

Darwin Education Initiative

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Evaluation of the Darwin Education Initiative

Full report to the Wellcome Trust

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Executive Summary

1 Introduction and Context

This report provides the findings from the final stage of the evaluation of the Darwin Education Initiative, undertaken by GHK Consulting, People Science & Policy Ltd and TNS-BMRB on behalf of the Wellcome Trust. The report provides the findings from follow-up interviews with case study schools which explored the continued use of the Great Plant Hunt and Survival Rivals materials. The main findings from the evaluation are provided in the previous interim report.

The aims and objectives of the evaluation, and a summary of the methodology followed, are provided in Section 1 of this report. Of specific relevance is the work with the 30 case study schools – ten primary and 20 secondary – who were contacted at three points during the study. The first contacts explored the schools' use of the Darwin Education Initiative materials and the benefits resulting for pupils and teachers, with the final contact exploring their continued use in the 2009/2010 academic year and potential future use.

The primary and secondary school materials are described in Section 2, with a summary of the findings of the first interim report. The materials produced were as follows:

- For primary schools – the Great Plant Hunt, delivered by the Royal Botanic Gardens (RBG), Kew, and provided to all 22 000 primary schools in the UK. This comprised:
 - The **Great Plant Hunt Treasure Chest** – containing curriculum-linked modular resources and activities, including ideas for thinking walks, identikits, magnifiers and seed presses, and resources to deliver in whole school, year or class assemblies such as a Darwin story book and a poster for displaying pupils' work;
 - A dedicated **website** – including downloads of the resources provided in each chest, and additional resources with a section which profiles the work done by schools; and
 - The opportunity to contribute to the **Millennium Seed Bank (MSB)** following guidance from a modern day plant hunter.
- For secondary schools – three separate experiments under the heading of Survival Rivals were provided by Philip Harris on a request-only basis, comprising:
 - **'I'm a Worm, Get Me Out of Here' (I'm a Worm)** – which focused on principles of natural selection and was targeted at ages 11–14;
 - **'Brine Date'** – which was targeted at ages 14–16 and used an experiment using brine shrimp to investigate sexual selection; and

- **‘The X-Bacteria’** – which used antibiotic resistance in bacteria to investigate horizontal gene transfer and was targeted at ages 16–19.

Each kit also provided written guidance, and a website with additional guidance was also available. Technical support for implementation was also provided by Philip Harris Ltd through a helpline facility.

The interim report found that good progress was being made towards the achievement of the objectives of the initiative, with evaluation evidence suggesting that:

- The materials had been successfully delivered to all primary schools in the UK, with at least one of the three Survival Rivals experiments being ordered by two-thirds of all secondary schools;
- The materials were widely considered to be high quality, appropriate for use with their intended pupil groups, flexible and adaptable and fitting well with the curriculum;
- Two-thirds of primary schools and 41 per cent of secondary schools ordering the materials reported their use in a survey undertaken as part of the evaluation, exceeding the target for use set at the start of the initiative;
- Use of the materials was resulting in a range of benefits and impacts for pupils and teachers; and
- Expectations regarding future use of the materials was high, both in the 2009/2010 academic year and beyond.

2 Study Findings

This stage of the study explored the extent to which the materials had continued to be used by the primary and secondary case study schools in the 2009/2010 academic year, and their likelihood of use in subsequent years. The previous contacts with the case study schools explored their expectations for future use of the materials, with a combination of firm, scheduled plans and more general expectations being reported. Twenty-six case study schools participated in the follow-up – nine primary and 17 secondary schools.

The Great Plant Hunt Materials

Six of the nine primary schools reported continuing to use the Great Plant Hunt materials in the 2009/2010 academic year, which compared well against the expectations for use established in the previous contacts. The flexibility of the materials was reflected in the patterns of use identified, which ranged from use with small groups of pupils to whole class and whole school activities.

The schools using the materials reported a similar range of benefits and impacts for pupils and teachers, with additional opportunities for hands-on and outside the classroom experiences being particularly welcomed. Use had

also extended to include the use of the materials alongside other 'environment'-based learning, such as Forest Schools and gardening clubs.

The primary schools not using the materials cited a number of reasons for this, including changes in the curriculum and resulting option choices by teachers, the loss of previous outdoor space and changes in teaching staff.

The use of the 'additional facilities' – namely the Great Plant Hunt website and the Great Plant Hunt Week – were found to be limited amongst the case study schools, despite the website being visited on 250 591 occasions and receiving 169 565 unique visitors between January 2009 and December 2010. The use of the additional support available to assist implementation was also limited, with this being an indication of the quality and comprehensive nature of the guidance provided with the materials.

Finally, seven of the nine primary schools considered that they would continue to use the materials in the 2010/2011 academic year and beyond, two of which had already scheduled their use into teaching plans. The two remaining schools were less clear of their intentions for future use, in one case due to the loss of their external space.

The Survival Rivals Materials

Here, ten of the 17 secondary schools contacted described using at least one of the Survival Rivals materials, with new experiments being trialled and the pupil coverage extending in many cases. The 'trial prior to wider adoption' approach identified in the Interim report appears to have been continued.

The I'm a Worm experiment continued to be the most commonly used, largely due to its simplicity, ease of use and flexibility, as well as the ease of acquiring replacement materials to allow it to be carried out repeatedly. However the other two experiments faced challenges to their use – notably the Brine Date experiment, where problems getting the shrimps to grow had put many teachers off attempting its use again. With The X-Bacteria the effort required for its use, and concerns over the capabilities needed to undertake it, had put some teachers off, although where it was used it was found to work well.

Where materials had not been used in the 2009/2010 academic year, changes in teaching staff, shortage of time to plan and deliver the experiments, and difficulties using specific experiments were the most commonly reported reasons for their use not being continued.

In common with the primary schools, very limited use was made of the telephone helpline by the secondary schools, which was again seen as an indicator of the quality and coverage of the guidance provided. Less positively, just one school reported participating in the Survival Rivals competition.

Finally, 12 of the 17 secondary schools reported planning to use at least one of the Survival Rivals kits during 2010/2011, and expectations for continued use beyond this were high.

3 Conclusions

The final interviews with the case study schools suggested that:

- Use of the Great Plant Hunt and Survival Rivals materials has continued in six of the nine primary and ten of the 17 secondary schools;
- The 2009/2010 academic year saw the continued use of materials and the introduction of new ones, often on an initial trial basis; and
- Many schools intend to use the materials in the 2010/2011 academic year and beyond, although as the final interviews illustrated, schools' plans for use may not always come to fruition.

As the previous interim report found, most teachers using the materials found them to be:

- Of a high quality – well researched, professionally presented and attractive to teachers;
- Easy to use – with both the content of the experiments and guidance to support their use being viewed extremely positively in the main, although experiences of Brine Date and to a lesser degree The X-Bacteria were more variable in the secondary schools;
- Sufficiently flexible to use in different circumstances and with pupils of different ages and abilities; and
- Capable of being re-used through the replacement of individual components, often sourced locally in the case of Survival Rivals.

The last follow-up interviews showed that as well as the early successes described in the Interim report, there is evidence of good progress being made towards the 'legacy ambitions' of the initiative, with a stock of resources being made available for teachers and continued impacts on practice being expected.

The Darwin Education Initiative has also provided a series of lessons for future initiatives of this nature. As the interim report described, these included: lessons for the planning and development of large scale education initiatives; the management of such initiatives; the effective communication and promotion of materials use within schools; and ensuring that materials leave a legacy of continued use.

