Science-for-Life
Programme Description Document:
CRI-School Partnership Programme
Guide

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1. **Background to Science - School Partnerships**

![Image](image.jpg)

**Introduction**

This guide provides assistance to CRIs and other science organisations in developing mutually satisfying interactions and relationships with the compulsory (Years 1 to 13) education sector. It defines the basis for interactions with schools as partnerships, some reasons for science organisations to partner with schools, how CRIs can establish partnership relationships and what form these associations might take, what level of commitment is required, and the partnership costs and benefits. It accompanies the Programme Description Guide\(^\text{14}\) that provides more detail about the Science-for-Life research and its educational context.

Sample case summaries are presented illustrating some of the activities undertaken during the Scion partnership trials with schools over the past two years.
This guide provides advice to science organisations who are considering contributing in this area, and thereby improving science learning and supporting the development of a broader understanding of science and its importance to society.

For further information regarding the development of CRI/science organisation – education relationships, please contact Andrew Dunningham of Scion at: Andrew.Dunningham@scionresearch.com or (07) 343 5899.

This document is one of several that reports from the Science-for-Life project. They are at www.forestsoflife.org. An HTML version of this guide will be on the website from March 2011.

**What is a school-scientist partnership?**

A school - scientist partnership is defined as a relationship that is formed “between science and education, based on the capacity of young learners to undertake studies, observations and analyses of real value to science”\(^1\). Partnerships originally commenced as a result of the 1983 *A Nation at Risk: The Imperative for Educational Reform* report\(^2\) commissioned by the American government, where a number of initiatives developed which mobilised the resources of public and private sector companies and organisations to support science teaching and student learning in schools.

The initiatives ranged from one-off grant programmes through to long terms relationships between scientists and schools. These partnerships demonstrated significant benefits for both the schools and the supporting organisations, by linking students and scientists together in relevant and authentic inquiries\(^3\).

Science-for-Life research focused on what interactions with schools were effective in improving science literacy, and found that personalised or targeted partnerships using Inquiry-teaching methods were very effective for improving science literacy across all ages. Increased use of communication technology can be used in interactions with older students and as student learning requirements become more specific.

Forests-of-Life (an earlier Scion science partnership programme) found that providing printed resources was a good starting point for teachers, but Science-for-Life found that schools who used resources such as the SKM sustainability unit\(^4\), or Science Learning Hub\(^5\) still wanted input and advice from scientists.

One of the long-term aims of partnerships is to improve science literacy\(^6\) in the general population. This requires starting with schools and students to enhance the quality of science teaching, and to promote the perception of science as an important and worthwhile field of human endeavour of relevance to all.

Research indicates that people in societies with higher levels of science literacy are in a better position to make informed decisions relating to the application and impact of science in their lives, the role science has in solving problems, creating wealth, and in improving world-wide quality of life - rather than basing such judgments on emotive and often inaccurate interpretations.

There is also significant research which shows increased levels of science literacy provides corresponding increases in economic performance\(^7\), demonstrating that a scientifically-literate population improves overall living standards and decreases socio-economic disparities.
Fundamentals of Science-for-Life partnerships

Science-for-Life partnerships provide interactions between schools, students and teachers to support student science achievement and to develop and enhance student engagement in science\(^1\). The core elements of Science-for-Life are:

- It engages with all students. It isn’t specific to gifted and talented students or those who are already engaged in science;
- It is embedded in the curriculum\(^8\). Partnerships are integrated with school’s implementation of the curriculum and are not an add-on to the school timetable, nor are they an interpretation of what scientists think students need to know - it isn’t ‘re-writing’ the curriculum;
- It occurs during the school day – it isn’t an ‘after school’ programme;
- It uses an inquiry\(^9\) approach, which makes it engaging and interesting for students. Inquiry is a specific method of teaching that emphasises students questioning, research and higher order thinking;
- It is focused on developing student engagement and achievement in science, with students being active participants in the learning. Science-for-Life is not a programme presented to students, but is a partnership between scientists, the teacher, and the students.

The current science education environment in schools - Why do we need partnerships?

Historically, the teaching of science in our schools – particularly our primary schools - has suffered from low prioritisation. There are many reasons for this, but principally this situation relates to:

- the ‘generalist’ nature of primary teaching, where one teacher is expected to cover all eight essential learning areas (‘subjects’);
- the perception of science as being specialised in nature, requiring high levels of specific knowledge, and equipment that teachers and schools do not have;
- the current heavy emphasis on numeracy and literacy which is ‘squeezing out’ time for other subjects;
- the poor experiences teachers have been exposed to in their own contacts with science in their school education;
- teachers lack the confidence to be able to teach science with accuracy and interest;
- science is perceived as one of the more difficult subjects to teach as it requires considerable personal research in an environment where time is limited.

