partnership to “respect and flexibility…we listen to each and try to fit in what is not going to increase the workload for each other.” She believes “the kids pick up on the mutual respect, friendship aspect. I think it is a very powerful modelling tool for your students to see you enthusiastic about learning and being willing to make mistakes to learn.”

Assessment

The partnership has been active since its formation and is likely to continue because both partners are passionate about promoting science in schools, and considerate of the demands on each other.

Data sources

October, 2008: interview with SC at Melbourne symposium.

October, 2008: input from teacher, scientist and four students to a session at the Melbourne symposium.

November, 2008: email from teacher.

December, 2008: children’s work reporting on their activities with their scientist.

April, 2009: separate email exchange with teacher and scientist.

Case Study 6: The WOW factor

The Nature of the Partnership in October, 2008

Who was involved

A K-6 Catholic school, a Year 1 and 2 teacher, and a female scientist.

The partnership was established in July 2008.

The school context

This is a well-established school, over 60 years old with an enrolment of nearly 300. In 2007, a school review suggested a more stimulating environment was required and the school has started regular science lessons in 2008. The teacher was looking for some outside assistance to enhance the science focus. Becoming involved in SiS was agreed to by the Principal because it was something that could be done with no financial cost.

What happened

The teacher and scientist met for coffee beforehand, as both felt the need for a one-on-one contact before a visit to the school. The scientist dissected sheep and beef hearts (the teacher obtained these from butchers' shops) as the final lesson in a topic about the human body in third term. This was the topic for Years 3-7, so the scientist did seven classes (about 200 students) over two days. Although the teacher had Years 1 and 2 students in her own class, she arranged to attend all of the lessons with the scientist, who found her presence helpful.

The scientist's view

The scientist enjoyed her sessions with the students. Having fresh hearts, rather than the preserved hearts she had used previously, was great. Even the initially squeamish students came to touch the hearts. She is happy to extend the science curriculum already in place, and thus value-add to what is already in the class. She believes participation in SiS assists students to see relevance of science to the real world.

The teacher's view

The teacher was delighted with the program, saying "the response from students was amazing". "Just holding a heart was WOW for students, putting their fingers into blood vessels!" At the moment students are "doing magnets" so no outside help is needed and as fourth term is so busy, there will be no visit from the scientist. However, she hopes the students can email questions that the scientist will answer.

The teacher regards their scientist as "part of the staff" and has invited her to a pupil free planning day for 2009. She also gave SiS "a great rap" when other schools came to visit.

What the future holds

The partners plan to meet again in November to plan a program for 2009. They expect to arrange a visit about once a term.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remained active.

The scientist and teacher have been emailing and met twice to plan a school visit in the next two weeks to talk about experiments relating to the CREST awards, and the scientist will return for the presentations later.

The teacher pointed out that they were: “taking small steps - Rome wasn’t built in a day – knowing that the partnership is a long term project.” Finding time to organise is hard work but both are committed to the program. The teacher appreciates knowing the SiS team is there for support if needed, and very grateful for the resources provided.

Assessment

The partnership has been active since early 2008 and is continuing, although perhaps with not as much activity as the teacher would like, but as much as the scientist can give. It is likely to continue. As the scientist wrote, “we get along really well and we are both passionate about science education”.

Data sources

October, 2008: interview with scientist and teacher together during the Melbourne symposium.

November, 2008: email from teacher.

A class of Year 5/6 children’s surveys relating to their activities with the scientist.

April, 2009: separate email exchange with scientist and teacher.

Case Study 7: "It's a human thing"

The Nature of the Partnership in October, 2008

Who was involved

A large co-educational government secondary school, the experienced Head of Science (HOS), and a young, male physical scientist.

The partnership began in mid 2008.

The school context

The school has a generally low SES, and an enrolment of about 1000 students of mixed cultural backgrounds. Few students have formed their career path. The HOS is trying to build up science in the school and has developed a project-based unit for Years 10-11 students based on popular science issues (including TV programs). Science numbers have improved for 2009.

The school had a SiS partnership in 2007 but the teacher had left the school. The HOS "signed up" for SiS at a networking meeting in 2008 and was quickly matched.

What happened

The HOS of science had asked for someone in astronomy (which was a particular interest of the HOS), and the matched scientist also had an interest in astronomy. Although the scientist's work was a bit different, he was happy to adapt. The HOS prefers to talk to people, rather than communicate at a distance, so he found time to visit the scientist to plan a program and see his place of work. The scientist visited the school twice, talking to junior students about science careers, and to a Year 10-11 astronomy class (plus a few interested other students) for which he prepared a power point and had "lots of pictures". He also was able to include information about special effects in movies. A number of students had follow-up questions which the HOS emailed on to the scientist who was able to find and provide the answers.

The scientist's view

The scientist enjoyed his contact with the students, was very happy with the questions they asked and hoped to continue with the school. He had anticipated that he would repeat his astronomy session with other students but due to pressures of time at the school, particularly with exams near the end of term, this had not occurred. He was happy for a partnership to be relatively unstructured and for activity to happen when it was possible.

The scientist had a partnership with a primary school in 2007 which had not got started. He thought that the teacher had become ill, and communication fell away. Consequently he requested reassignment and was very happy with the new partnership.

The teacher's view

The HOS was very enthusiastic about the scientist's contribution, particularly his flexibility and "adaptiveness", even though it was a long drive from his place of work to the school. He described the scientist as "young and hip", so the students were impressed with him and could see that science was "achievable for them". A number of girls, in particular, had followed up with questions. He felt he had been remiss lately in not communicating again with the scientist but pressures of time at school had meant that this had fallen down "the priority list". "After all," he said, "it is a human thing."

What the future holds

Both partners hope the partnership will continue into 2009.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remained active.

The scientist has visited the school and an excursion for students is planned in May. He finds the teacher easy to get on with, keen to expose his students to science and open to having the scientist in his class.

As well as continuing this partnership, the teacher has an additional partnership with another scientist. He believes both are going well.

Assessment

This partnership is intermittent but strong and is likely to continue due to “mutual enthusiasm”, according to the teacher. It seems to be flexible with partners having realistic expectations of each other.

Data sources

October, 2008: visit to school, interview with HOS.

October, 2008: interview with scientist as part of focus group.

April, 2009: email exchange with HOS and scientist.

Case Study 8: The Need to Add Value

The Nature of the Partnership in October, 2008

Who was involved

A K-12 independent school, the experienced Head of Science (HOS), and a female scientist in her first year of employment.

The partnership began in October 2007.

The school context

This school was established well over a century ago. It has keen, enthusiastic students ("they want to be here", as the HOS said) and a strong academic focus. The school is well-resourced with a committed and effective science staff.

What happened

The HOS envisioned a partnership with a scientist who could help students with research projects (currently only 1 or 2 students are involved in the Student Research Scheme) and assist in the primary school which does not have much science. However, she was happy to be matched with a young, female chemist who could be a role model for the students. The scientist spoke to all of the Year 12 students about her career, which was beneficial. However, she was concurrently studying for her DipEd, and arranged to have a teaching practice at the school. As a student teacher, she worked on the usual science courses, rather than contributing something extra or different. By third term, the scientist had too much to do in her own life, especially with study, and was unable to do more at the school so the partnership was not operational.

The scientist's view

Not interviewed at this time.

The teacher's view

Whilst the talk about the scientist's career experiences was a positive contribution, her youth and inexperience meant that, unfortunately, she had nothing else to offer to the school. The HOS believed that she was willing to assist, was enthusiastic and related well to the students, but was unable to "value add" to the curriculum. The HOS of science felt that the SiS program had lots of potential but it was very dependent on what the scientist was able to contribute to the school. More consistent monitoring would be helpful to check whether partnerships were working.

Expectations for the future

The HOS will ask for a new partner for 2009.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership was inactive.

The HOS had not heard from the scientist and believed she should have followed up with the SiS team to get a new scientist but hadn't done so. She apologised and asked the researcher to do this on her behalf. She would like to be paired with a scientist with an idea for an ongoing project at the school.

The scientist said that she had been “hectic with work and not heard from them. I thought I’ll wait until Term 2, when teachers are more settled in”. She would like to continue with the partnership.

Assessment

The partnership has been inactive since early 2008 and is unlikely to continue. The best outcome would be a new partnership for both participants.

Communication had been lost mid 2008 and not pursued by the HOS because she could see limited value from the scientist. The scientist was too busy herself to pursue further activity with the school during 2008 and also in 2009. The situation would benefit from intervention by the SiS team to prevent embarrassment on both sides.

Data sources

October, 2008: visit to school, interview with HOS.

April, 2009: separate email exchange with HOS and scientist.

Interrogation of SIS database.

Case Study 9: “I want to be happy with my career”

The Nature of the Partnership in October, 2008

Who was involved

A Catholic secondary school, the Head of Science (HOS) and a young, male chemical scientist.

The partnership began in semester 1, 2008.

The school context

The school is well-established, over a century old, well-resourced, with a strong academic focus. However, 2008 turned out to be a difficult year for the science department. Very nearly all of the science teachers were new to the school, new to teaching and most did not have a science background. Their content knowledge was generally inadequate, resulting in them “clinging to the textbook” and not able to be flexible or adaptive with regard to the curriculum they offered. The HOS spent a great deal of time helping these new staff and mentoring them.

The senior science classes were focused academically with a content-driven curriculum. The HOS was working hard to promote science in the junior school. She was concerned about the level of teacher expertise and was developing a project-oriented unit in Year 10, integrating science and mathematics that focused on issues of interest to the students. Her aim was to keep students interested in science, and thus keep them in science.

The school had a SiS partnership in 2007 but the only teacher involved in it had left the school.

What happened

The HOS enthusiastically joined SiS because she could see the potential of the program. With a background in industry, she was keen to use the scientist to demonstrate how science related to the everyday world, to promote its relevance and stimulate students’ interest in science. In particular, she was anxious to get more science into the junior school and hoped to involve the scientist at this level. Consequently, she requested to be matched to a scientist who could focus on the middle level and who was engaging.

She and the scientist communicated and discussed what could be achieved. It was clear that his area of expertise fitted best with a small segment of the chemistry syllabus. He was also invited to a science staff meeting to learn more about how the school worked and to allow the other teachers to find out what he could offer and thus how he could be used in their classes. None of the junior school teachers could think of a way to include the scientist.

The scientist attended two, double lessons with a senior chemistry class and conducted an extended laboratory investigation during the first half of the year, however the contact has not been maintained.

The scientist’s view

The scientist enjoyed his experience with the senior class and hoped it could be repeated. He believed that the students enjoyed the activities, but he also stated that it was difficult to fit him into the class because the syllabus was so content-laden.

The teacher’s view

The HOS was very appreciative of the scientist’s time, his cooperation and willingness to be involved and the depth of his knowledge. However, it was very difficult to fit him in anywhere except a small spot in senior chemistry. The teacher felt rather guilty that she had not followed up contact, but the issues in the junior school had kept her very busy, and she could see no additional ways to involve the scientist. Whilst commending his expertise and willingness, she believed that his narrow focus and the general difficulties of teaching in the junior and middle school meant that he could not be fitted in.