The findings from the final study stage have provided further evidence of enablers and barriers to continued use. In terms of helping continued use, additional considerations include ensuring that:

- Awareness and use of the materials is distributed across all teaching staff;
- The design of the materials maximises the likelihood of the experiments working in schools with varying capability with regard to technical support;

- Any materials produced can be used with schools in different environments and with different resources; and
- All guidance materials are informed by actual use with schools, and that clarity is provided on the time required to undertake each experiment.

Finally, it appeared from the interviews that certain curriculum areas have few existing options for practical activities, which represent areas of unmet demand which could be addressed through interventions of this type. Consequently, preliminary research with schools to identify these gaps would add value to the development process.

1 Introduction

GHK Consulting with People Science & Policy Ltd and TNS-BMRB were commissioned by the Wellcome Trust to conduct an independent evaluation of the Darwin Education Initiative, between January 2009 and December 2010. This is the second of two reports produced, following the main interim report produced in February 2010, and provides an update on the degree to which the Darwin materials have continued to be used in 30 case study schools and the factors underpinning their continued use.

1.1 Study Aims and Objectives

The overall aim of the evaluation is to provide “*a good quality evidence base and recommendations to inform future large-scale projects on unrelated themes*”. This includes identifying transferable lessons to inform the development and implementation of similar future initiatives by the Trust, and to inform its approach to supporting schools more widely.

More specifically, the evaluation has a series of objectives which include:

- Developing a detailed understanding of how schools and teachers have engaged with the initiative;
- Exploring the outcomes and impacts of participation for teachers and pupils;
- Identifying the extent to which the initiative has built capacity and left a long term legacy – in terms of teachers’ abilities and confidence to teach evolution and related issues, and whether the materials produced will be used beyond Darwin Year; and
- Identifying the extent to which participation in the initiative has influenced teachers’ attitudes to the use of experiments in the classroom, and so had an impact on pedagogy.

The final stage of the evaluation, upon which this report is based, sought to contribute to these overall objectives by identifying the extent to which the Darwin materials had continued to be used in schools, based on a sample of ten primary and 20 secondary schools developed for the earlier stages of the study. The method used for this, and previous stages, is summarised below.

1.2 The Evaluation Methodology

The evaluation methodology has included both qualitative and quantitative techniques across a series of stages¹. Key elements of the methodology include:

- A scoping stage, featuring a series of initial tasks including a literature and practice review, initial interviews with the funder and delivery partners,

¹ A detailed description of the evaluation methodology is provided in the previous interim report.

and the development of an evaluation framework and implementation timetable.

- Interviews with a range of stakeholders, including key staff from the Wellcome Trust and each delivery partner, to explore the rationale for the initiative, progress with implementation, issues and challenges faced and views on impact and future development.
- Case study fieldwork with ten primary and 20 secondary schools across the UK² – featuring three phases of contact to examine the use of the materials, the benefits and impacts resulting, and the likelihood of their continued use, with:
 - Each school being visited in the summer or autumn terms of 2009, depending on the timing of materials use, featuring interviews with lead/other teaching staff and pupils, and where possible observations of lessons where the materials were being used;
 - A second contact in the subsequent term, featuring a visit to the school or a telephone interview with the lead teacher, to allow a more reflective focus on teachers’ experiences of implementation and of any support accessed; and
 - Telephone interviews in the autumn term of 2010 with the lead teacher in each school, to explore whether the materials have continued to be used, and to collect any final comments and reflections. In several cases the lead teachers had either retired or moved on to new positions, and attempts were made to re-contact those moving on to see if they were using the materials in their new schools.

The case studies also included the completion of questionnaires by pupils before and after the use of the materials, the responses from which were analysed in the interim report³. To encourage participation an incentive payment was offered to schools to participate.

- A telephone survey of schools – a snapshot telephone survey of 502 teachers in primary and secondary schools across the UK conducted between September and October 2009. The sample was randomised and comprised: 250 primary teachers, 202 secondary teachers in schools where materials had been ordered and 50 secondary teachers in schools where materials had not been ordered. The survey explored a range of issues, including experiences of the initiative, the extent to which and how the materials were used, the pupil groups they were used with, the benefits and impacts for pupils and teachers and likelihood of and plans for future use.
- Delivery Management Information Data – final monitoring data provided by the Royal Botanic Gardens (RBG), Kew, and Philip Harris – was

² The characteristics of the participating schools are provided as Annex I.

³ A small number of pre and post questionnaires have been received following the previous interim report. The additional 20 questionnaires received have not been analysed, although a review of the responses shows they are in line with the overall findings reported previously.

analysed to explore the number of secondary schools ordering the kits, and website and helpline usage.

This final summary report describes the findings from the final contacts with the 30 case study schools, which took place between September and November 2010 and featured completed interviews with 26 schools (nine of the ten primary schools and 17 secondary schools).

1.3 Report Structure

The remainder of the report is structured as follows:

- Section 2 provides an overview of the Darwin Education Initiative, and a summary of the findings of the main interim report;
- Section 3 explores the extent to which the Darwin Education Initiative materials have continued to be used amongst the case study primary schools;
- Section 4 explores the extent to which the Darwin Education Initiative materials have continued to be used amongst the case study secondary schools; and
- Section 5 provides our conclusions and recommendations for consideration around the planning and implementation of similar large scale educational initiatives.

The report also contains one Annex, setting out the characteristics of the case study schools and the timings of the evaluation fieldwork with each.

2 The Darwin Initiative and Previous Study Findings

This section provides an overview of the Darwin Education Initiative, and a summary of the key findings from the previous interim report.

2.1 The Darwin Education Initiative

2.1.1 Background, Aims and Objectives

The Darwin Education Initiative was developed as part of a programme of activities supported by the Wellcome Trust to celebrate the 200th anniversary of the birth of Charles Darwin and the 150th anniversary of the publication of *On the Origin of Species by Means of Natural Selection*.

A total of £3.3 million of Wellcome Trust funding was allocated to the initiative, which sought to make a series of Darwin-inspired experiments or practical enquiries available to every child of school age in the UK. The initiative also supported the Trust's wider objective of supporting public engagement and research activities which promote interest, learning and excitement about biomedical science and its impacts on society, as well as to the Trust's education programmes, which aim to stimulate interest in science amongst young people, and so increase the quality of young people entering biomedical related careers.

A series of age-appropriate and Darwin-inspired practical science experiments and materials were developed and distributed to primary and secondary schools across the UK. While the initiative aimed to 'reach every child' more realistic targets were set to involve at least 25 per cent of all UK primary and secondary schools, with an emphasis on schools not typically participating in other science 'enhancement and enrichment' activities. The specific objectives of the initiative included:

- Helping young people to see the link between Darwin's ideas, modern evolutionary principles and contemporary biomedicine; and help teachers to teach, and young people to understand, the parts of the UK curricula relating to Darwin, evolutionary biology and its applications;
- Increasing understanding and awareness of the principles of evolution, and of Darwin's contribution to modern science, amongst young people, teachers, and wider society;
- Providing opportunities for young people to undertake 'real' experiments, rather than simply taking part in demonstrations or simulations, and to provide an enjoyable and memorable experience for pupils and teachers;
- Providing a quality continuing professional development activity for teachers that enables delivery of the main enquiries and builds capacity to teach science and evolutionary principles in future years; and
- Leaving a legacy beyond the end of the initiative, including the capacity to continue to carry out practical enquiries, use new equipment and teach evolutionary concepts.

2.1.2 The Great Plant Hunt and Survival Rivals

Two sets of materials were developed for the initiative, comprising:

- For primary schools – the Great Plant Hunt, which was delivered by the Royal Botanic Gardens (RBG), Kew, and provided to all 22 000 primary schools in the UK.
- For secondary schools – three separate experiments grouped under the heading of Survival Rivals, provided by Philip Harris on a request-only basis.

In both cases Guardian Professional also provided support in terms of marketing and the design and on-going development of the respective websites. In each case the materials included guidance notes for teachers, technicians and for pupils, and were designed to support continuing professional development for science educators. Extra support was also made available through a range of means, including through the Science Learning Centre Network in England and Science Centres in Wales, Scotland and Northern Ireland.

Following comprehensive development and piloting stages, the final materials made available to schools were as follows:

- The **Great Plant Hunt (GPH)** element of the initiative comprised three main elements:
 - The **GPH Treasure Chest** – which contained curriculum-linked modular resources and activities targeted towards primary school children in Years 1–6 (and their equivalents in Northern Ireland and Scotland).⁴ This chest included ideas for thinking walks, identikits, magnifiers and seed presses, as well as resources to deliver in whole school, year group or class assemblies such as a Darwin story book and a poster for displaying pupils' work. The materials were designed to be used flexibly, either as stand alone or one-off activities or as part of more structured programmes of learning;
 - A dedicated **GPH website** – including downloads of the resources provided in each chest, and additional resources with a section which profiles the work done by schools; and
 - The opportunity to contribute to the **Millennium Seed Bank (MSB)** – following guidance from a modern day plant hunter, pupils were encouraged to collect and submit seeds to the MSB.
- The **Survival Rivals (SR)** element comprised three experiments targeting different secondary pupils, made available to secondary schools on request:

⁴ For consistency, all numbered school years in this report are given as per the English and Welsh system; so classes in Scotland or Northern Ireland are referred to as the year the pupils would be in if in England or Wales.

- **‘I’m a Worm, Get Me Out of Here’ (I’m a Worm)** – which focused on principles of natural selection and was targeted at ages 11–14;
- **‘Brine Date’** – which was targeted at ages 14–16 and used an experiment using brine shrimp to investigate sexual selection; and
- **‘The X-Bacteria’** – which used antibiotic resistance in bacteria to investigate horizontal gene transfer and was targeted at ages 16–19 (and which could only be ordered by schools and colleges that teach this age group).

Each kit also provided written guidance, and a website with additional guidance, games and videos was also available. In addition, technical support for implementation was provided through a helpline facility provided by Philip Harris Ltd.

In both the primary and secondary materials, the experiments and practical activities were designed to be as straightforward as possible, and with comprehensive guidance and support, so they could be used ‘straight out of the box’ by pupils and teachers.

2.2 Key Findings from the Interim Report

The previous interim report provided the main findings from the study, based on a quantitative telephone survey of 502 teachers in primary and secondary schools and a programme of case study fieldwork with 30 schools (ten primary and 20 secondary). The findings are summarised below.

2.2.1 Levels of Take-up and Use

The primary schools received their materials between March and May 2009, and by January 2010 more than two-thirds of the secondary schools had received at least one of the three experiments available to them.

The vast majority of teachers responding to the telephone survey and interviewed in the case study fieldwork considered that the materials provided were: of a high quality and wholly fit for purpose; accessible, practical and user friendly; flexible and adaptable; and fitted well with the curriculum.

The telephone survey findings suggested that the level of use of the materials was high. Two-thirds of the primary schools reported their use, and of the 66 per cent of secondary schools ordering the materials 41 per cent also reported their use. This level of use at the time of the survey exceeded the 25 per cent use target set for the initiative at the outset.

While use of the respective websites was high, this appeared to be mainly by teachers to access guidance materials, rather than for more ‘in-depth’ engagement (e.g. uploading photographs) or use by pupils.

2.2.2 How the Materials Were Used

The materials were used differently across the schools, often being ‘triallyd’ with a small group of pupils or a single class before being used more widely, and with schools being at different points between ‘triallyd’ and wider adoption.

The materials also demonstrated their flexibility of use from the outset, with both sets of materials being used with different pupil or year groups, in different settings and, in some cases, being adapted for use in other curriculum areas.

The teachers using the materials reported few challenges, emphasising the effectiveness of their design in making use as straightforward as possible. This was reflected in the level of use of the additional support available for both sets of materials, which was very limited at the time of the first report. The main challenge reported across the schools was related to the Brine Date experiment, where difficulties were experienced in many cases in growing the brine shrimp.

It appeared that the main issues affecting levels of use at the time of the last report were less about their suitability and more related to schools’ abilities to include their use in plans of activity for the year.

2.2.3 Impacts for Pupils and Teachers

The evaluation identified a series of positive benefits and impacts for pupils and teachers as a result of their use of the materials, even when their use had been comparatively recent. The benefits identified included:

- For pupils – while the pre and post questionnaires from the case study schools suggested that the benefits for pupils centred on enjoying the use of the materials, and less on improved knowledge or changed attitudes to science, teachers more widely reported:
 - Enhanced enjoyment of and engagement with science lessons; and
 - An increased understanding of science.
- For teachers – both the qualitative and quantitative fieldwork suggested that the use of the materials had led to impacts on:
 - Their teaching practice – either by introducing new approaches to practical sessions or changing their previous approach;
 - Their confidence in undertaking practical sessions – with over half of both primary and secondary teachers reporting an increased confidence in this area; and
 - Their knowledge of evolution and evolutionary principles – with almost 60 per cent of survey respondents highlighting this benefit.

Finally, the teachers were almost unanimous in their view that the materials had the potential to support the teaching of the science curriculum in the longer term.

2.2.4 Expectations for Future Use and Legacy Effects

Consequently, teachers' expectations around the future use of the materials were strongly positive, both amongst those who had already used the materials and those yet to use them in the classroom. It appeared that the key factors in their future use included:

- The extent to which the materials linked to the curriculum, and that these links were explicit;
- The degree of support for their use from headteachers and members of the school senior management team;
- The capacity of teaching staff to both plan for and deliver practical sessions with their pupils;
- The ease with which replacement or new materials could be acquired; and
- The costs associated with repeating any of the experiments.

As suggested previously, the timing of the arrival of the materials in schools was found to be a key factor in their initial, and continued, use. While different views amongst teachers emerged on the most appropriate time for the delivery of such materials in the future (with spring being the most commonly suggested, either to allow planning for the following academic year, or to take advantage of flexibility in the summer timetable), the likelihood of use was likely to be higher if teachers were aware of the materials prior to their arrival, and so could put appropriate plans in place in advance.

2.2.5 Areas for Exploration in the Final Fieldwork

The final stage of the study comprised final telephone contacts with each of the 30 case study schools, to identify the extent to which the materials had continued to be used and the likelihood of their use continuing beyond the 2010/2011 academic year. This also included identifying:

- Whether the ambitions for further use reported in the previous contacts were realised – if so what were the resulting benefits, and if not what were the reasons for non-use;
- Whether use of the materials had 'spread' in the case study schools – in terms of the specific materials used, the pupil groups/classes they were used with, or their adoption by a wider range of teaching staff; and
- Whether the case study schools expected to continue to use the materials in the future, beyond the 2010/2011 academic year, and if not why not.

3 Continued Use – Case Study Primary Schools

This section explores the extent to which the Darwin materials have continued to be used by the case study primary schools in the 2009/2010 academic year, and are expected to be used in the 2010/2011 academic year and beyond.

3.1 Introduction

The previous interim report described how expectations of continued or future use of the Great Plant Hunt materials amongst the primary school population were very high, with the telephone survey identifying that 99 per cent of schools responding were very (66 per cent) or fairly (33 per cent) likely to use the materials in future. Similarly nine of the ten case study primary schools described the intention to use the materials in the 2009/2010 academic year, although just one had firm, scheduled plans for future use in place.

Nine of the ten case study primary schools were re-contacted in the autumn term of 2011 to explore whether these ambitions for continued use had been realised. In the remaining case study primary school the previous lead teacher had been promoted and was no longer able to participate in the study.

The continued use of the materials, and the key factors influencing any continued use, are described below.

3.2 Continued Use of the Great Plant Hunt Materials

Six of the nine primary schools contacted reported that they had continued to use the materials since the last contact. In addition, in one school where use had not continued and the lead teacher had moved to a new school, the teacher was re-contacted and described developing plans to use the materials in her new school in future.

This compares well against the expectations for use within the 2009/2010 academic year described previously, with use against expectation being summarised in Table 1 below. As the table shows, although most of the schools expressed the broad intention to use the materials again by the end of the 2009/2010 academic year, none reported having firm, scheduled and committed plans for use in place. The 'continued users' also included one school which had no expectations regarding the continued use of the materials at the last contact.

3.2.1 Nature of Continued Use

The Great Plant Hunt materials had continued to be used in the 2009/2010 academic year with six of the nine case study schools re-contacted, with a range of pupil groups and in different circumstances.

The Great Plant Hunt materials have continued to demonstrate their flexibility through their use with different pupil age groups, and in small group and

whole class/whole school situations. They have also been used as discrete practical sessions. Table 1 summarises the reported use since our last contact with the schools.

Table 1: Summary of Use of Great Plant Hunt Materials in 2009/2010 Academic Year

School	Plans for Use in 2009/10	Summary of Plans	Use in 2009/2010 Academic Year
1	Yes	No firm plans – opportunistic use with combined Year 3 and 4 class.	The plant press, the viewers and the information pack with the seeds have been used with Year 4 pupils, with activities including looking at how seeds are transported. The materials have been adopted as part of a suite of practical materials – <i>“it’s definitely become mixed in with what we use for our nature studies and so on”</i> .
2	Yes	No firm plans, but hope to use as part of Great Plant Hunt Week, and as part of a day trip away from the school, involving other teachers in materials’ use. Any use will be across four mixed age classes.	The materials have continued to be used across the school and with specific pupil groups. Use is still constrained to a single teacher, with the box being kept in the corridor for children to access. The content of the box has extended, with more books on gardening and bird watching, and a pair of binoculars, being added. The materials have been used in assemblies, with Darwin’s footsteps being used and a thinking walk undertaken. The materials have been used by the lead teacher in her role as the eco-schools coordinator, and a ‘green group’ has been established looking at the green agenda, citizenship and gardening, including developing a garden to explore the benefits of growing food, which was linked to work on World War 2 and food shortages.
3	Yes	No firm plans – but hope to continue to use online and other resources.	Used on a highly flexible basis with all pupil year groups. The materials have been dipped in and out of during the year, and different parts of the kit are being used with different classes.
4	Yes	No firm plans, other than to use the materials as a context for practical sessions across all school years, and involving additional teachers in their use.	Used with three year groups. The materials (including identikits and the book) were used by a number of teachers across the school in the spring and summer terms, when pupils were learning about plants and new growth. This included identifying parts of the plant and looking at plant reproduction.

5	No plans	No plans.	Despite having no plans to use the materials again, they have been used with pupils in each year in single class and whole school approaches. The materials were used in the summer with three new teachers to count the plants and wildflowers around the school grounds, using the identikits. Some classes used the press for samples to label. Every class went to different places in the grounds and reported their findings through sharing assemblies and by classes linking. A whole school approach was followed for the Great Plant Hunt Week, and the materials were used to support a number of curriculum areas, including habitats, looking at plants, conditions for growth and living things.
6	Yes	No firm plans, but looking at cross-curricular links, continued use with Years 5 and 6, introducing the materials across Years 3 and 4, and extending use with other teachers.	Used with Year 5 and 6 pupils. Materials have continued to be used by a single teacher, no extended use. Have used the identikits in the garden and planted some seeds – although not the ones from the kit.
7	Yes	Plan to use in summer term, hoping to link with outdoor element of curriculum for excellence.	Not used in 2009/2010 academic year.
8	Yes	Plans to extend use but no firm plans.	Not used in 2009/2010 academic year.
9	Yes	Firm plans for use with Year 6 pupils and a whole school approach around 'growing and cooking'.	Not used in 2009/2010 academic year.

The table also shows how the Great Plant Hunt materials had been used to support a range of additional activities – including extra-curricular activities and in those with Forest School status.

Use of Great Plant Hunt Materials Linked to Other Activities

A number of primary schools have used the Great Plant Hunt materials to support the delivery of lunchtime and afterschool activities, as well as linked to other topic areas, such as Forest Schools, Eco Schools and Gardening Clubs. As one head teacher explained:

“The materials can be used to support many areas in the school – and have been used by the school gardening club. One of the teachers is training for Forest Schools and the use of the kits links well to the concept – using the local environment and being aware of what is there and to look after it”.

Another school explained that they have just received Forest

Schools status, and have tied the use of the materials to activities undertaken as part of this status.

A number of schools have used the materials with children who are involved in their gardening clubs, and cited positive links to other initiatives providing materials for school gardening activities such as the Morrisons Let's Grow Scheme. One school mentioned they plan to use the identikits with children next summer to undertake a survey of the plans within the garden.

One school have placed the treasure chest within the corridor which all children, especially children who are part of the 'Green Group', can access. The lead teacher using the materials is the Eco Schools Coordinator, and the Green Group undertakes activities which are linked to environmental topics, including green issues, citizenship and gardening. In addition, the teacher has added materials to the box, including binoculars and additional gardening and bird watching books.

3.2.2 Benefits and Impacts from Continued Use

The experiences of the case study primary schools continuing to use the Great Plant Hunt materials provided additional evidence of the positive benefits and impacts resulting for pupils and teachers. The benefits reported reflected those described in the interim report, as summarised below.

Benefits to Pupils

The interim report described how the use of the Great Plant Hunt materials by teachers in the case study primary schools had provided a number of benefits to pupils. These included inspiring pupils and increasing their engagement with science, contributing to their understanding of science and, perhaps most commonly, contributing to their enjoyment of science teaching and practical activities both in and away from the classroom.

The subsequent experiences of the primary schools continuing to use the materials reinforced these findings, and provided additional examples of how their influence was both helping to provide opportunities to participate in practical sessions in and outside of the classroom, as well as creating links/supporting learning across different curriculum areas. Examples included:

- The activities continued to provide pupils with the opportunity to participate in practical and hands on activities, and so enable pupils to *"learn as they do"*. As one teacher described: *"Seeing science in action is a stimulus, it helps to engage and reinforce. It helps children to try and sort it out in their head"*.
- Participating in activities outside of the classroom, introducing children to the outside environment and teaching them to respect the environment. One teacher said that working outside the classroom had helped *"teach the children about being aware of what is there and to look after it"*.

- The Darwin's Footsteps book and many of the suggested activities were used in several schools to link different curriculum areas – including science, history, geography and English – and so allowed pupils to experience and understand these links through practical experiments. For example, the Great Plant Hunt covered both art and science, as it enabled pupils to use different science equipment, such as microscopes and viewers, as well as learn the skills appropriate to use keys, and sketch and annotate flowers they had found.

Benefits for Teachers

The interviews with teachers also identified a similar range of benefits to those stated in the previous report, with examples including:

- One lead teacher, who reported in the last contact that the materials had been particularly useful in teaching evolutionary principles, described how she had subsequently shared the materials with other teachers. She had identified that several of her colleagues were less confident of teaching in this area, and that the subject was particularly complicated to teach to young children. The materials had been very useful in challenging this view, and had provided simple solutions that had been more widely adopted and were likely to continue in future.
- Many teachers reiterated that the materials had enabled them to see and experience the benefits of teaching outside of the classroom. One teacher suggested using the Great Plant Hunt materials *“has opened my mind to use the outside more – it got me out and let me see the possibilities”*.
- The materials also inspired teachers to undertake a range of new activities, which would be unlikely to have taken place otherwise. Aligned to undertaking more teaching away from the classroom, a number of teachers made particular reference to the Thinking Walks. One teacher described how *“the book emphasised them and we have been out on a Thinking Walk – which is not something I would have done normally”*. Another teacher said that *“the plant press is something I wouldn't have done, but having the pack has given us new ideas to use, and the children enjoyed using it”*. In another case a teacher found the Great Plant Hunt useful for setting challenges for pupils to search for specific plants in their own communities.
- The materials were also considered to have raised the profile of 'environmental issues' more broadly within the schools. As one early and continued user described: *“We started before the chest came in. We have managed to raise the profile of the environment, how to look after the environment, and as a whole school we had Darwin Assemblies and the children were plant detectives. The whole school approach was effective, we invested in it further and the staff were behind it”*.
- Some teachers found the materials helpful to 'dip in to' and use to supplement existing lessons, existing ideas or to support other activities happening within the school such as Eco Schools, Forest Schools and Gardening Clubs. This also highlights the versatility of the materials.

The benefits realised for teachers using the materials to date inevitably influenced the likelihood of the materials continuing to be used across the 2010/2011 academic year and beyond. However, a commonly reported longer term benefit was an increased confidence amongst the teachers to use the outdoors and to use practical approaches during teaching more broadly. For many teachers, the materials have provided ideas to undertake activities outside, or to undertake more practical based sessions to teach children topics such as seed dispersal.

3.3 Schools Not Using Since Last Contact

At the time of the previous interim report, all but one of the case study primary schools described the intention to continue using the Great Plant Hunt materials in the 2009/2010 academic year. As the text above describes, six had continued to use the materials, although these ambitions had not been realised in the remaining three schools. The reasons why use had not continued are reviewed below.

As the previous report established, the vast majority of schools, and each of the case study schools, considered that the Great Plant Hunt materials were of good quality, fit for purpose and sufficiently flexible to be used with different pupil groups and in different circumstances. These views had not changed, and so it was clear that the basic quality of the materials did not have an adverse impact on continued use in the short term.

Instead a range of factors were found to have influenced the continued use of the materials in the 2009/2010 academic year, as described below for each case study school:

- In one school in Scotland the decision was taken to follow topics under the new Curriculum for Excellence which were not related to plants, and so use of the materials had not continued into the 2009/2010 academic year. While the school could well use the Darwin materials again if appropriate subject areas were selected, the two teachers who championed their use initially have since retired, which the teachers interviewed considered would make the materials' future use less likely.
- In the second school a large construction project has begun, which means they have lost the outdoor space previously available to them where the materials had been used initially. A decision was taken to postpone any continued use until the construction work is completed (which could be as long as 12 months in the future).
- In the third school a change in teaching staff also influenced the continued use of the materials. After using the materials intensively and holding a Darwin week soon after the materials were received, the lead teacher left the school and the materials "*went on a shelf*" and had not been used since. In the final interview the headteacher described how the former lead teacher had discussed the materials with a Year 6 teacher, who had looked at them and used the powerpoint presentation and some other ideas with his class. However, this teacher has also left the school and it is not clear whether there are plans to use the materials again. Ironically,

this school reported the most advanced plans for the use of the materials in 2009/10, with a schedule of use not being taken forward following the lead teacher's departure.

The former lead teacher was contacted at her new school and described that she was highly likely to use the materials in her new role. She had taken copies of the key documents with her from her former school, which was fortunate as she had not seen any evidence of the box in her new school.

So while the sample of schools not using the materials since the last contact is small, and showed a range of factors which had contributed to no further use, the role of the lead or champion teacher in ensuring sustained use is clear. As the previous interim report described, use of the materials was often 'championed' by a single teacher, and if ownership was not more widely distributed it could limit wider and sustained use.

3.4 Use of Additional Facilities – the Great Plant Hunt Website and Great Plant Hunt Week

The degree of engagement with and use of the additional facilities and services available for primary schools – namely the Great Plant Hunt website, Great Plant Hunt Week and the additional support with planning and implementation – was explored during the final contacts.

3.4.1 Use of the Great Plant Hunt Website

The previous interim report showed that the website received a total of 156 633 visits in the period between January 2009 and January 2010. A total of 250 591 visits were recorded to the end of December 2010, 169 565 of which were unique visits. The use of the website had focused primarily on the collection of information and guidance, with more in-depth engagement being rare, with over 2600 schools registering but only around one in ten of these uploading photographs. In the final fieldwork each of the case study primary schools were questioned on their use of the website since the last contact with the evaluators.

Just three of the nine primary school case studies reported using the website between the initial contacts and the last, each of which also reported using the materials over the same period. In each case the use of the website had extended beyond sourcing information and guidance to a more 'active' form of engagement, as described below.

Continued Use of the Great Plant Hunt Website

The three case study primary schools reporting continuing to use the website did so as follows:

- One school described using most of the functions of the website – starting with collecting guidance and progressing to uploading materials and using games with pupils. He found the website "*so clearly organised, and it is really good to aid*

independent learning – it is easy for the children to use". The teacher found the video clips to be particularly useful, and gave the example of teaching a Year 4 class about micro habitats where he was able to use the video clips as a visual aid in the lesson. As with many others he did not use the teacher resources on the website as he felt confident in his use of the materials, although he felt it was good that they were there for teachers to use if needed. As he described: "*The materials and the website are so good that I have promoted their existence to the Royal Society as good practice of materials and websites which successfully engage children in science*".

- In a second primary school, the teacher reported being particularly impressed by the games on the website and their effect on his pupils, and plans to use it again in future. As he described: "*I used the games – I love it, there were a couple of times you couldn't get onto it because they said it was being updated. I haven't used them since September because I have been in a new class, but I plan to do it. The children were excited about the games*". The website was also considered have something for pupils from all years, with the infant group being particularly enthusiastic, and the website was considered to be "*too good to be wasted and not used*".
- In the third school the teacher reported registering with the website and receiving the newsletter, which she reads and passes on to the school's science coordinator (who is currently on maternity leave). Their use of the website seems restricted to receiving outgoing communications, and they have not loaded a profile of their work, mainly due to the lack of time to do so.

For the remaining six case study schools, website use had either never taken off or had fallen away following an initial examination of its content. However, in two cases limited further use appeared to be linked to issues with 'technology':

- Teachers in one school, which had not continued to use the materials, described how they had tried to use the website but the school computers experienced a problem with Flash Player. This meant that the games they were trying to access did not load properly, and in the end the teacher 'gave in' and did not use the website again. While the teacher acknowledged that the 'technology problem' experienced was internal, she said: "*I think teachers are so busy, if it works it's brilliant and they will use it again, if not it will fly out of their mind and they won't go back to it. I didn't go back to the website*".
- In a second school, which remains a frequent user of the materials, frustration was also expressed with the website. Having been very enthusiastic about it in the last visit, they were disappointed by their experiences of accessing different areas only to find they were "*not*

working or being maintained” when they sought to use it. As a result the website is now used very rarely, and as one teacher described “... the games were not working when I last looked... I haven’t bothered with it at all this term”.

3.4.2 Participation in the Great Plant Hunt Week

The primary schools were asked about their involvement in the most recent Great Plant Hunt Week, which took place in May 2010. Just two of the case study primary schools reported having an active involvement in the 2010 Week, both of which followed whole school approaches and submitted pictures to the website. The experience of one school is described below.

Participation in the Great Plant Hunt Week

One school located in a deprived area mentioned in the second round of fieldwork that they had no firm plans to use the Great Plant Hunt materials in the future. Previously the school described participating in the Great Plant Hunt Week, where they followed a whole school approach, and identified a number of positive benefits. These included becoming more aware of the opportunities for and benefits of teaching outside the classroom, and the extent to which the children enjoyed the activities, and decided that they would like to incorporate the materials into their teaching practice.

In the last contact the head teacher explained how the school had also taken part in the second Great Plant Hunt Week. They had recently recruited three new teachers, who had not used the materials before, and the Week allowed them to become familiar with the different components. During the Week each class explored different areas of the school grounds, counted the plants they found using the identikits, and used the plant press to press samples of the flowers found before labelling them. The activities gave the children an opportunity to use microscopes for the first time, experience using keys, and using IT to look at photographs they had taken on their return to the classroom. The children reported their findings to each other through sharing assemblies, and more informally by classes linking together.

The head teacher explained how the Great Plant Hunt Week supported a number of curriculum areas across the various year groups, including habitats, looking at plants, conditions for growth and living things, while the activities involved exploring outside. The Week and the use of the materials also provided a good opportunity to work on a cross-curricular basis (IT, science and using the natural environment), and allowed the children to learn in their local environment; use new science equipment (such as the microscopes); make links to IT (using the computer to look at their photos); and sketch what they had seen.

In the remaining primary schools engagement with the Great Plant Hunt Week was limited for a number of reasons, including:

- Variable or limited awareness – with one teacher describing only finding out about the Great Plant Hunt Week after the event;
- Timing – with one school describing how the Week fell during their half-term break; and
- Prioritisation – in one school which had participated in the previous year and felt there was little more they could add, and in the second where the teacher would have liked to participate but the school had other priorities.

3.4.3 Use of Additional Support

Finally, none of the case study primary schools reported making use of the additional support available to help them use the Great Plant Hunt materials. The demand for, and use of, additional support was found to be minimal in the interim report, and so while all but one of the primary schools were aware of the additional support available none had made use of it since the previous contact. Indeed, each of the schools felt that the additional support was not necessary, with the guidance provided being perfectly adequate and the kit itself being straightforward to use. Both of these aspects were seen as strengths of the materials, with their simplicity and ease of use continuing to be a key factor in their adoption.

Consequently none of the primary schools were able to identify any areas where additional support would have been helpful. As one teacher described: *“To be honest, if I needed to use the phone then I wouldn’t do it – too much time”*.

Two schools did report using additional materials, although in both cases this was to enhance their use rather than address any issues:

- In one school the lead teacher described using the Natural History Museum website and the Darwin Voyage, as well as the RBG, Kew website, with the Natural History Museum website being used alongside reading the book to pupils.
- In the second school additional books and pictures of plants downloaded from the internet were used to supplement the Great Plant Hunt materials. The teacher described using the additional materials *“partly because we could have done with some more of them – as with anything like that you tend to need a class set or about 16”*.

Finally, one teacher made a broader point and considered that having a teacher trained – or someone that went around to schools with the box – would have been useful in broadening awareness and engagement with the materials. Based on her experience of other education initiatives, she suggested that having an INSET day on the use of the materials and how to deliver them to the children would be helpful: *“I had an INSET day on Fair Trade, the environment and on citizenship and you come back enthused – it gives you a new lease of life for that area”*. The teacher also considered that

more could have been done to establish a 'community of interest' or a discussion forum for participating teachers: "*Teachers can be insular at times, and they don't have time to share good practice and make links to share ideas with other schools*".

3.5 Plans for Continuing Use – 2010/2011 and Beyond

Having established the most recent patterns of materials use amongst the case study primary schools, their plans for using the materials into the 2010/2011 academic year and beyond were investigated. Of the nine primary schools:

- Seven considered that they would use the materials in the 2010/11 academic year – two of which had already made arrangements and scheduled use into the year:
 - In one case the materials will be used across each year group to cover plant growth, with teachers being given the latitude to use the materials as they consider most appropriate. The current 'lead teacher' has a new class this year, and has been teaching Year 6 pupils, so has not used the materials as much as previously, although they have been used on a continuous basis elsewhere in the school.
 - In the second the school plans to continue to use the materials in a similar manner and with the same Year 4 target group as the previous year. Use is also planned as part of the school's foundation studies on plants and nature, which will include growing plants and using the press, viewers and identikits.

In the remaining five schools plans for use were less clear, with the intention to use the materials being expressed but the detail of when, how and with which pupil groups being less clear. For example:

- One school described planning to continue to use the materials in a flexible, fluid and creative way, seeing the materials "*as a toolbox of resources to draw on in the future ... continuing to use the box as storage but also as a tool to aid learning – for example, creating plays around the box and getting pupils to come up with ideas about what Charles Darwin would have used the box for*".
 - A second school described having several ideas they would like to pursue this year, including using the identikits with the school gardening club to do a survey of plants, and the other materials alongside the habitat topic for Year 5 and 6 pupils in the summer. They also hoped to extend the use of the materials within the school, including with the lower years linked to Forest Schools. The school has recently been awarded the bronze Eco School award and is working towards the silver, which includes bio-diversity. As the lead teacher on this also leads the bio-diversity and gardening group, it is highly likely the use of the materials will continue.
- The remaining two schools were less clear on their use of the materials in the coming year – as described previously one school has lost its outside

area due to a large construction project, and a second school in Scotland is following a curriculum that does not feature plants and the two lead teachers have recently retired. While the first school considered that the materials would be used again once the construction work was complete, the second school felt that the future use of the materials was unlikely.

Few challenges were expected in the use of the materials in the current year, with the teachers continuing to emphasise that their ease of use made them more likely to be used again in future.

3.6 Key Success Factors

Finally, the case study schools were invited to look back over their experience of the Darwin Education Initiative, and the use of the Great Plant Hunt materials, to identify what had worked well, what had worked less well, and what might represent key success factors for initiatives of this nature.

3.6.1 Worked Well

The schools reiterated many of the points raised in the interim report regarding the quality, appropriateness and ease of use of the Great Plant Hunt materials. Indeed, several struggled to identify what single elements had worked particularly well; as one teacher in a continued use school stated: *“It all worked well ... it was brilliant”*.

More specifically the teachers continued to make reference to:

- The high quality and professional appearance of the materials. As one teacher described: *“The box was amazing – it was so nicely packaged I thought I should use it. If it came in a bag, I probably wouldn’t have used it”*;
- The ability to use the materials ‘straight out of the box’ – with clear guidance and instructions for their use, and not requiring additional time or additional resources for their use;
- The clear links between the materials and the curriculum, which helped the teachers identify where the materials could be used in a supportive role;
- The clear suggestions for use with different age groups, with, for example, the activities suggested in the Darwin’s Footsteps book being particularly easy to implement; and
- Finally, the extent to which the materials were ‘child-centred’ in their design, which contributed to the children commonly enjoying their use, and particularly by encouraging use outside of the classroom.

3.6.2 Worked Less Well/Areas for Improvement

Few examples were identified where the materials were felt not to have worked well, with many teachers being unable to suggest any areas which could be improved.

Two points were raised in terms of potential improvements for the future:

- The first related to having sufficient copies of the materials to use with large or whole class groups. A couple of teachers stated that the limited numbers of items in each kit made use on this scale more difficult, although others described making copies of the identikits or purchasing additional seed samples for whole class use. Fewer appeared to be aware of the opportunity to download copies of the materials from the Great Plant Hunt website, which would have been useful where copies had been lost or taken by teachers when they moved to other schools.
- The second related to the timing of the materials' delivery and the most appropriate time for them to arrive to allow teachers to plan for their use and maximise the benefit of potential curriculum links. However, as the previous report described, views varied on the most suitable time for the materials to arrive. Most considered the materials had to be with the schools well in advance of September if they were to be used in the next academic year, with delivery in April/May being the most commonly suggested to link with annual planning cycles. Others felt that a September delivery could catch teachers when they were refreshed from the summer break, and more open to new ideas. Finally one head teacher reflected that *"there is never a good time. If materials are aimed to be used in the summer, receiving the information in the autumn is useful. If they are to be used in the autumn, it would be good to receive them in the summer – but not at the end of term because the schools are busy"*.

3.6.3 Key Success Factors

Drawing from the reports of what worked well and the things that encouraged use of the Great Plant Hunt materials, we would summarise the key success factors for an initiative like this as follows:

- The materials must be easy to use;
- Professionally produced materials are attractive and pique teachers' interest;
- Materials must be flexible enough to be used both 'straight out of the box' for less confident teachers or those under greater time pressure, and as stimuli for more confident teachers or those with the scope to develop more in-depth activities;
- An engaging and accessible topic is important. References were made to the ease of associating with both Darwin and local plants; and
- The capacity to stimulate outdoor activities has been very important in this instance.

4 Continued Use – Case Study Secondary Schools

This section explores the extent to which the Darwin materials have continued to be used by the case study secondary schools in the 2009/2010 academic year, and are expected to be used in the 2010/2011 academic year and beyond.

4.1 Introduction

Expectations for the continued use of the Survival Rivals materials throughout the 2009/2010 academic year were high at the time of the previous interim report. Of the 20 case study secondary schools, all but four reported expecting to use at least one of the three Survival Rivals experiments during the year. Several of the 16 'expected users' also described using a combination of experiments, with five describing plans to use all three experiments over the course of the year.

As with the primary schools, the secondary schools described a combination of firm plans (with detail of the groups the materials would be used with, and when and how they would be used) and more general intentions. The final telephone interviews with the case study schools allowed the achievement of these firm plans and more general expectations to be explored.

A total of 17 of the 20 case study secondary schools were re-contacted in the autumn term of 2010 to explore their use of the Survival Rivals materials. In one of the other three schools, the lead teacher had been promoted to a pastoral role, was doing less science teaching, and was no longer using Survival Rivals, which had not really been embedded with other teachers. In the other two schools one lead teacher was on long-term sick leave (and it appeared that no-one else had taken the use of the materials forward) and in the third school repeated attempts to contact the previous lead teacher were unsuccessful. Of the 17 achieved contacts, nine reported using one or more of the Survival Rivals experiments since the previous contact, as described below.

4.2 Continued Use of the Survival Rivals Materials

Of the 17 case study secondary schools contacted, 13 described expecting to use the materials in the 2009/2010 academic year at the time of the interim report. As with the primary schools, the secondary schools' plans had developed to varying extents, with two describing firm and scheduled plans for use, while others described ambitions to use the different experiments with different pupil groups and in different contexts.

Table 2 below summarises the expectations of use, and the extent to which they were realised or exceeded, as identified in the final interviews. In the three schools where interviews with teachers were not achieved, two of the three considered that future use was only 'possible' or unlikely, although the third school described plans to use all three sets, building on their previous experience.

The reasons for non-use amongst the case study secondary schools are explored in Section 4.4 below, after the experiences of the continued users, the benefits achieved and challenges faced, are described.

4.2.1 Use of the Survival Rivals Materials in the 2009/2010 Academic Year

Of the 17 case study secondary schools contacted, ten reported continuing to use one or all of the Survival Rivals materials in the 2009/2010 academic year. As perhaps would be expected, each of the ten schools described intending to continue to use the materials in the last contact – including two with particularly well developed and scheduled plans for use. This also compares well to the numbers expecting to use the materials, although in three cases these previous plans were not realised (the reasons for which are explored in Section 4.4).

Table 2: Summary of Use of Survival Rivals Materials in 2009/2010 Academic Year

School	Plans for Use in 2009/2010	Summary of Plans	Use in 2009/2010 Academic Year
1	Yes	The X-Bacteria will continue to be used, Brine Date if can get colony to grow.	The X-Bacteria continued to be used, and Brine Date used for the first time with sixth form students.
2	Yes – firm and scheduled plans	Using all three experiments – The X-Bacteria with a Higher class, Brine Date and I'm a Worm with a Higher class.	All three experiments continued to be used – I'm a Worm with S2, Brine Date attempted with S3 and The X-Bacteria with Higher and Advanced (S5 and 6). However Brine Date not successful as unable to grow shrimp.
3	Yes	Plan to use I'm a Worm with special needs group.	Continued use by the special needs teacher of I'm a Worm throughout the year – and plans to extend in future. This year included the design of special feeders for birds and use in the new school garden.
4	Yes	All three – continued use of The X-Bacteria, and Brine Date and I'm a Worm being used for the first time with a Year 12 group	None used – but firm plans for use in 2010/2011 academic year.
5	Yes	I'm a Worm.	I'm a Worm used by whole of Year 8 in the summer term, delivered over three sessions, and as a one off exercise with sixth form students. Attempted to use The X-Bacteria but culture had died, and unsure if will use again.
6	Yes – firm plans	Continued use of I'm a Worm.	I'm a Worm continued to be used in extraction lessons, with Year 7 and 8 pupils of different abilities, and with some full Year 7 and 8 classes.

7	No		None used – had tried The X-Bacteria and Brine Date initially but not taken forward, and I'm a Worm not used following a change in timetable.
8	Yes	To use The X-Bacteria with Year 12 and extending use of I'm a Worm with Year 8.	I'm a Worm used with Key Stage 3 students, but felt not to fit well with the syllabus and unlikely to be used again. The X-Bacteria has also been used in Year 12 taster sessions – but questions over whether too technically demanding for frequent use.
9	Yes	I'm a Worm and possibly The X-Bacteria.	I'm a Worm not used as fewer opportunities for enhancement and enrichment activities, The X-Bacteria used with a single biology A level student.
10	Yes	Plan to use all three experiments – The X-Bacteria with Year 12, Brine Date with Years 9 and 13.	The X-Bacteria and I'm a Worm used – although space for I'm a Worm was limited and experiment felt not to work well and unlikely to be used again. Brine Date was not used due to shortage of technicians, but plans are in place for this academic year.
11	Yes	Continued use of I'm a Worm with Year 8 pupils.	The use of I'm a Worm has continued and has been built into the 'inheritance and selection' KS3 model with Year 9 students. The X-Bacteria was tried but found to be too complex, and brine shrimps did not grow so Brine Date was abandoned.
12	Yes	Plan to continue to use I'm a Worm and The X-Bacteria, with Brine Date being piloted in autumn 2009 and I'm a Worm as an extension activity.	I'm a Worm is now used each year, although limited outside space means it is used with Year 12 pupils who undertake the experiment at home. The X-Bacteria is now embedded in the Year 12 scheme of work, with the school investing in an incubator as a result. Brine Date is used as an enhancement and enrichment activity in a lunchtime science club with lower ability Key Stage 3 pupils.
13	Possible	Possible use of Brine Date and The X-Bacteria.	None used – time appeared to be main barrier, but plan to use Brine Date and The X-Bacteria this year.
14	Yes	Plans to use all three – I'm a Worm with Year 8, The X-Bacteria with Year 12, continued use of Brine Date.	None used – but intend to in future.

15	Possible	Possible use of kits in science club.	None used.
16	Possible	Brine Date.	None used – had used The X-Bacteria previously but considered too expensive to repeat (believed replacement materials would cost £104 ⁵).
17	Yes	Continued use of I'm a Worm on a test basis, and interest in using The X-Bacteria.	None used.

The patterns of use described above for the ten schools where the materials had been used in 2009/2010 were different; however, a series of features emerge:

- In each case the schools using the materials expressed intentions to use the materials in the last contact, and in two cases had established clear plans and a timetable for their use. However, five schools with established plans reported not using the materials;
- While several schools described using all three materials, the principle established in the interim report of initial trialling, followed by wider implementation, appears to have continued – with examples of continued use and ‘trials’ of other materials with a view to adoption if effective;
- Where trialling took place prior to the interim report, several cases were identified where use of the materials has extended and been used with whole class or whole year groups;
- In addition, the flexibility of each of the materials allowed them to be used with student age groups other than those for which they were intended for, as well as in extension activities, school science clubs and with pupils of widely differing abilities; and
- The I'm a Worm experiment continued to be the most popular, for a variety of reasons including being very simple to use, the ability to secure replacement components locally, and being popular with pupils and good at stimulating thinking and reasoning skills.

The box below provides a series of examples of the use of the materials in the 2009/2010 academic year.

Continued Use of the Survival Rivals Materials

One school has continued to use all three kits, although the nature of use has differed for all three. The X-Bacteria has been established in the Year 12 scheme of work. The lead teacher reported that “*The X-Bacteria one is perfect for our Year 12. Horizontal and vertical gene transmission is on our Year 12 syllabus*”. Brine Date has not been

⁵ This is the cost of the full kit. The combined costs of the bacteria and antibiotics are just under £40, but this teacher had obviously not found information about the options or had them explained.

used within formal teaching but as an activity for the school's lunchtime 'Beast Club'. The colony of brine shrimps was established by the teacher, with technician support, the initial algal culture had not been used promptly but standard 'brine shrimp food' from a pet shop had allowed a healthy colony to be established. I'm a Worm presented serious difficulties as the school has no undisturbed outside space that could be used to encourage bird feeding. After an experiment where students were asked to complete the experiment at home, use of I'm a Worm has become a regular feature of Year 12 students' work. These students are viewed as sufficiently mature and motivated to carry out the experiments reliably at home without supervision, and it is easy to make the experiment more testing than the basic design for Key Stage 3 students. The lead teacher reported that the students particularly enjoyed taking responsibility for the experiment rather than just being told what to do. *"What engaged them was that they were given responsibility for a practical themselves"*.

Despite the encouraging signs that the Survival Rivals materials are becoming embedded, there is still a strong reliance on the initial lead teacher who teaches AS and A2 level biology and runs the lunchtime club.

At a second school, I'm a Worm has become a staple project for a support teacher specialising in 'extraction students'. This involves taking groups of students out of lessons to teach them in smaller groups and is often, although not solely, used for students with lower attainment levels. A key strength of the kit for extraction groups is its flexibility: *"I could use it for low ability groups but I could also adapt it as well if I wanted to do it with gifted and talented students, so it was attractive to me because I could use it for all ranges of children"*.

The experiment has been used with whole classes, but the long-term follow-up interview confirmed that I'm a Worm was mainly being used in extraction lessons in the school, with Year 7 and 8 pupils of different abilities. The experiment was described as a particularly good fit with 'ecology matters' in Year 7 and 8. This topic covers food webs, environments, predator-prey relationships, building food chains and how animals adapt to survive. The school's scheme of work emphasises this topic in Year 7 more than in Year 8 and it is considered likely that future use of I'm a Worm will reflect this priority.

The teacher has now included I'm a Worm in her list of extraction projects, so if she was to leave it would still be slotted in to the schemes for extraction lessons. The teacher suggested it was a particularly important extraction project because she finds that biology tends to lend itself more to practical work.

4.3 Benefits and Impacts

As with the case study primary schools, the secondary school case studies also provided additional examples of the benefits and impacts for pupils and teachers resulting from use of the materials.

4.3.1 Benefits for Pupils

A similar range of benefits for the students were identified as described in the interim report, including continued reports of:

- Increased pupil engagement with science – both during the practical sessions and afterwards;
- Students feeling inspired – and increasing their overall interest in science; and
- Improved understanding of science, particularly evolution and evolutionary principles.

The case studies provided additional examples of benefits and impacts in these areas, as well as providing an opportunity to try new experiments in new areas. One school described how they would not previously have been sufficiently confident to try a ‘bacteria related’ experiment, and their use of I’m a Worm encouraged staff and pupils to work outside the classroom. As one teacher explained in relation to the I’m A Worm kit: *“We do do experiments, but that was a bit more open-ended really, they felt like they were really researching something rather than trying out an experiment that we know the answer to”*. In addition, the worm kit enabled pupils to learn outside of the classroom and learn about researching the local environment.

Teachers commonly reported that the experiments helped stimulate pupil enjoyment of, and so interest in, science at school – through doing something different as well as developing and using analytical and reasoning skills. There were also several examples where the pupils ‘took ownership’ of their projects, which they found enjoyable and which enhanced both individual and teamworking approaches.

Finally, one school felt that the Survival Rivals materials had contributed to a marked increase in the uptake of triple science GCSE and A level sciences. Although they are not sure of the reasons for this, the teacher described how *“activities like Survival Rivals can only help by promoting positive experiences of science”*.

4.3.2 Benefits and Impacts for Teachers

While again the teachers cited many of the benefits identified in the interim report, schools where the materials had become more frequently used, or had become ‘embedded’ in teaching plans, suggested that the materials were having a lasting impact on their practice. While factors like the ease of materials use, the fact that they could be used ‘straight out of the box’, and that the materials were accompanied by comprehensive guidance information underpinned their likelihood of use, many teachers described

how the Survival Rivals kits enabled them to undertake experiments and investigations for topics which are rarely taught in practical sessions. As a result, many teachers explained they planned to use experiments tried for the first time in 2009/2010 again.

Finally, one teacher described how undertaking I'm a Worm outside of the school grounds, then returning and analysing the findings and drawing conclusions in a 'round table style' had changed his relationship with his Year 9 pupils. Although they were a medium ability group, behaviour management issues had arisen. A more open and discursive teaching style had improved the relationship between the teacher and pupils. The pupils had benefited because they were able to be more interactive and thus appreciated the learning experience more than they usually would.

4.4 Schools Not Using Since Last Contact

Seven of the 17 case study secondary schools had not used any of the Survival Rivals materials since the last contact, the reasons for which were explored in the final interviews. A range of factors and issues were reported, which included:

- Changes in teaching staff – particularly where teachers who had led on the use of the experiments had either left their original role (or indeed the school) or were on long term absence. Examples included one school where the lead teacher was on maternity leave, and plans to use the materials in the school science club had not been taken forward, and a second case where the lead teacher had been promoted and their teaching role changed, and there was no evidence of continued use by other teachers. In a third case, where the lead teacher had moved to another school, use of the I'm a Worm experiment did not continue as planned. