SCION
Next generation biomaterials

Science for Life:
The Lynmore School Study

www.scionresearch.com

REPORT INFORMATION SHEET

Report Title	Science for Life: The Lynmore School Study
Authors	Dr. Garry Falloon University of Waikato
ISBN:	
Scion output number	48294
Date	2010
Confidentiality Requirement	Publicly Available
Intellectual Property	 This work is licensed under the Creative Commons Attribution-Non-Commercial-No Derivative Works 3.0 New Zealand License. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/3.0/nz/ or send a letter to Creative Commons, 171 Second Street, Suite 300, San Francisco, California 94105, USA.

Lynmore School Study

Dr. Garry Falloon

University of Waikato

2010

Table of Contents

Table of Figures

1. Introduction

This study is the second in the series of case studies detailing the work of Scion in supporting science teaching and learning as part of the Science-for-Life programme. This study, and others in the series, will be used in the development of, and reporting on, a range of possible interaction models based on a meta-analysis of the case study data, with approximate costings associated with the models also being calculated. It is important, therefore, that this study be viewed as part of the process of data gathering, rather than as an end point in itself. Recognising this, no detailed theoretical framework or methodology has been included in this summary – substantial detailing of this having being already documented in the previous Newstead case (see Falloon, 2009b).

The focus of this summary is, therefore, two-fold:

1. To provide detailed description of the interaction between Scion and Lynmore primary, in order to identify the nature of support for science schools find most valuable, and learn more about how such support can be effectively delivered;
2. To provide Scion with guidance for 2010 interactions, which will assist in broadening the base of data available to be used in generating interaction/collaborative models (and associated costings) for end-of–project reporting purposes.

2. Background

Lynmore is a suburban contributing school located in Rotorua in the Bay of Plenty. It has a roll of just over 600 students, making it one of the largest primary schools in the Rotorua region. The school's decile rating of 9 indicates that it is situated in an area of above average socio-economic demographics, despite most other schools in the area holding deciles of an average 5 or below.

- Lynmore School's philosophy appears to be based on a series of fundamental understandings about how learning occurs, and emphasises the active role of the learner when engaging in the learning process, the importance of relevant, meaningful experience to effective learning, and developing learner independence. These are summarised below:
- All learning involves understanding and memory;
- Quality learning is achieved through powerful memorable experiences which inspire children to learn;
- Understanding is built on robust thinking and questioning. These are fostered through reflecting on what has been learnt and targeting future learning;
- Children learn best when they develop independence and ownership of their learning in a purposeful context;
- Successful learning requires effective and efficient scaffolding- feed forward / next step learning.

(Lynmore School, 2009)

In response to these broad beliefs, the school has a strong focus on the use of Inquiry approaches to learning across the curriculum, and has developed its own Inquiry-based model known as Future Learning. According to the school's website, "Future Learning is Lynmore's inquiry learning process. The focus is on teaching children how to learn rather than to merely absorb information. We also look at how the children can use the information they have gathered to solve real life problems" (Lynmore School, 2009). The Future Learning model has five stages which closely align to conventional Inquiry models.

These are:

IMmersion: The children are given a scenario/ problem they have to solve

Make a decision: the children highlight key words and decide what they need to research in order to solve their problem

Explore: the children use a wide range of tools to research their topic

Record: the children use graphic organisers to record and organise their findings

Synthesis: the children use their new knowledge to solve their problem

Evaluate: the children evaluate their own learning

(Lynmore School, 2009)

The Scion/Lynmore interaction took place over a period of one school term at the end of 2009, and was based on the school-wide Future Learning theme for 2009 of Sustainability- Understanding the Environment. The selected topic within this theme was a Stream Health investigation, where the students were to carry out a number of explorations in order to determine the health of a stream that ran through school property (Figure 1). 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.

3. The Teacher, the Class and the Rationale

This interaction involved a class of approximately 28 year 6 students, and an experienced teacher, Lynda, who had been teaching at the school for 8 years. Lynda's desire was for her year 6 students to carry out practical research to inform the development of 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. While the broader Sustainability theme had been commenced in the previous term, the focus on the stream investigation did not get underway in any significant way until term 4. According to Lynda, the original plan was to complete most of the practical explorations in the third term but "we haven't got nearly as far as we'd wanted to at the beginning, so we will carry on. It is important to these guys (the class) – they will be leaving at the end of the year, and for them we need to investigate ways of sustaining the bush and stream and handing this information over to the rest of the school" (Lynda, interview transcript, 2009, section 6).

3.1. Planning and Organisation

Organisationally, the topic was taught as a whole class using the school's Future Learning framework, although most practical tasks were undertaken in groups to enhance manageability. The focus of teacher planning emphasised a blend of contextual science knowledge development (Living World, Planet Earth), Nature of Science strand outcomes, and the development of information processing capabilities.

Achievement objectives were drawn from both the Science and English curriculum statements, and included reference to Managing self, Using language text and symbols, and Participating and contributing from the curriculum's key competency framework.

The learning objectives for the topic were based on curriculum achievement objectives at level 3&4 and were:

- 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.

Objectives related to the Nature of Science strand reflected an emphasis on science processes, and included developing skills and capabilities in designing and implementing science inquiries, and using and analysing information from a range of sources when developing responses to science problems and questions.

Figure 1: Lynmore School and adjacent stream and bush area

As introduced earlier, the topic was developed around the 'big idea' of environmental sustainability, with the context being the adjacent Waitawa stream and bush area (figure 1). The pedagogical approach was designed around student questions and concentrated on four key areas of learning:

1. Recognising the value of having the bush reserve and the stream as a school resource;
2. Understanding why it is important to have a healthy stream and bush reserve, and how to achieve this;
3. Recognising the features of a healthy stream and bush area;
4. Learning ways of monitoring bush and stream health, and carrying out tests to determine this.

Additionally, Lynda identified opportunities to integrate the use of ICT into the topic, establishing a section devoted to the project on the class blog. She also used Skype videoconferencing on the class's interactive whiteboard to carry out an interview with Brenda, a Scion scientist - about life as a scientist, and to find out more about the nature of science and its importance.

3.2. Interaction Goals

Lynda's goals for the interaction related to both the science content, and more broadly to understanding the work of scientists and the importance of science in our lives. She viewed the stream study as being an ideal way of tying both sets of goals together, within the context of a unit of local relevance and value. As she stated,

> *...my understanding of it (Science-for-Life) is that its encouraging the children to investigate and get into science a bit more, and they (Scion) will support us as teachers as well as the kids in the programme – exposing the children to science, and what a scientist might do, and through this we can find out if our stream is healthy…*
>
> (Lynda, interview transcripts 1&2, 2009, pp.1-3)

She considered the opportunity to work with Scion presented her with a chance to both upskill her own science knowledge, and also get support to introduce a range of new science skills to her students, in an

area she was unfamiliar with. The fact that Scion was local was an additional benefit, and meant that logistically any collaboration should be reasonably easy to arrange and coordinate. Interestingly, Lynda appeared to know little about the Science-for-Life initiative at the outset, commenting that, "we made the initial contact with them (Scion)- it was decided that rather than us going to visit Scion, it was best that Scion came to see us and then decide what direction we wanted to take" (Lynda, interview transcript 2, 2009, p.2). This initial communication appeared to have been prompted by Lynda's knowledge of the previous Forest of Life project, which Scion operated between 2005-07. After browsing some of the Forests of Life school project descriptions on the web, she made contact with Scion to explore the opportunities for support… "what we were hoping to do was to go and have a look at what they do down there (Scion), but it didn't turn out that way which was fine. I didn't know about the programme at the start" (Lynda, interview transcript 1, 2009, p.1). While the interaction was essentially based on Lynda's existing planning, early meetings with the Science-for-Life facilitator were held to identify opportunities for interactions, and a tentative timeline for these was planned out.

3.3. Descriptions of Scion Interactions

Scion/school interactions within this topic took several forms. These, and responses to them, are outlined briefly below.

1. An initial planning meeting

A two hour planning meeting was held at the school approximately 2 weeks before the collaboration commenced. The meeting was attended by the Science-for-Life facilitator (Andrew), the researcher, Lynda the class teacher, and Rhys, the Deputy Principal of the school. During the first half of the meeting the broader goals of Science-for-Life were shared, and expectations relating to data collection to support the development of this case study were negotiated. Some discussion also took place regarding the broader work of Scion to help Lynda and Rhys gain a better understanding of the potential for collaboration, and identify the form any collaboration may take. Rhys also took the opportunity to clarify the level of expected commitment from the school, as there was obvious and apparent concern from administration that involvement in the collaboration did not result in further 'teacher overload'. Lynda also took the opportunity to explain some of the in-school constraints that the collaboration would have to work within, in that its timing towards the end of the year was not ideal due to the 'compression' of activities and expectations occurring in the fourth term. These issues, and their impact upon the collaboration, will be discussed more fully in a later section.

The second hour of the meeting was turned over to exploring possibilities for Scion interactions and contributions compatible with Lynda's objectives and learning intentions as previously described, and agreeing to a timetable through which these were to be undertaken. The nature of these interactions is described below. Logistical aspects such as student group size for practical work and who within Scion could be involved in the collaboration were also discussed, in order that both parties had an agreed-to understanding of the operational parameters.

2. Facilitator on-site visit

Before commencement of any substantial interaction, Andrew, the Scion facilitator, visited the stream and bush reserve with a number of teachers to discuss the inquiry possibilities which existed there. Although not all of the teachers were to be involved in the initial collaboration, the team emphasis was seen as useful to ensure 'buy in' from the staff – a factor that Rhys, the DP, considered to be of upmost importance,

> *…we need to make sure Roger (the principal) is onboard with this. He has the final call… and it would be good to have some of the other teachers there too – so they know what's going on.*

Even though you (Lynda) will probably be doing most of this yourself, it would be good to have others onboard…

(Rhys, recorded meeting, 2009, 37.28 – 38.05)

The site visit was seen as an important initial component of the planning, as it gave both Lynda and Andrew an opportunity to evaluate the potential of the site. It was also perceived by Lynda as a useful exercise in negotiating the programme, with Andrew able to offer up suggestions as to learning experiences that might be suitable, and providing the 'expert knowledge' on how these might take place.

…it was an important part of the negotiation; we spent a good hour down in the bush with him – me and the other teachers. Then he came in again with another (Scion) staff member and had a good look down there, and came up with what he wanted to do…

(Lynda, interview transcript, 2009, p.6)

Following on from the facilitator's visit, an initial skype videoconference was held in which Andrew and Brenda (a fresh water ecologist) responded to student questions about the work of scientists and the relevance of science generally to individuals and society.

3. The Skype Videoconference

The skype conference was an important component of this study, as it supported the student-led inquiries integral to the school's Future Learning approach. It also helped Lynda meet her objectives under the Nature of Science strand of the curriculum, and provided an ideal opportunity for the students to develop their information recording and processing capabilities. The exercise also worked in well with Lynda's language programme, as a formal agenda was generated and children were identified to ask questions while others recorded responses. Questions were concerned not only with the stream study, but also with the work of Scion and more generally how science contributes to our society…

…I talked to the kids about the questions we could ask… now that we think we know what a healthy stream and area looks like… but we also wanted to find out the other things Andy and Brenda do at Scion. We came up with a bunch of questions, and everyone else scribed the answers, so it was not only about the stream, but what Scion was involved in and Andy… they were really interested that Andy was involved in the satellite monitoring of forests. It was a big WOW for them… but we didn't really follow it up.

(Lynda, interview transcript 2, 2009, p.2)

The conference appeared to be valuable in broadening the students' understandings of the breadth of science, and it "put a new light on what we were studying, it took it from a different angle" (Lynda, interview transcript, 2009, p.3). The conference was also useful in introducing the students to the Scion staff with whom they were going to be working on the practical aspects of the interaction, so that when they met them face-to-face there was a level of familiarity already developed.

4. Scion-supported field visits

In total there were two Scion-supported visits to the school, which involved Scion staff working with teachers and students investigating stream and environmental health. The first of these visits focused on helping the students understand more about the environment, and the went some way to answering some of the questions the students had about the stream's origin, and the sort of wildlife that lived in

and around it. Prior to this visit, the students had undertaken web-based research into what was likely to live there, and were interested to learn if their hypothesis was accurate. Andrew and Brenda spent some time talking over the questions students had, before dividing the classes into groups to undertake some preliminary investigations. Four main investigations were carried out at this time: stream mapping (within the school boundaries); flow rates; water viscosity; and water clarity. A basic array of equipment was used by the students in the investigations, including clear plastic tubes (testing clarity) and timing floating objects (using sticks, oranges and rope). Due to the large number of students (90 in total), four Scion staff supported this investigation – Andrew, Brenda, Lucy (a GI specialist) and Tom (a physicist). According to Lynda, these practical activities were well-timed, and helped to provide some much needed "hands on, hard and fast results. We needed to have something that we could compare with our knowledge of what makes a healthy stream. We had only found this out online at that point in time" (Lynda, interview transcript, 2009, p. 3). This first interaction was also useful in that it stimulated further student interest in the study, especially with regards to discovering the sort of bugs and small animals that lived in or near the stream, which became the main focus for the second interaction. While this first interaction was generally successful in meeting Lynda's expectations, it did raise some managerial and communication issues which will be discussed in more detail later in this report.

The second interaction involved Tom, Andrew and Lucy in working with Lynda's students at the stream undertaking extension investigations, based on the findings of the initial explorations of the previous week. For the purposes of this study, Andrew had developed a worksheet to guide the students in their data collection which 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. This 'hands on' phase lasted almost 2 hours, during which time groups of students under the direction of the Scion team and the teachers involved, recorded their findings on the preplanned worksheets. While not all students managed to complete every activity, enough data were recorded by the groups to enable a detailed collation on the following day.

5. Data collation and analysis

The final activity Scion contributed to in this unit was assistance with the collation of data from the field investigations, and the development of tentative conclusions relating to the overall health of the stream as indicated by the data. On the day following the second field study, Andrew revisited the class and led a session where the results the students had collected were developed into summaries and recorded on the interactive whiteboard. Andrew facilitated a session where each group was required to both present their results, and explain the process by which the data were collected. Any significant discrepancies in outcomes between the groups were debated, and usually linked back to possible issues with consistency in sampling methods, or the location where the sample was taken (eg: adjacent to a drain, slow vs faster moving water, sheltered vs open areas etc). General discussion arose from this regarding the nature of science investigation and the influence of such variables on outcomes and results, which linked closely to Lynda's goals around the Nature of Science strand objectives.

At the end of the session the collated results were analysed, and the students were invited to reach and justify a tentative conclusion relating to the overall health of the stream, and the indicators of this.

4. What Has Been Learnt From This?

Several significant outcomes from this interaction can contribute to the overall goal of this project- namely, evaluating the efficacy of CRI-education interactions, and identifying mechanisms and models through which these can take place. While possibly none of those listed below could be seen as particularly 'new', they were seen by participants as important in the overall performance of this interaction, and influenced their attitude towards it.

1. Communication and commitment

As with any successful relationship, the quality of communication and level of commitment to it was viewed by both parties as being critical to this interaction. There was no doubt from comments made, that there existed a level of frustration on this front, with both Lynda and Andrew appearing to struggle on occasions to coordinate times and keep prearranged appointments. As Lynda commented,

> *…the first time I met with Andy we had a talk and went down to the bush and had a look – and we made a date and he forgot, something happened and he didn't come, so we had to wait a couple of weeks till he could come…*
>
> *(Lynda, interview transcript 2, 2009, p.3)*

This issue appeared to be related to the 'busyness' of both parties, but in particular the nature of life in school towards the end of the school year when this interaction took place. The initial communication around this interaction appeared to be somewhat haphazard, which contributed to a lengthening-out of the unit and to some extent, a sense of 'fragmentation' which developed. Lynda stated that there was a need for interactions to be tightly focused, and aligned with a set timeframe through which they are to be delivered, if they are to be successful…

> *…I didn't really know what Scion had to offer… but I guess I was kind of open to see where I could lead.. Maybe if I was more focused, and said 'this is what we need, what can you come up with' and working to a timeframe of doing the actual hands on stuff over a couple of weeks… because we really stretched it out, and that wasn't good…*
>
> (Lynda, interview transcript 2, 2009, p.6)

Initial communication by both parties was via telephone and email, and it appeared that this was not particularly effective, with voicemail messages not 'getting through' or emails not being responded to. It needs to be noted, however, that responsibility for such issues was shared, with Lynda commenting that "it's a bit hit and miss, it's hard for me to get hold of Andy, and it's hard for him to get hold of me – its just how schools are at this time of the year" (Lynda, interview transcript 1, 2009, p.6).

Issues with communication undoubtedly impacted upon the continuity, planning and evaluation of this interaction. While generally it was viewed very favourably by Lynda, it was seen as being highly desirable that coordination and planning was more robust and timetabled, and that opportunities were made available to evaluate the performance of the interaction as it took place, and at its conclusion. This latter point was seen by her as being particularly important in new initiatives such as this, where it is very important to "see what went well and not so well, so you can make changes" (Lynda, interview transcript 2, 2009, p7). She also commented that better planning, coordination and timetabling would help build the programme's continuity, and break down a sense of it being a series of 'one-offs', rather than a more substantial collaboration over time.

Another concern was that both parties were very clear on the level of commitment each needed to make. This was a particular concern for the Deputy Principal, who made repeated references to the need to ensure teachers were not overloaded, and that participation in Science-for-Life did not detract from the other programmes and professional development initiatives the school was involved in. As Lynda commented,

…I got the impression that Rhys was worried about getting into something that we couldn't carry through… but that wasn't my understanding of it at all… my understanding was 'let's get help in science' as its an area I'm not great at… science is not a big area of mine.

(Lynda, interview transcript 2, 2009, p.3)

Once again Lynda attributed some of the responsibility for this on a lack of internal communication in the school, and that in some respects the DP had been "thrown in at the deep end- he hadn't seen my planning or anything… he was wary of making a commitment he thought we couldn't keep... but that wasn't the case" (Lynda, interview transcript 2, 2009, p.3). The need to establish clearly in the minds of those involved the operational parameters and scope of any interactions is critical for enhancing prospects of success. This especially applies to school administration and management, who have the ultimate say over whether or not teachers are able to participate. It was apparent in this instance that there was a level of 'nervousness' around this, which appeared to have little foundation. While it is crucial to have 'buy in' from school leadership, this can only be achieved when accurate and commonly-held understandings have been arrived at.

2. School-wide focuses and learning models

As was the case in the Newstead interaction, the benefits of incorporating Science-for-Life within a school-wide topic was highly apparent in this instance. As the whole school was involved in an 'Understanding our Environment' topic with each class (or syndicate) able to select and develop their own theme within this, the advent of Science-for-Life was seen as a 'natural fit' and did not necessitate significant or undue changes to be made to existing plans. This factor was seen as particularly important to school management in their decision to support involvement, given their concern not to add significantly to already busy teachers' workloads. Aligned with this, there was clear compatibility between the learning model operating in the school (Future Learning) and the Inquiry approach of Science-for-Life, meaning that for Lynda, although science was not her strength, it was a relatively straightforward matter for students to integrate the skills they had been developing in other curriculum areas into the science theme. The question-oriented approach, according to her, "allows my kids to do their own investigations… where they decide on their question and then research that… do the practical side of things; hypothesise and test, and come up with conclusions" (Lynda, interview transcript 1, 2009, p.2). The fact that she had been using an inquiry-based model in other curriculum areas for over three years, gave her a level of confidence that she could successfully apply it in this programme.

One of the initial teaching issues she identified with using such and approach, however, were difficulties she experienced in maintaining a focus on the learning outcomes of the topic, when the investigation "went off in all kinds of different directions to start with" (Lynda, interview transcript 2, 2009, p. 1). As she observed, this was always an issue with adopting Inquiry-based models in the initial phases, where student questions play such a significant role in directing the study- "it is simply a matter for the teacher to direct them subtly back to the topic – in this case, is it healthy, is it a healthy stream?" (Lynda, interview transcript 2, 2009, p. 1). To achieve this, Lynda encouraged the students to group their questions and from these groups generate 'key questions' which they could then use to guide their research, and make decisions about the best information source to use to find an answer.

In addition to this, the topic provided Lynda with an ideal opportunity to integrate learning in a number of curriculum areas, and also practice some of the skills she had been developing through other professional initiatives such as the ICTPD programme. The inclusion of a dedicated area on the class's blog in which students were able to post comments and develop summaries related to the topic which could be viewed by others, provided the students with an authentic audience for their work, and an ideal context to develop language skills – "it's great, we have practiced our procedural and persuasive writing, done research – IT skills. Now we are going to turn our stills (digital photos) into a photo story

and as a movie, to show to the whole school" (Lynda, interview transcript, 2009, p.2). Lynda commented that it was particularly gratifying to the class to have feedback on the project from overseas, where the students' grandparents or other relatives were able to log in to the project page and monitor progress.

In considering further interactions within the Science-for-Life initiative, both documented studies thus far have indicated the benefit of project-based, whole school approaches, where minimal support has been needed to get teachers 'up to speed' with Inquiry learning models. By selecting such cases, it is possible, therefore, to concentrate on supporting the science rather than needing to allocate a lot of resource to upskilling teacher pedagogy.

3. The quality of Scion staff and their expertise

According to Lynda, one of the real strengths of the initiative lay in the quality of the staff from Scion who worked with the students. This related not only to their science knowledge, but also to their ability to communicate this to the students. As Lynda observed,

> *…sometimes you get people who know about things – are really knowledgeable- but they can't put this over to the kids… they lose them. But this has been really good – hearing from an expert, rather than me reading from a book. Brenda, she talked to the kids about electronic testing… stunning the fish to measure them… and as they went on (the Scion team), with the kids, the better it was – they found their feet – they were shown the boundaries, and they were a neat bunch. It worked really well.*
>
> (Lynda, interview transcript 2, 2009, p. 5)

It was also apparent from the audio recordings of the in-class and field sessions held by Andrew, that he had a very good grasp of the questioning techniques which are integral to a teachers' role when adopting Inquiry models. The use of multiple open and deductive questions where students were required to explain and justify their responses and build on the ideas of others, typified interactions, and was an important aspect which contributed to the success of the 'face-to-face' sessions.

4. The desire for an ongoing relationship

Throughout the data a common theme was apparent indicating Lynda valued highly the opportunity to have Scion support, and that, given appropriate planning and organisational parameters, she would welcome the opportunity of further involvement on an ongoing basis. By her own admission science is an area she (and many other teachers) struggle with, and she appreciated the assistance of expert knowledge provision to provide her with the confidence to complete investigations thoroughly and accurately. While she did not see the need for 'day to day' support, she considered her involvement in the programme had provided enough of an insight into its value to assist on a 'needs basis'…

> *…I'd love it as an ongoing thing… you know as teachers we don't know everything – we can't, and science is an area many of us have trouble with as it is quite specialised. It would be good to know that we can call on them again sometime…*
>
> (Lynda, interview transcript 2, p.3)

The importance of the programme in developing teacher confidence was a finding consistent with the earlier Newstead study, and was linked substantially to the level of personal interaction and contact both teachers had with the Scion personnel, either virtually (through Skype, video or audioconference) or 'live'. As Lynda succinctly put it, "you can get plenty of information on the web or through kits- but

when you get real people involved… that's when it really makes a difference" (Lynda, interview transcript 2, 2009, p8).

5. Managing logistics

While the school wide thematic approach was a strength in terms of planning and the compatibility of Science-for-Life with wider school initiatives, it also presented some issues logistically in managing large groups for field work. As introduced earlier, while Lynda had a preference for undertaking this interaction as a single class, school policy initially dictated that 2 other classes were also to be involved (ie: the syndicate), meaning that for the first field study over 90 students were involved. While 4 Scion staff and teachers were available to manage the group, essentially it was up to the Scion personnel to coordinate the investigations, as the teachers were unfamiliar with the procedures to be used, or how the data were to be recorded. The large number of students was a particular concern in this instance, as the explorations involved students being in and around the stream and even though it was reasonably shallow at the time, still presented a potential safety hazard. The large groups also meant that not every student managed to get each investigation completed, and while this didn't impact negatively on the overall summary of results, it was voiced as a disappointment by some students. As Lynda commented,

> *…we had discussed what we were aiming for, but had not discussed the logistics of it. It was a fun afternoon and they (the students) got a lot out of it, but we had 90 kids, and if we did it again we would get 3 of them (Scion staff) to come and do it class by class so we would have much smaller groups. We really needed to revisit because the groups were way too big, and management too hard…*
>
> (Lynda, interview transcript 1, 2009, p.3)

As the second field study only involved Lynda's class, management logistics were not an issue, and all students were able to complete each activity completely, and report back their findings at the collation session.

6. Equipment and the use of technology

As introduced earlier, and consistent with the Newstead study, the project provided an ideal opportunity for both Lynda and the students to utilise the array of technology available at the school. During this interaction, students accessed the laptop pods (CoWs) to undertake their web-based inquiries, completed a Skype videoconference using the Interactive Whiteboard (which was also used to help collate and analyse investigation results), and set up their own blogspace on Blogmeister (www.classblomeister.com) which served as a 'sharing point' for student work and reflections. While data indicated that electronic technology contributed significantly by enhancing communications, an interesting observation made by Lynda was the fact that relatively 'low tech' equipment was used for the field studies, but still yielded useful and reasonably accurate data. According to her, the fact that "basic gear" (Lynda, interview transcript 2, 2009, p.4) had been used for the field investigations would encourage her to attempt these by herself at another time, and that she had gained sufficient knowledge through working with the Scion about how to analyse and interpret results to be in a position to make reasonable sense of data.

5. Summary and Recommendations

The Lynmore interaction in many ways is consistent with the earlier Newstead study, in that it provides validation of the worth of Science-for-Life as a concept, while at the same time raises issues about its sustainability, given that clearly the most valuable and meaningful contribution it made was through face-to-face interactions involving scientists 'on the ground', working with the students and teachers

on-site. As with the Newstead experience, the presence of knowledgeable personnel from Scion who were able to help setup and undertake investigations with the students and teachers, greatly assisted in building teacher confidence, to the extent that Lynda now feels capable in attempting these herself. The revealing comment relating to the abundance of information now available, but that it was of limited use without 'interpretation' into a meaningful context (though personal scaffolding), indicates that web-based and other information, while being valuable, only goes part way to meeting teacher capability deficits in this area. In some ways, Science-for-Life's greatest strength – the making available of quality science expertise to schools - is also one of its main weaknesses, and threatens its long term viability.

Secondly, there is a need for future interactions to be much more tightly organised, structured and timetabled, and for this to occur communication systems, both within the school involved and between the school and the Scion facilitator, need to be greatly improved. A lot of time was unnecessarily wasted in this interaction with the teacher trying to get hold of the facilitator, and visa versa. This delay led to compression in the amount of time available to interactions, resulting in project 'creep'. The fact that much of the practical work involving Scion was forced into the 4th term through repeated planning delays, meant that some work was unable to be completed, as they had to be fitted in around other commitments leading up to the end of the year. Better communication and more robust planning and timetabling would have alleviated such issues. It is also recommended that, where possible, interactions are scheduled for earlier in the year as term 4 is a busy time for many schools with end of year activities, assessments etc taking priority.

Thirdly - and aligned to the previous point, this study revealed issues about (and the importance of) gaining the support of school management, for participation. While some of the difficulties in this instance could fairly be attributed to internal communication issues within the school, it is critically important that school management are absolutely clear on what the programme is offering, and the level of commitment they, and/or the teachers involved, are required to make to it. While the nature of this commitment will not be the same for each collaboration – for part of the programme's strength is its negotiated approach to this - it is important that all parties understand exactly what the commitment is, and when and how it is to be delivered. Given the busy day-to-day activities of the school, there should be 'no surprises' in this respect. To assist with this, it is recommended that the Scion facilitator consider developing an introductory flyer (or equivalent) which can be sent to schools considering involvement in the programme in advance of any initial planning work. The flyer could contain introductory information about the work of the CRI, and the sort of areas it may be able to assist with in helping schools, along with some short summaries of the case studies to date. Such a resource could assist by lessening the time needed in the initial contact period for teachers to gain a sufficient understanding of what the programme is about, to make informed decisions about how they might use it.

Fourthly, and consistent with the Newstead study, this case clearly showed the benefit of interacting with schools in which Inquiry-based learning models are the prevailing pedagogical approach, rather than having to spend time migrating teachers from teacher to student-centred learning models. There is a significant body of literature indicating the efficacy of student-centred learning models in science and general education (see Falloon, 2009), and it should not be seen as a primary role of Science-for-Life to educate teachers in Inquiry learning. Data from both case studies thus far, and from the series of specialist workshops (eg: GIS) held by the facilitator in schools and presently being developed into interaction descriptions, indicate that the greatest value Science-for-Life can provide is helping teachers with the science, not with the pedagogy. While it is important that Scion facilitators and scientists involved in the programme understand the basics of Inquiry models, they should not see it as their core business to teach this to teachers – to do so could cause interactions to 'bog down' and make little progress towards enhancing science learning.

Aligned to the issue of programme cost and long-term sustainability, it is recommended that the Scion facilitator commences the development of costing models which provide an indication of the monetary and personnel costs associated with running the programme. As one of the developing strengths (and appeals) of Science-for-Life is in the face-to-face support it provides, these models should be based on both the actual costs of organisation and facilitation (etc), and the 'opportunity' costs of having scientists involved who may have instead been working on other profit-making projects. It would also be an advantage to commence discussions with Scion management relating to these costs and how they see programmes such as Science-for-Life fitting in with their broader activities, to get their perspective on the longer term viability of the initiative. Such data would be valuable for broader decision-making if any such programmes were to be considered for national roll out.

Finally, in terms of the overall requirements of this project and to get a broader indication of the value of the concept, it is important that Scion 'cast its net more widely' and undertake interactions with schools of other types and at other levels. To date, two significant studies have been completed in primary schools and several more limited and specialised ones at secondary level, and while these have been reasonably successful, more substantial and longer-term collaborations need to be undertaken – particularly in secondary schools. In meeting the requirement of this programme to develop models of CRI-school interaction to support science education, and the costs associated with these, the base of data to draw upon in the final meta-analysis of case studies to develop these models, needs to be significantly wider.

6. References

Falloon G. 2009. *Key Issues in Science Education: A Literature Review.* Scion Report 46876. Rotorua: Scion.

Falloon, G., Helen, Dunningham, A., Bergin D., & Palmer D. 2010. *A study of a crown research institute school Interaction*: The Newstead experience. Scion output number 48295. Rotorua: Scion