The scientist's presentation was "rather dry" and one of the students wrote in a survey response "He seemed so sad when he was doing it and I want to happy with my career."

What the future holds

The HOS is very positive about the potential of the SiS program, but this partnership was not a good match and will not continue. She will request a new partner more suited to the school's needs in 2009.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership was withdrawn.

The HOS was unable to be contacted at this time, but had reported to the researcher by email in November that she had requested a new partner. This occurred early in 2009.

The scientist said that he was now working with a different school, closer to his home and had given a presentation there. He thought that the new partnership would be successful, and although he believed it would progress slowly, he felt that "progressing slowly is better than nothing". This partnership had been made late 2008.

Assessment

The partnership has been inactive since mid 2008 and did not continue. The best outcome has been a new partnership for both participants, and the SiS Project Team was aware that new partnerships were needed by November, 2008, and had acted for that to happen.

Although both the scientist and the HOS had been willing, the rather dry presentation from the scientist, and his very narrow expertise, as perceived by the HOS, precluded further involvement. Communication had lapsed from mid 2008. The HOS had too many commitments within her school to make further attempts to engage with SiS during 2008. Intervention by the SiS team allowed both sides of the partnership to save face.

Data sources

October, 2008: visit to school, interview with HOS.

October, 2008: interview with scientist as part of focus group.

November 2008: email from teacher.

One Class of Year 11 student surveys.

April, 2009: email exchange with scientist, HOS could not be contacted.

Interrogation of SiS database.

Case Study 10: Raising the profile of science

The Nature of the Partnership in December, 2008

Who was involved

A government primary school, a mature female teacher and a young female scientist.

The partnership began in Term 2, 2008.

The school context

The primary school is very small, catering for K-7 students, within the metropolitan area. Because the school is located within a lower socio-economic area they cannot afford excursions. The SiS partnership provided an opportunity to bring the expertise to the school (i.e. a free incursion). The whole school supported the project, from the Principal down, and they all wanted it to be sustainable.

What happened

One teacher collaborated with the scientist for the whole school (because it is a small school), usually through email. The scientist presented sessions relating to Natural and Processed Materials in different classes as required. The scientist worked unusual shifts, so no regular pattern of interaction was possible. However, the scientist was still prepared to visit the school, even after a long shift.

The scientist's view

The scientist joined the program because she had a love of science and wished to pass this on to young students. She was also feeling unmotivated at work, and wanted to be around people who would get enthusiastic about science, such as young students. Further, the scientist was challenged by the idea of communicating to young students.

The scientist found that she was re-motivated in her job as a consequence of being involved in the project. She commented on the students' enthusiasm when she walked into the school – with children rushing up to her and asking if she would be in their class today. I "wanted to be around people who would get enthusiastic about science; so the kids have been good for that", she said.

However, the scientist was disappointed that some teachers left the students in her sole control. She had difficulty trying to control a full class of loud and enthusiastic children on her own. She felt this was very unfair, as classroom management should be the teacher's responsibility.

The teacher's view

The teacher noted that "science has a high profile and that it has been raised" in the school as a consequence of the scientist coming to visit. She also noted that "the children are developing a positive attitude" towards science.

The open lines of communication through email were important in this relationship, especially due to the shift work of the scientist. Along with this was the flexibility in arrangements, and being able to change things quickly if required. The support of the Principal and staff was recognised as pivotal to the success of the relationship.

What the future holds

Both the teacher and the scientist plan to continue their partnership into 2009. There were no definite ideas at the time of interview, reflecting the variable, adaptable and flexible nature of the relationship.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remains active.

The scientist continues to visit the school, fitting in with her work commitments. The school remains extremely positive about and supportive of the SiS program.

Assessment

This partnership is successful due to its adaptable and flexible nature, and the open communication and understanding between the teacher and the scientist.

Data sources

October, 2008: interview with teacher at a net-working meeting.

October, 2008: interview with scientist as part of focus group.

Year 1 and Year 7 children’s work from during the year.

April, 2009: email exchange with teacher.

Case Study 11: Collaboration, communication and enthusiasm

Note: This case study is described in more detail as Appendix 12.

The Nature of the Partnership in December, 2008

Who was involved

A government primary school, the Year 6/7 female science teacher and a male forensic scientist.

The partnership began late in 2007.

The school context

The primary school is small in size, caters for K-7 students, and is located in a metropolitan area. The teachers and the principal recognised a need to be teaching more science to the students, and thus embraced the SiS program. This is the first SiS partnership in the school.

What happened

As a parent in the school and known to be a scientist, the scientist had been "approached" to do something on forensic science. However, he was unsure just what this "something" would look like. In late 2007, the scientist approached the Year 6/7 science teacher to gauge the interest in a forensic science program of work for the class. This was the catalyst for the SiS partnership.

The teacher and the scientist developed and delivered a 7-week forensic science program. The program occupied 90 minutes each week on a Thursday afternoon during Term 2, 2008. The goal of the program was to introduce the students to the basic concepts associated with forensic science, while also providing the students with hands-on activities illustrating various techniques for obtaining evidence at a crime scene.

The scientist brought many specialist pieces of equipment for the students to use, including ten-print cards, magnetic wands, magnetic dusting powder, forensic light sources, rulers, tape, evidence bags, and specialist clothing.

The scientist's view

The scientist identified both professional and personal advantages of being involved in the project. He believed his communication skills with students and the general public had improved as a consequence of his involvement. He also obtained a much greater understanding and appreciation of what happens in the primary school classroom, and therefore a much better understanding of what happens to his children. The scientist was highly motivated working with the students – especially when he could see them having fun and engaged in activities that he had helped to develop and deliver.

At his workplace, the scientist had been actively encouraged to participate in SiS. This was a major impetus for becoming involved in the SiS project. However, as limitations attached to his involvement, he acknowledged the large amount of time required to prepare resources, and he was unsure how his fellow colleagues perceived his involvement in the project.

The teacher's view

The teacher identified the advantages of being involved in the project to be the collaborative approach between herself and the scientist, and the expert knowledge and resources that the scientist provided. She emphasised that the use of authentic resources greatly assisted the students to think and act like scientists. The teacher also noted how the partnership had challenged many students' views of what a scientist is and does, allowing the students to see scientists as real people, and that a career in science was accessible. The teacher also commented on the increased engagement of the students when they were involved in forensic activities.

What the future holds

The high degree of collaboration, ongoing communication, flexibility and enthusiasm were identified as major characteristics of this partnership. Both the teacher and the scientist plan to continue their partnership into 2009.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership remained active.

Both the teacher and the scientist remain enthusiastic about the partnership. They are planning to teach another forensic science program in Term 2 to the Year 6 class, making various changes to the one they had used in 2008. They remain highly focused on a collaborative approach to the partnership.

Assessment

The success of this partnership can be attributed to the collaboration, flexibility and enthusiasm of both partners. Consequently, it is expected to continue.

Data sources

June, 2008: visit to school, observation of students performing forensic activities.

December 2008: interview with teacher at school, interview with scientist at work place.

Children’s work from the forensic science program.

March, 2009: verbal exchange with the scientist and teacher.

Case Study 12: “I saw one swimming! I saw one swimming!”

The Nature of the Partnership in December, 2008

Who was involved

A K-12 independent school, a Year 1 teacher in the school, and a male scientist.

The partnership was established in fourth term, 2007.

The school context

The school is ten years old but has new buildings in a new suburb and is still building. The school is well-resourced and offers a full curriculum. The teacher was new, both to teaching and to the school in 2007, but is keen to promote science.

What happened

After matching, the teacher and scientist met and brainstormed ideas for the Year 1 class. The teacher implemented a topic on soils, and a focus on scientists (for example, students made a poster of a scientist). The scientist visited the school and discussed the children’s experiment with four different soils.

Into 2008, the scientist continued his visits and worked with other classes on issues relating to a sustainable environment. He also continued working with the Year 1 teacher’s class, together with the other Year 1 class. On the day of the researcher’s visit, the classes were looking at microscopes, and took it in turns to visit the senior school biology laboratory where, with some parent and teacher assistance, they made a slide of onion skin and then looked at *Euglenia* in pond water. One little boy was so excited when he saw these single-celled life forms that he ran around shouting “I saw one swimming! I saw one swimming!”

The scientist’s view

The scientist wanted to break down stereotypes of scientists. He likes to visit the school one afternoon a month. He has found his experience very rewarding. Although he started working with the Year 1 teacher he now has met and is working with other teachers throughout the school.

The teacher’s view

The teacher believes it is her (and other teachers’) role to build a framework that the scientist can fit into, and thus make the most of his visits. She is very happy with the progress of the partnership and the spread of the scientist’s skills and resources into other classrooms.

What the future holds

This partnership is very successful, and in December, both the scientist and teacher were planning for 2008. The scientist addressed a staff meeting offering his assistance wherever it can be used.

Follow-up in April, 2009: What happened in 2009?

Outcome: The partnership was dormant.

After some early email communication for planning in 2009, the scientist became seriously ill in March and hopes to return to work late in May. He is keen to continue his partnership at the school.

The teacher reduced her time fraction to care for a family member and has had leave due to bereavement. The teacher now looks after science in some older primary classes. There are plans in place for the scientist to contribute to the school and she intends to resume the partnership as soon as practical. In particular, the scientist is expected to work more with the older students.

Assessment

The partnership was very successful from its inception late in 2007. Once both partners are available, the partnership will resume.

Data sources

May, 2008: interview with scientist and teacher after their showcase presentation at a SiS networking meeting.

November, 2008: email exchange with teacher.

December, 2008: visit to school, observation of classes, interview with both teacher and scientist.

Two classes of children's work done on the day of observation.

April, 2009: separate email exchange with scientist and teacher.

Appendix 13: Detailed Report of Case Study 11

Note: The following report was accepted for publication in Teaching Science and appeared in 2009.

Analysis of an exemplary Scientists in Schools project in forensic science: Collaboration, communication and enthusiasm

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Sara Waugh (Oberthur Primary School)

Abstract
Scientists in Schools (SiS) is an initiative of the Australian Government Department of Education, Employment and Workplace Relations that aims to establish and maintain sustained and ongoing partnerships between scientists and school communities as a means of developing more successfully literate citizens. This paper describes and analyses an exemplar SiS project that was based around a Year 6/7 forensic science program in a small metropolitan school in Perth. Students, the teacher and the scientist were all found to benefit from this partnership. In particular, the students valued the access to specialist equipment and the wealth of knowledge which the scientist brought into the classroom. Many of the students became more interested in becoming a scientist as the science had been made more interesting for them and because they were involved in real experiments. This partnership was found to be successful due to the highly collaborative approach taken by teacher and the scientist. Other characteristics that contributed to their positive partnership included ongoing communication, a shared vision, acknowledgement of each other’s expertise, enthusiasm for delivering engaging science to the students, and a willingness to be flexible. This analysis has shown that a highly collaborative approach between scientist and teacher, along with the use of relevant and engaging student learning experiences, should lead to a successful SiS partnership.

Introduction
Scientists in Schools (SiS) is an initiative of the Australian Government Department of Education, Employment and Workplace Relations that aims to establish and maintain sustained and ongoing partnerships between scientists and school communities as a means of developing more successfully literate citizens. In their evaluation of the 2007 SiS pilot project, Howitt and Rennie (2008) identified many positive outcomes from the project for teachers, scientists and students. Teachers were found to benefit through increased knowledge and understanding of real-world, contemporary science; increased opportunities for professional learning through communication with scientists and other teachers; increased access to resources; increased awareness of the type and variety of careers available in the sciences; and increased motivation. Scientists were found to benefit from involvement in SiS through communication with teachers and other scientists about their work; improved methods of communication with students; increased motivation and enthusiasm in their job; legitimization of the partnership in their

workplace; and better understanding of the community's awareness and perceptions of science, scientists and their work. Students were also found to benefit from their involvement in SiS through increased knowledge and understanding of real-world contemporary science; opportunities to experience real science with real scientists; and increased awareness of the types and variety of careers available in the sciences.

A major strength of the SiS pilot project was found to be the flexible nature of the teacher-scientist partnership and the variation of interaction that it allowed (Howitt & Rennie, 2008). The role of the scientist in the partnership was found to be highly variable, ranging from lectures, question and answer sessions, careers information, implementing experiments in the classroom, assisting students in designing experiments, assisting students and teachers in finding information, curriculum design and development for teachers, planning and implementing excursions, providing a role model for women in science, to providing access to resources. To further illustrate this flexibility, Howitt, Rennie, Heard and Yuncken (2009) described three different partnerships in detail: the established relationship, the new relationship, and the long distance relationship. The nature of the teacher-scientist partnership within each of these three case studies was very different, yet each was successful in achieving their outcomes.

The purpose of this paper was to describe and analyse an exemplar SiS partnership at a metropolitan school in Perth, Western Australia, between Sara Waugh (teacher) and Simon Lewis (scientist) that was based around a Year 6/7 forensic science program. This paper firstly describes the partnership and its outcomes from the perspective of the students, teacher and scientist. It then provides an analysis of the partnership, in an attempt to identify specific characteristics that contributed to its success.

The partners

Sara Waugh is a part-time teacher at Oberthur Primary School: a small-sized school of approximately 310 students from K-7 in south metropolitan Perth. Sara is an experienced primary school teacher, having taught for 15 years. Sara teaches science to a combined Year 6/7 class of 56 students on Thursday afternoon for 1.5 hours. She shares this large class with another teacher who assists with supervision. In her science class, Sara prefers the use of hand-on activities as a mechanism for student involvement and motivation. She regularly uses small group work along with investigations where students have the opportunity to contribute and assist one another. Sara decided to become involved with the SiS program as she saw it as an opportunity for the students to access an area of science that they would not normally have exposure to, along with having access to an 'expert' with associated knowledge, skills and equipment. Sara considers science to be an important aspect of a child's learning, and involvement in the SiS project became another avenue to integrate science into the school.

Simon Lewis is an Associate Professor in Forensic Science at Curtin University of Technology who has a passion for outreach to schools and the general public. He has presented many forensic science lessons to secondary school, but this was his first journey into primary school. As a parent in the school and known to be a scientist, Simon had already been 'approached' to do something on forensic science. However, he was unsure just what this 'something' would look like. In late 2007 Simon subsequently approached Sara to see if she would be interested in a forensic science program for the Year 6/7 science class. This became the catalyst for the SiS partnership. Simon fully supported SiS, and saw the project as an ideal opportunity to be involved with young people and show them real science. He also considered it a personal challenge to teach forensic science at the primary level where, in a similar fashion to secondary school, there is great interest in the subject. Simon considered the primary school setting an ideal one to explore the use of forensic science through an integrated approach to science, numeracy and literacy. In addition, Simon had not been involved with a systematic longer term incursion type activity previously and was interested to see how this would impact on the science class and himself. Sara was the science teacher of his eldest child.

Data collection

Data was collected from a variety of sources including teacher and scientist interviews, student questionnaires, and observation. Both Sara and Simon were interviewed separately (during Term 4, 2008) where they were asked why they wanted to be involved in SiS, how they went about developing their program, how they described their relationship with the other, what they recognized as the advantages and limitations of being involved in the project, why they thought their partnership had been so successful, and their plans for the future. These interviews were audio taped and transcribed at a later date. Common themes in responses were identified, with quotes being used to support these themes.

The students were given a questionnaire (during Term 4) which asked the following four questions:

i) What did you learn from the scientist?
ii) What was it like working with a real scientist?
iii) What different science careers did you learn about?
iv) Did the scientist make you more interested in becoming a scientist? Why or why not?

The questionnaire was completed by 22 students (with a 50:50 girl:boy response), representing a 40% response rate in the class. Answers to questions were read, common themes identified, and these were then summarized into a table with percentages. Responses to individual questions could include more than one theme. Examples of positive and negative responses were provided to highlight the identified themes.

In Week 7 of the program the first author became a participant-observer. She was asked to assist with the implementation of one of the activities within the lesson, after being provided with a short overview. Observations during this time included the student's enthusiasm to the tasks, ability to carry out the tasks, and their language and understanding of the tasks presented.

The forensic science program

Sara and Simon developed and delivered a 7-week forensic science program during Term 2, 2008. The goal of the program was to introduce the students to the basic concepts associated with forensic science (every contact leaves a trace and we are all unique), while also providing the students with hands-on activities illustrating various techniques for obtaining evidence at a crime scene. A summary of the 7-week program can be found in Table 1.

The lessons during Simon's visits to the class took the following format.

(1) A short powerpoint presentation on the background to the lesson discussing the science and the forensic significance of the activities to be carried out in class.
(2) An activity relating to forensic science (see Table 1).
(3) Classroom discussion of the results and significance of the results.

To cater for the large class size, three groups were run most weeks and rotated over the length of the period. One group would be inside working with Sara and her weekly forensic topic. A second group would be outside doing physical education with another teacher. Simon would take the third group with his forensic topic. Where groups were required to spend extended time on a weekly topic, the lesson would carry over to the following week. On a few occasions Sara and

Simon worked closely together with one large group, while Neale had the remainder of the students outside.

Table 1. Summary of the 7-week forensic science program for Year 6/7 students

Week	Description	Summary and resources
1	Obtaining children's prior knowledge	Classroom discussion with Sara, brainstorming students' ideas of forensics.
2	Individual fingermarks	Powerpoint presentation on ridge skin patterns on skin, fingermarks and their use to identify and how to make inked fingerprints. Mock ten-print cards used in conjunction with normal ink-pads allowing each student to produce a set of prints. Fingermarks examined to identify and classify them based upon a simplified scheme (loop, whorl and arch). Results were then plotted as a graph and compared with population frequencies of occurrence.
3	Dusting for latent fingermarks	Powerpoint presentation on the exchange principle in forensic science and the detection of latent fingermarks on non-porous surfaces. Latent fingerprints deposited on a range of non-porous surfaces (glass, laminate table tops, tiles) by students. Dusted for prints using magnetic wands and magnetic dusting powder provided by Simon. Developed prints lifted using transparent sticky tape and stuck into students' workbooks. Students examined prints and tried to identify the patterns they had discovered in the previous class.
4	Development of latent fingermarks on paper	Powerpoint presentation on basic chemistry of latent fingermarks, interaction with paper and the phenonmenon of luminescence. Demonstration of the use of a forensic light source to reveal luminescence from chemically developed latent fingermarks on paper surfaces. Student's informed that this is a relatively new technique that is used by Western Australia Police, and is currently the subject of studies within Simon's research group at Curtin. Demonstrated and discussed the use of forensic light sources to detect trace evidence such as fibres.
5/6	Lip prints. Analysis of inks by paper chromatography	Powerpoint presentation on other forms of possible impression evidence including lip prints, importance of colour analysis to forensic science, and an introduction to chromatography. These activities were carried out over two weeks with Simon supervising the chromatography and Sara supervising the lip prints
7	The Great Oberthur Crime Scene	The final session involved a powerpoint presentation on Crime Scenes, including a discussion on safety, contamination and documentation. Demonstration of crime scene equipment including clothing. Students provided with background information to a crime scene scenario, then proceeded to search two linked scenes – one inside a room and the other outside, which had been carefully 'seeded' with appropriate evidence. Students used specialized crime scene equipment (forensic light sources, rulers, evidence bags) to enable them to find the evidence, record its details in situ before removing and placing in evidence bags and labeling appropriately. Students organized into teams including someone to look after recording, and others to search, collect and package. Final discussion on significance of evidence and whether evidence 'proved guilt' or not.

Success of the partnership

The success of the partnership was measured through the students, Sara and Simon. As the SiS project has been developed to benefit all those involved, all three of these participant groups should experience positive outcomes.

Student outcomes

The outcomes for the students were identified through the questionnaire. Each of these four questions is addressed in turn. In response to the first question, "What did you learn from the scientist?", six main themes were identified: fingerprints, lip prints, crime scene investigation, chromatography, the role of evidence, and forensics in general. A summary of the percentage responses to this question can be found in Table 2. Fifty-two responses were obtained from 22 students.

Table 2. Major themes identified from student responses to the four questions on the questionnaire

Question	Theme	% response
1. What did you learn from the scientist? (52 responses)	Fingerprints	29
	Lip prints	23
	Crime scene investigation	15
	Chromatography	15
	The role of evidence	10
	Forensics (general)	8
2. What was it like working with a real scientist? (34 responses)	Access to excellent equipment	32
	Scientist's extensive knowledge	29
	Fun	21
	Exciting	18
3. What different science careers did you learn about? (26 responses)	Forensic science	76
	Police	12
	Scientists	8
	Science lecturer	4
4a. Why the scientist made you more interested in becoming a scientist? (16 responses)	He made science interesting	44
	We did real experiments	25
	His extensive knowledge	25
	Better understanding of the role of science	6
4b. Why the scientist did not make you more interested in becoming a scientist? (9 responses)	Science doesn't interest me	33
	Already have a chosen career	33
	Need specialist skills that look difficult	33

The responses the students provided tended to reflect the main concepts that were taught during each week of the forensic science program. Many students answered this question listing a wide range of responses, as illustrated with the below quotes. Given the gap of two terms between when the students completed the activities and when they performed the evaluation, the wide range of detailed responses reflects the student understanding and engagement with the subject matter.