School organisation and assessment constraints in senior levels of secondary schools often mean that authenticity and relevance of science to students is sacrificed to focus on achieving NCEA Achievement Standards\(^10\) assessment credits. Typically, the teacher ‘transmits’ content to meet these requirements.

Partnerships have been shown to add value to secondary science teaching through:

\(^1\) Includes subjects such as Biology, Physics, Chemistry, Geography and Technology.
• helping to improve and update teachers’ skills and knowledge in ‘current’ science;
• providing teachers with New Zealand examples of contemporary and authentic science research and inquiry;
• supporting students to learn alongside practicing scientists and to develop enhanced understanding of the nature of science;
• demystifying and enhancing student perception of science and thereby encouraging students to pursue advanced science studies or career options;
• introducing secondary teachers to new methods of teaching science that utilise more student-centred and project-based approaches.

Data from international studies on science achievement in New Zealand indicate that while our very best and brightest students are on a par with the best internationally, the range of achievement (or lack of) in science is considerable, with a significant ‘tail’ of science underachievement being of major concern. Data from two international achievement studies\(^1\) relating to New Zealand’s science education achievement can be summarised as follows:

• New Zealand students generally have a low interest in science careers or advanced science study, and perceive learning science as a means to achieving non or only peripherally-related future goals;
• Students have a below average\(^2\) perception of self-efficacy in science i.e. personal belief in their ability to ‘do’ science;
• A significantly lower than average number of students have an interest in learning science;
• Trends indicate at best a stable position in science achievement in relative terms;
• Data indicates a significant issue facing science learning is the long ‘tail’ of underachievement;
• Underachievement in science may be linked with socio-economic inequities.

**Why not just partner at senior high school level?**

Research has shown that students who are not engaged in science by age 14 will probably never engage in science. It is critical that engaging students in science commence as early as possible and occurs frequently.

**What are the benefits?**

International literature indicates that science organisations have identified significant benefits for their staff, their organisations, and in supporting their triple bottom-line (economic, social and environmental) philosophy, from partnering with schools.

The reported benefits include:

• the underpinning of economic growth, innovation and enterprise within a country through having scientists and science organisations involved in developing science literacy in students;
• preparing students to succeed in an increasingly competitive and technologically advanced workplace,

\(^2\) Comparisons are with OECD-wide statistics
• assisting teachers in aspects of teaching science that they cannot do. For example, introducing new science, applying current real-world and authentic contexts, and providing insight into the nature of science;
• assisting teachers by improving their confidence and competence in science;
• inspiring and engaging students in science based on their strengths and resources;
• providing high levels of staff satisfaction in being able to ‘give back’ to the education system they consider themselves to be the beneficiaries of, and at the same time encourage young people to engage with science;
• enhancing staff perception of the value of their work through feedback from students and teachers about the importance of their input and the benefits of this for the learning of young people;
• having direct student involvement in the research work of science organisations through supporting activities such as data collection, analysis and reporting;
• raising the profile and improving the perception and general level of understanding of the work of the partnering organisation in the community;
• meaningful fulfilment of ‘societal’ component of work programme and corporate statement of intent/core purpose.

Studies from overseas\textsuperscript{12} and within New Zealand\textsuperscript{13} indicate that collaborative partnerships can be highly successful endeavours for all participants with demonstrable outcomes for students and teachers.

Participation in partnerships by organisations such as CRIs is generally not motivated by the expectation of financial returns, but rather by a philosophical stance related to the importance of improving general science literacy, and furthering understanding of science in the community.

What forms can partnerships take?

The form a partnership takes is the result of a process of negotiation between the teacher and school and the partnering science organisation. It takes into account factors such as the goals of the teacher, the priorities of the school, the number and age of the students involved, the topic, partnership theme or content, the availability of resources, and the probable time commitment required.
Successful overseas examples and partnerships formed during the Science-for-Life programme indicate the critical success factor in partnerships is meeting the goals and needs of the school.

Some large overseas partnerships with major companies such as Merck (Institute for Science Education) and Universities (e.g., Cornell, Stanford and Purdue) are continuous; however, smaller-scale, limited duration partnerships have also proven to be highly effective. Some examples of successful local partnerships and interactions established during Science-for-Life include:

- A ‘hands on’ inquiry involving scientists working with 9 and 10 year old students on understanding the threats to, and caring for, a gully reserve adjacent to the school (topic duration 10 weeks);
- Scientists helping three classes of 8-11 year old students to better understand stream life and threats to the stream ecosystem for a waterway running past the school;
- Scientists helping 10 and 11 year old students study and develop a care plan for a neglected bush reserve owned by the school;
- Scientists assisting senior secondary students with predator tracking and monitoring to assess the threat to rare native snail and lizard populations in a controlled reserve environment adjacent to the school;
- Using videoconferencing to link scientists remotely with senior NCEA scholarship students to support study for their Achievement Standard by providing knowledge and examples of up-to-date biotechnology techniques and their application;
- Scientists working with year 9 students using tracking tunnels to survey predator populations at a Maori Trust reserve;
- Scientists holding a range of teacher workshops and professional development days in schools and at the CRI, targeted at specific areas of teacher need (e.g. GIS science);
- Technology-facilitated interactions with a range of teachers and students in schools using audioconferencing, Skype, email, wikis and blogs;
- Providing equipment on loan to schools to support science inquiries (e.g: night vision camera, tracking equipment, digital microscopes etc).

The above examples ranged in duration from interactions of only a few hours, to those involving a limited number of visits, workshops, or virtual interactions, through to more substantial and sustained relationships comprising several months of activities distributed manageably during the partnership period. (An expanded list of all interactions with schools is provided in the Programme Description Document on the website)

What are the costs of a partnership?

The costs of a partnership vary according to the nature of the interaction and its duration. Typically, partnership commitments can range from single ‘one off’ sessions of an hour through to multiple sessions supporting a unit of learning, or ongoing relationships focused on major projects.

The important consideration is to ensure that expectations and goals are made clear from the outset and during the partnership, and any limitations are made explicit.

While for primary schools ‘face-to-face’ support has proven to be highly effective, it can be relatively expensive to provide. Technology-based interactions such as audio or videoconferencing, email communications, or contributing to student wiki’s or blogs can be more cost effective and useful for some purposes, but have much less educational impact than face-to-face contact.
In Science-for-Life where formal partnerships of significant duration were negotiated, typical costs comprised of:

- Staff time for partnership activities;
- Travel costs if staff need to interact ‘face-to-face’ with students or teachers;
- Resource and technology costs (e.g. some basic equipment, photocopying etc);
- Any overhead charges;
- Any purchase of resources that are capital;
- External providers;
- Any costs associated with independent programme monitoring and evaluation.
2. Establishing partnerships

Having a person in your organisation is who is responsible for managing school partnerships, for promoting opportunities to schools and engaging with schools and teachers is essential to initiating and maintaining partnerships. Science-for-Life found that schools rarely initiated any contact beyond an initial email or phone call.

Methods to promote partnerships:

- encourage staff to raise the possibility of interactions at meetings and events run by their local schools and (e.g. parent/teacher interviews, BOT meetings);
- proactively notify schools of the programme;
- promote examples of successful interactions through local media (e.g: community newspapers); the New Zealand Education Gazette; and through many of the magazines that go to schools;
- have an education presence at wider company promotional events;
- attend and run workshops at conferences. e.g., Learning at Schools, ULearn, and SciCon.

Partnership establishment typically follows the sequence below, and these steps are elaborated on in the remainder of this section.

1. ask teachers what topics or themes they are teaching over the next term(s);
2. identify topics that the CRI could assist in that relate to either the CRI’s current research or staff capabilities;
3. meet with teachers to review teaching programme, plan potential interaction types and duration;
4. review the commitment in terms of costs, staff availability and resource requirements;
5. confirm the programme and the dates of further meetings.

For longer engagements, the steps may include multiple meetings during the term to plan and confirm interactions.

Promotion of specific learning topics by the CRI to schools is difficult, although not impossible. If the school is not teaching in that learning area then there is less chance of a partnership developing.
What needs to be kept in mind for negotiating successful partnerships?

Once initial contact has been made, typically a meeting is scheduled between the teacher/s involved and suitable personnel from within the CRI. For short-term interactions, a phone conversation may be all that is required initially, but for longer term or more substantial partnerships, face-to-face meetings are recommended.

These meetings cover:

- the requirements of the teacher (expectations and goals);
- the goals, expectations and limitations of the CRI;
- a discussion of aims and objectives;
- a discussion on how the partnership is going to help improve science learning, including the following possible enhancements to teachers programmes:
  - by deepen the level of science being undertaken - most students are capable of understanding key aspects of science;
  - by developing experiments or add variety and depth to current planned experiments;
  - by using experiments as a basis for either discovering a concept or confirming a concept, rather than an ‘experiment for experiment’s sake’;
  - By suggesting reputable websites for information.
- who is to be involved in the partnership (class levels, number of teachers and students etc);
- clarification of roles and responsibilities (eg: teachers to manage and organise students, organise logistics and paperwork, secure support from school administration, be in attendance at all times etc);
- the actual activities of the partnership (as concrete as possible);
- the timeframe against which the partnership is to be implemented (a negotiated and manageable timetable is developed);
- sharing how the partnership fits in with the curriculum and teacher planning;
- the means through which the partnership is to be implemented (eg: workshops, visits, using technology etc);
- coordinating resources needed to facilitate the partnership;
- how the effectiveness of the partnership is to be evaluated;
- appropriate communication channels and systems (sharing landline and mobile numbers, email addresses etc);
- how outcomes from the partnership are to be recorded and communicated (if relevant).

The most important outcome from the initial meeting/s or interactions is the establishment of a positive working relationship. It is vital for a successful partnership that each party has clarity of expected actions, defined roles in delivering expectations and the anticipated timeframes and resources involved.

It is recommended for on-going partnerships that a scientist attends teacher meetings if required to confirm ‘next steps’.
How can scientists help?

Research and outcomes from Science-for-Life identify a range of opportunities for scientists’ engagement with schools. Some examples include:

- Field work with teachers and students to assist with learning or using specific techniques or knowledge based on scientists’ capabilities;
- Working directly with teachers and/or students to assist with upskilling on contemporary scientific techniques and processes;
- Helping teachers understand the science behind basic phenomenon so they are able to accurately teach their students. This can be either on an ‘as needed’ basis or planned as advertised professional development;
- Assisting teachers by providing ‘real world’ examples and contexts of ‘science in action’, and how they relate to economic and social goals;
- Introducing and promoting the nature of science to teachers for inclusion in lesson and unit plans;
- Visiting schools and assisting senior students with labs and other practical activities;
- Hosting teachers and/or students at the CRI as part of a teacher scholarship or fellowship programme (e.g., The Royal Society Teacher Fellowships) and involving them in applied research work;
- Partnering with teachers and students on significant CRI studies/research. Students can often support data collection, reporting and communicating outcomes etc;
- Holding workshops for teachers on using new technologies in science (e.g: GIS, datalogging equipment etc);
- Holding specialist seminars, workshops or ‘clubs’ with students interested in science;
- Providing loan equipment and resources. Scion loaned equipment for a period (e.g., a set of laptops or other equipment) and provided equipment and consumables for undertaking experiments in classes (e.g. thermometers, stands, planting mix, lettuce plants, fertiliser, hydroponics feed etc). Schools have a very limited or no budget for equipment or consumables.
Operational considerations – working with schools and students

It is recommended that partnerships keep a record of what was agreed to, noting in particular responsibilities, resources requirements and action items.

It is important that teacher planning is shared and discussed, any resources or materials prepared by the CRI are shown to the teacher/s in advance of their use with students to ascertain level and content ‘appropriateness’, and that the content and format of each session with students – and any follow up - is well-planned and organised.

While it is important that material and activities covered with students is scientifically accurate, of even greater importance is that these ideas are communicated to the students in a way which is engaging, and that they are able to understand. It is of little value to either party to have an ‘expert’ in a field who cannot communicate ideas in a way that is accessible to teachers and students. As a broad rule of thumb, the following are guidelines for working with students:

• keep the language used simple without dumbing it down unduly. Avoid the use of unexplained technical jargon, but where specific names and labels are used, explain these to the students in understandable terms. Definitions and technical words should be included in a glossary in any handouts and in information to teachers, if required;
• link science ideas with practical examples the students may know of and that affect their lives;
• use equipment and involve the students as much as possible in ‘hands on’ explorations. Remember that we learn more from ‘doing’ compared to listening, so allowing students to explore and discover science ideas for themselves is extremely valuable;
• use lots of open questions. If you think the students could work out an answer for themselves, do not tell them! Try to use multiple questions to guide student thinking towards the scientifically-accepted view;
• don’t become a ‘talking head’! Remember that it is important to help dispel popular myths and misconceptions about science and scientists, and being seen as a ‘real person’ in the eyes of young people is an important message;
• your enthusiasm and interest for your science is communicated to students through voice, body language, disposition, attitude etc. The influence of these on students cannot be underestimated in conveying a positive perception of science;
• encourage students to develop science skills (e.g., inquiry, experimental method, variable management etc.) as well as to learn science knowledge. Knowledge needs to be learnt in context;
• if the partnership involves field work, ensure you visit the site beforehand and are familiar with what is there, any hazards etc;
• ensure you and the teacher have all equipment needed for practical work set up well in advance of the students being present. It can be difficult to set this up when students are in the room. This may mean turning up early;
• for the manageability of practical work encourage the teacher to organise the class into groups rather than working with the whole class at once;
• it is the teacher’s responsibility to ensure any paperwork associated with taking students outside the classroom is completed appropriately;
• management and control of students is the teacher’s responsibility, although when you are in front of the class, you can expect and request quietness. It is not your responsibility to admonish individual students.
Understanding schools

The ways schools are organised has implications for how partnerships and interactions are enacted. Points to note are:

- how many classes are you working with? It may not be just one as classes work as teams for determining and planning work;
- schools operate a reasonably rigid calendar of activities that can constrain when interactions can occur. It is very difficult to make changes at the last minute. School-wide calendared items cannot be moved;
- school terms are organised by weeks - week 1 is the first week of the term. Some schools have week ‘lengths’ that are not 5 days;
- each school has their own curriculum which they have developed based on the NZ Curriculum framework from which annual planning is developed.

Within schools be aware:

- school have specific rules and ‘culture’ with respect to addressing adults, dress standards, student dialogue in class, and grouping students;
- normally you can’t use student toilets;
- if you are at a school for a day, the teacher may have other responsibilities, so may not be available at e.g., lunch times;
- that teachers do not have email open normally during school hours, so a response can be delayed.
- Schools have little spare money, and their limited resources are prioritised across many areas.

Using discussions and questions with students

Getting students to verbally express and defend their understanding and to be exposed to positive critical feedback from their peers is an underpinning component of effective learning. Some points for encouraging effective discussion are:

- Always ask questions - never lecture unless you are summing up or reviewing, and then encourage the students to sum up by asking even simple questions;
- Be positive to all student answers; try to avoid the word ‘no’. For an answer that either isn’t complete or is irrelevant, thank them and move on to others;
- Don’t labour a question, if students can’t answer it, either rephrase or provide the answer you were looking for;
- Involve many students in answering, not just the keen ones. Engaging or expecting more from individual students is the teacher’s responsibility;
- Try to avoid QRE – Question from teacher, Response from student and Evaluation of answer by teacher. Students are wise to this and try to figure out what you want rather than express what they think!

Doing practicals with students

Remember that you may be asking up to 30 students to do an experiment! In planning any experimental work:
• Emphasise any health and safety issues with the teachers and clarify whether activities are suitable for students to do themselves or whether it should be a demonstration. Health and safety is the teacher’s/ school’s responsibility;
• Be aware that classrooms may have smoke detectors connected to the fire station;
• You cannot single-handedly supervise all students at once. If you are working with one class, a good ratio is probably 1:15 (adults to students). Make sure that teachers are involved, and bring in extra staff, if needed;

In class:

• Review each step with students verbally and have it on a projected computer screen, if possible;
• Understand that students may not read your workbooks in depth, nor refer to it to see what to do next;
• You need to work out logistics of undertaking the experiment with larger student groups;
• Experiments can fail, but not too often. Failure is a natural part of science, but the difference is that scientists typically get to rethink and redo the experiment, whereas students often don’t;
• Provide the teacher with electronic versions of your plans.

Field trips

Learning outside the classroom provides powerful learning experiences. Field trips to your site are optional, however seeing science and scientists in action is powerful for students in dispelling common myths about who scientists are and what they do. Scion has not brought students into laboratories due to OSH and HSNO policies.

Scion has brought junior high school classes on tours with mixed success as some students do not fully engage. These events can reinforce science engagement in already interested students, but can have limited impact on other students. We have found that tours are more suited to NCEA level 2 and 3 classes, which have specific personalised learning goals. However, site trips where students are actively involved in a programme that has hands on activities are very effective.

Field trips to separate locations (e.g. forests) are very positive learning experiences. These are the responsibility of the school to organise, however, you should inform the school of any known hazards. Some preparation and pre-visits are probably required (e.g. putting in transects - start points can be pre-defined and marked), also terrain and other natural hazards can be assessed.

Legal information

No inappropriate touching or speaking with students and no physical or verbal abuse is permitted.

We recommend that there is no contact with unknown students outside of classes, and this includes medium such as email or Skype. However, many schools can allow controlled access for scientists into school wikis and forums for you to have ongoing and transparent conversations with students.

If a student randomly contacts you with a question, it is appropriate to respond from your work email and preferably, copies should be cc-ed to a teacher.
Never provide students with your personal contact details such as home email, Facebook page or MSN.
3. **Partnership evaluation**

An important component of a partnership is ensuring there are opportunities to evaluate and feedback on its operation and outcomes. Mechanisms to achieve this should be negotiated at the partnership planning stage, and typically could comprise:

- open communication channels that would ensure any issues that arise of a less formal nature can be dealt with as and when needed. Scion communicates with teachers before the week of the interaction, or they email us, to confirm the interaction and any teacher responsibilities;
- ‘checkpoints’ during the partnership where brief meetings or phone conversations could be held to review progress to date, revise timelines, adjust goals, and identify ‘next steps’. These meetings should involve concerned stakeholders (teachers, school management, CRI personnel) and summary notes should be made for reference purposes;
- a formal review meeting should be held at the conclusion of the partnership where key outcomes and ‘learnings’ are identified and carried forward to be acted upon in subsequent partnerships;
- opportunities to communicate positive outcomes from the partnership should be identified and actioned (e.g. local and regional media, CRI and school newsletters, websites, the Education Gazette, published articles, BoT communications);
- Undertaking formal research on impacts and outcomes (see Programme description document for the Science-for-Life research design).
4. Other worthwhile engagement activities

Science-for-Life partnerships engage with all students to improve science literacy. There are many other exciting initiatives CRIs can be involved with that aim to build science engagement with students, though typically outside the classroom or after school hours. Some are:

Crest

Crest is an international awards scheme designed to encourage years 6-13 students to be innovative, creative, and to problem-solve in science, technology and environmental studies. CRIs can provide mentors for student projects. It is modelled on the Duke of Edinburgh Scheme. (see: www.royalsociety.org.nz)

Future-In-Tech Ambassadors

Futureintech is a practical attempt to increase the number of young New Zealanders choosing careers in technology, engineering and science. Ambassadors go into classrooms for a variety of reasons such as to get students ‘excited’ about technology, engineering and science, and to give students an opportunity to meet a professional in these fields. Other goals are to assist students with a project, inform them about career options, and help them make decisions about secondary and tertiary subjects. (see: www.futureintech.org.nz)

Science Learning Hub and Biotechnology Learning Hub

The hub’s provides resources for teachers for school years 5–10. The resources for teachers explore the latest research in New Zealand. (see: www.sciencelearn.org.nz)

Liggins Senior Biology Seminar series

The Liggins Institute runs a broadcast lecture series to year 13 biology students. Schools either need a satellite disk and a freeview decoder, or a link to the KAREN network. Scion hosts local schools to come in and view the presentations. This is a no cost opportunity to provide support for schools. (see: http://lens.auckland.ac.nz/index.php/Main_Page)

Science Olympiads

Science OlympiaNZ fosters academic excellence in Science. Teachers and students discover the opportunities provided by science-related international competitions. All of the programmes provide the gifted and talented students of New Zealand with student-centered science learning. (see: http://www.scienceolympianz.org.nz/index.php)

Science Teacher Fellowships

The Ministry of Education, through the Royal Society, provide a number of scholarships for teachers to working within science organisations for an extended period in order for teachers to experience science in action. See www.royalsociety.org.nz.
5. **Case studies**

The case studies collectively provided these outcomes for Scion and scientists:

- information to help refine the contribution the CRI can make towards furthering general science literacy and understanding of science;
- enhanced sense of value of the work of scientists and perception of contributing to the education of young people (enthusing students towards science);
- scientists considered their work with students to be immediately rewarding;
- meaningful fulfilment of ‘public good’ component of work programme and corporate statement of intent/core purpose;
- improved ability to communicate science to different audiences;
- greater public awareness and appreciation of the work of the CRI;
- enhanced understanding of the work of schools, the constraints they operate within, and how they are able to assist;
- building a more open and ‘demystified’ view of science; better personal understanding of their science through the need to explain and teach it to others;
- better skills at communicating science in accessible ways to general audiences.

**Case 1: Newstead Model Country School**

**Newstead**  
**Hamilton**

**Overview and goals**

This partnership focused on the care and maintenance of a gully area adjacent to the school. Over time, the gully was used as a dumping ground for rubbish, and had suffered from neglect and lack of care. Some pathways are established in the gully but had become overgrown and disused, and rodents had colonised the area. The goals of this partnership were to identify the biological and human-made threats to the environment, for students to gain a greater understanding of what they can do to care for the environment, and to become familiar with how the gully was formed and the native and introduced flora and fauna that lived there.

**Class details**

The class comprised thirty mixed ability year 5 and 6 students (9-10 year olds), which in the past has had limited exposure to science topics. They did, however, have a good grasp of the basics of student-led inquiry approaches to learning.

**How did Scion scientists contribute to the study?**

Over the ten-week duration of this partnership, five scientists contributed in a variety of ways to the study. They included:

- an audio conference with an entomologist talking about her work and what scientists do;
• two scientists (a soil scientist and a plant ecologist) visited the school twice to work with the
students and teacher in the gully on plant identification and regeneration, to examine soil
profiles and explore how the gully was formed, and to identify threats from introduced species;
• loaning the school digital microscopes, some notebook computers and a night vision camera to
explore plant life and survey nocturnal predators;
• assisting the teacher to develop personal science knowledge to support the study - such as
locating predator traps, setting bait, identifying species by predator tracks, tree and plant
identification etc;
• contributing to and feeding back on a class wiki;
• some technical support for use of the night vision camera and installing images to the class wiki;
• the teacher visited Scion for partnership planning and familiarisation day.

Outcomes for the students and the teacher

The outcomes for students and teacher were significant. These included:

• increases in teacher and student science conceptual knowledge in the Living World and Ecology
areas of the curriculum;
• greater levels of teacher confidence to be able to undertake studies of a similar nature on an
independent basis in the future;
• an appreciation of the importance of science and its role in caring for and maintaining our
environment and the work of scientists in this process;
• enhanced personal understanding of what individuals can do to assist in caring for the
environment (the benefit of using a local context);
• the development of a range of science skills including science inquiry and investigative skills;
• a ‘humanising’ of scientists and dispelling popular misconceptions about the nature of science;
• development of a range of technological skills including the use of digital microscopes, the night
vision camera, wikis, blogs, audioconference protocols (etc);
• expansion of student-led inquiry learning approaches to new areas of the curriculum;
• contacts and relationships were formed that could be used to support other science studies at
the school.

Case 2: Wellington College

Basin Reserve
Wellington

Overview and goals

These interactions focused on assisting students to meet the criteria for NCEA Achievement Standard
3.6 in Biotechnology: Describe applications of biotechnology techniques. This Achievement Standard
“requires students to be able to describe two biotechnological applications, two techniques used in
each application and the human need or demand for each application”. The two biotechnology
applications identified by the teacher as the students’ focus for this standard were transgenesis and
gene cloning. The purpose of the interactions was to assist the students by providing quality local
examples of the biotechnology techniques in practice, and to demonstrate how they are being
applied for economic and sustainability purposes.
Class details

The class involved in the interactions was a group of 17 senior students studying for their scholarship level qualifications. They were one component of a partnership which also involved other activities within the school, and took place over a period of approximately six weeks. The teacher was an experienced science teacher who was also the head of the science department at the school. Due to geographical distance, the interactions took place using synchronous videoconferencing over the KAREN high speed fibre network.

How did the Scion scientists contribute to the study?

Two Scion scientists and a coordinator were involved in this series of interactions. One scientist was a plant and tissue culture specialist, and the other was a molecular biologist. They contributed to the interactions in a number of ways:

- through videoconferencing, supporting teacher knowledge development in new areas of biotechnology through providing them with examples of up-to-date science techniques and how they are applied to local commercial, industrial and experimental contexts;
- through the use of email, responding to a small number of teacher and student queries about the demonstrated techniques and general questions regarding the Achievement Standard module;
- working directly with students through videoconferencing presenting and discussing Powerpoints which illustrate the nature and application of techniques to local commercial and industrial examples;
- providing contacts for teachers to access specific equipment for practical labs;
- providing print materials and web references of local and international examples of demonstrated techniques and their application;
- contributing to a ‘round table’ meeting at Scion looking at where interactions could be planned, and hosting a group of teachers from the College for the day and introducing them to Scion research activities;
- assisting teachers via ‘teacher only’ videoconference sessions to improve and update the content of their courses, and introduce them to more contemporary knowledge and greater learning authenticity;
- through their clearly communicated and genuine passion for science and high levels of expert knowledge, enthuse and engage students towards both the science content and the discipline itself.

Outcomes for the students and the teacher

The key outcomes for the students and the teacher were:

- knowledge of up-to-date biotechnology techniques with local application of immediate relevance and use for NCEA Achievement Standards;
- enhanced student appreciation of the value of their school studies and what they may lead to in future employment or educational opportunities;
- enhanced understanding of the nature of science and its application to ‘real world’ endeavours;
- greater enthusiasm towards an interest in science as reflected by the passion and commitment to science displayed by the scientist presenters;
- new knowledge of different sources of scientific equipment useful for school labs;
- a range of print and web-based data and resources to support other NCEA standards;
• ‘one-to-one’ answers to specific questions of relevance to their studies;
• seamless integration of the videoconference seminar format with the existing teaching approach used in the school;
• contacts and relationships were formed that could be used to support other science studies at the school.

Case 3: Lynmore Primary School

Iles Road
Rotorua

Overview and goals

The Scion-Lynmore interaction took place over a period of one school term, and was based on a school-wide Future Learning theme of Sustainability- Understanding the Environment. The selected topic was a stream health investigation, where the students carried out a number of explorations in order to determine the health of a stream that ran through school property. The original vision for the topic was to develop a plan or outline for the school to help improve the stream’s health, in order to maintain it in good order for future school generations.

The integrated theme was based on objectives from the New Zealand curriculum:

Science: Living World – Investigate local ecosystems and understand the interdependence of living organisms, including humans and their relationship with their physical environment;

English: Presenting – Using verbal and visual features to communicate information.

Class details

The main interaction involved a class of approximately 28 year 6 students and an experienced teacher who had been teaching at the school for 8 years. The teacher’s goal was for her students to carry out practical research to help develop a ‘maintenance plan’ for the stream – including some detail of possible uses for the surrounding bush and plant area – that her leaving students could ‘gift’ to the school. Other classes (an additional 60 students) were also involved in some practical work.

How did the Scion scientists contribute to the study?

In total, four scientists from Scion were involved in this interaction at various stages and in different ways over its 10-week duration. Their input comprised:

• the Scion facilitator meeting with the teachers and the Deputy Principal to secure leadership support for the interactions;
• direct assistance with identifying and planning opportunities for engagement through participation in syndicate planning meetings;
• a scientist held an initial professional development session with involved staff exploring the bush reserve and discussing possible learning activities for their students;
• a Skype videoconference was held with a fresh water ecologist to respond to student questions about the work of scientists and the role of science generally in today’s world. The conference also introduced students to the scientists they were going to work with in the field studies;
two stream investigations involving four scientists and a total of 90 students. The first focused on general student understanding of the environment and what lived there, while the second included practical stream mapping (within the school boundaries) and flow rate, water viscosity, and water clarity experiments;

- a follow-up stream investigation with one class which expanded on the previous general investigation and focused on monitoring and recording water pH, clarity, temperature, and velocity, as well as examining the surrounding habitat and looking more closely for evidence of bug and small animal steam life;

- an analysis session where one scientist revisited the class and worked with the students collating and classifying data collected from the stream studies, exploring discrepancies, and linking these back to developing knowledge of correct scientific methods, variable management, and the need generally for rigor and precision in science inquiry;

- creating some student study materials to be used in the stream investigations.

**Outcomes for the students and the teacher**

The key outcomes for the students and the teacher were:

- significant development of new knowledge within the Living World and Nature of Science curriculum strands by a considerable number of students, particularly relating to scientific methods and techniques;

- greater levels of teacher confidence to be able to undertake studies of a similar nature on an independent basis in the future;

- greater understanding of the work of scientists, how science impacts upon our daily lives, and what we can do as individuals and collectively to care for our environment;

- an authentic opportunity to explore the use of a range of technology tools for science investigations and for communicating outcomes;

- easy integration of science content with the existing student-centred learning model used at the school;

- contacts and relationships were formed that could be used to support other science studies at the school
6. References

(1) Science – School partnerships


(2) Nation at Risk report


(3) Other Government & NGO reports

American Association for the Advancement of Science (1989). *Science for all Americans: A project 2061 report on literacy goals in science, mathematics and technology*. Washington, DC: AAAS.


(5) Science Learning Hub:

[www.sciencelearn.org](http://www.sciencelearn.org)

(6) Science Literacy:


(7) Economic of Education


(8) New Zealand Curriculum


(9) Inquiry


(10) NCEA Achievement Standards.


(11) PISA and TIMSS Studies


http://www.educationcounts.govt.nz/data_collections/pisa_research

http://www.educationcounts.govt.nz/data_collections/NEMP

http://www.educationcounts.govt.nz/data_collections/timss

(12) Science partnerships


(13) Case study reports


(14) Science for Life Programme description document