> I learnt a lot about forensics, especially about finger prints, and crime scene investigations. I learnt about different types of fingerprints, and how to classify them (loop, arch and whorl). I also learnt about lip prints, and leaving prints on a crime scene. (Student 1, Girl)

> Working with a real scientist was very interesting because we actually got to use equipment. The most important thing was that the knowledge we gained was from fun realistic activities. (Student 9, Girl)

A variety of techniques used by a forensic scientist such as: finger printing, lip printing, packaging evidence, chromatography, UV light and its advantages, how to connect evidence to find a subject. (Student 18, Girl)In response to the second question, “What was it like working with a real scientist?”, four main themes were identified: access to excellent resources, the extensive knowledge of the scientist, fun, and exciting. A summary of the percentage responses to this question can be found in Table 2. Thirty-four responses were obtained from 22 students. The students greatly appreciated both the equipment and the expertise which Simon brought into the classroom, commenting that both of these allowed them to experience what is was like to be a real scientist. The students also acknowledged that the forensic science program had been both fun and exciting with the use of engaging and relevant activities.

> It was interesting working with a real scientist because he [k]new a lot more than a primary school science teacher. Also he had all of the equipment needed. (Student 7, Girl)

> It was heaps more exciting [than normal school], with all of the proper equipment, which enabled us to do many more activities. We learnt a lot of proper words, like what real scientists use. (Student 11, Girl)

> It gave us a large advantage for he knew exactly what he was talking about, had all the equipment and made it easier to understand science. (Student 18, Girl)

The third question asked the students to identify the different science careers that they learnt about. As shown in Table 2, four major themes were identified: forensic science, police, scientists, and science lecturers. Twenty-six responses were obtained from 22 students. Not surprisingly, the majority of students simply listed forensic science as a career. However, a small group of students also mentioned other careers that had been discussed in class.

> I learnt what forensic scientists do and that they are nothing like the people on NCIS. (Student 10, Girl)

> I got really interested in heaps of cool career choices there are in science like scientists, science lecturer and forensic scientists. (Student 12, Boy)

> We learnt about forensics and the police at a crime scene. (Student 17, Boy)

The final question asked if the scientist had made the students more interested in becoming a scientist. Fifty-nine percent of the students agreed, while the remainder disagreed. Of those students who had become more interested in becoming a scientist, four major reasons were identified: science became interesting, the provision of real experiments, the extensive knowledge that scientists possess, and the role of science. The real experiences provided within the forensic science program assisted the students to perceive science as interesting, and they obtained a new appreciation of the expertise that scientists possess.

> He made science really interesting and he was very enthusiastic. We were doing real experiments which made science much more interesting. (Student 1, Girl)

> I found the topics really interesting and it really was fun to take part in the activities we did. (Student 17, Boy)

> Because it showed that science possesses such a variety of roles and how much it affects society. Without science we have so many more questions about earth and why we are here. So many questions that couldn't be answered. (Student 18, Girl)

The main reasons for students stating the scientist had not made them more interested in science were that science did not interest them, they had already chosen their career, or they recognized that scientists required specialist skills which they believed they could not possess.

> I think being a scientist will be difficult because you will have to have good math skills and puzzle skills. (Student 3, Boy)

> It didn't really make me more interested because science doesn't interest me. (Student 11, Girl)

> Because I already have dreams and goals to follow in other areas. (Student12, Boy)

Through the forensic science program the students generally became more interested in science and becoming a scientist. This was mainly attributable to the authentic and engaging experiences that were provided in the classroom, which was supported by access to excellent resources and the in-depth knowledge of the scientist.

Teacher outcomes

Sara identified the advantages of being involved in the project to be the collaborative approach between herself and Simon, and the expert knowledge and resources that Simon brought to the classroom. She emphasized this latter point, and how the use of authentic resources assisted greatly in helping the students to think and act like scientists.

> The information that Simon came with and the equipment. The equipment was a big plus. The kids tried all the equipment on – they dressed up in the suits and the gloves when we did the crime scene. They felt like they were real crime investigators. It was great! (Sara, lines 121-124)

Sara also noted how the partnership had challenged the student's views of what a scientist is and does, assisted them to see scientists as real people, and that a career as a scientist was accessible.

> But Simon was great with the scientific information and we did a lot of presentations with the interactive whiteboards. You know it sort of gave the kids an indication of what it would be like to become a scientist and it did change the kid's opinions about this, maybe this might be a good subject to get into when they are older. (Sara, lines 102-105)

Finally, Sara commented on the increased engagement of the students when they were involved in the forensic science program. Sara also noted that some students who were infrequently engaged in classes were eager and enthusiastic in the forensic science lessons, and that this enthusiasm for science had continued into Terms 3 and 4.

> And the children - as with all schools we have odd times where some students find it hard to stay on task all the time. You know when presenting this topic I found that they were all really involved and they wanted to be here. It really had all of the students motivated. (Sara, lines 167-169)

Scientist outcomes
Simon identified both professional and personal advantages of being involved in the project. He believed that his communication skills with children and the general public had improved as a consequence of his involvement. He had also obtained a much greater understanding and appreciation of what happens in the primary school classroom, and therefore a much better understanding of what happens to his children. Simon found that he was highly motivated working with primary school children – especially when he could see the students having fun and being engaged in activities that he had helped develop and deliver.

> The advantages are just seeing children have fun with science. It's moral boosting. It really is. It's like a tonic to go out and see them do that. It was also fun being involved with my child's class as well. (Simon, quote 5)

At his workplace, Simon was actively encouraged to participate in outreach. This was recognized as a major impetus for becoming involved in the SiS project. However, as limitations attached to his involvement in the project, Simon acknowledged the large amount of time required to prepare resources, and he was unsure how his fellow colleagues perceived his involvement in the project.

How the partnership worked
Sara and Simon developed and delivered their program of work through what they described as a highly collaborative effort, which included ongoing communication, a shared vision, acknowledging each other's expertise, their combined enthusiasm for delivering engaging science to the students, and a willingness to be flexible. Each of these points will be discussed in turn, and how they influenced the partnership.

Ongoing communication
Sara and Simon started their initial discussions at the end of 2007. They planned to teach the program in Term 2, 2008. They had deliberately chosen Term 2 as it was a quieter term compared to the other terms, while also allowing time to develop their ideas. Neither Sara nor Simon saw any reason to rush into a forensic science program and believed it better to be prepared, while at the same time allowing time to think. They had one brainstorming session at the beginning of 2008 where they discussed possible forensic activities, and how the program would work. When it came to teaching the program they planned one week in advance. On the afternoon of delivery Simon would come into school early and discuss with Sara what the following week's lesson would entail and what equipment was required. They used various forms of communication including face-to-face (when Simon picked up his children from school), email and telephone.

Shared vision
From the start of the partnership, Sara and Simon found it important to establish with each other how they would work together. Both agreed that they wanted a series of successive learning experiences, where each week built upon the previous week, and where both the teacher and scientist were involved in delivery.

> Simon came up with some ideas for the unit of work and I had researched some ideas on the internet. We put our thoughts on paper and discussed possible activities for the weekly lessons and went from there. It worked perfectly as we were both in sync with what the other one was up to. (Sara, lines 57-60)

> I'd had an idea of a series of linked activities based around a forensic science theme and that's what I took to Sara and Sara was obviously looking towards the idea of having a linked

> series of activities from forensic science. But she didn't necessarily know what the forensic science activities would be but she knew she wanted to link them. (Simon, lines 59-63)

Acknowledgement of each other's expertise

The success between Sara and Simon was based upon an acknowledgement of the skills and expertise that each of them brought to the partnership. Sara was well aware of the expert knowledge and resources that Simon has access to. Sara also made it clear that classroom management was her responsibility. While Simon was aware of the knowledge he possessed, he relied on Sara to advice him on how to make it appropriate for primary school and to fit into the specified time period. This ability to 'give and take' between the two partners resulted in an appropriate, engaging and relevant program of work.

> I basically had ideas about how we wanted to do it. Simon obviously hasn't taught this year level so for him the material of it was fine but he wasn't sure whether it would be too advanced or too below. (Sara, lines 50-52)

> Because they had been used before as demonstrations for the general public and secondary school students I knew the activities would work. I took her advice to make it simple as possible in that it would fit the class at the time. (Simon, lines 74-76)

Combined enthusiasm for delivering engaging science to students

Both Sara and Simon believed in what they were doing, and shared a common enthusiasm for the project and its potential outcomes. This enthusiasm was then shared by the students.

> And I think Simon is quite enthusiastic as well. He is good at what he does. When he'd come in [to class] he'd say, this is what we are going to do today, and I've got this [equipment], …and we're going to wander around, and we are going to be doing this, and the kids are like, great, yeah, let's do it. (Sara, lines 214-218)

> [Our relationship was successful because] we shared an enthusiasm about it.

> (Simon, lines 208-209)

Being flexible

Flexibility became an important component to the partnership. This flexibility was reflected in willingness to change ideas, willingness to take constructive criticism, and willingness to reflect on what did and didn't work. They also required flexibility in working out the best way to teach to such a large group of students.

> I don't mind taking criticism, Simon doesn't mind taking criticism. We're both pretty laid back and easy going. (Sara, lines 165-166)

> We actually tweaked [the lessons] as we went and when I did the first presentation I asked Sara "Is this what you want? What shall we do?" And so on. (Simon, lines 86-88)

The highly collaborative nature of this partnership has clearly assisted in it being so successful. This collaborative nature included characteristics such as ongoing communication, a shared vision, acknowledgement of each other's expertise, enthusiasm for delivering engaging science to the students, and a willingness to be flexible.

Future plans for the partnership

Both Sara and Simon plan to continue their partnership into 2009. They plan to teach another forensic science program in Term 2, making various changes to the program they used in 2008.

Simon plans to present a general talk to the public on forensic science, as a means of raising money for the school's science budget. He considers this to be outreach from the school, and to reinforce the school as a place of education.

Conclusion

The purpose of this paper was to describe and analyse an exemplar SiS project that was based around a Year 6/7 forensic science program. Sara and Simon developed and delivered a 7-week forensic program that was found to be highly educational and engaging. Students, the teacher and the scientist were all found to benefit from this partnership. In particular, the students valued the access to specialist equipment and the wealth of knowledge which Simon brought into the classroom. Many of the students became more interested in becoming a scientist as the science had been made more interesting for them and because they were involved in real experiments.

This partnership was found to be successful due to the highly collaborative approach taken by Sara and Simon. Other characteristics that contributed to their positive partnership included ongoing communication, a shared vision, acknowledgement of each other's expertise, enthusiasm for delivering engaging science to the students, and a willingness to be flexible. This analysis has shown that a highly collaborative approach between scientist and teacher, along with the use of relevant and engaging student learning experiences, should lead to a successful SiS partnership.

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Figure 1. A student tries on the specialized clothing of the forensic scientist.

Figure 2. Students recording evidence with a digital camera and ruler at the scene of The Great Oberthur Crime Scene.

Figure 3. Students collecting and recording evidence at the scene of The Great Oberthur Crime Scene.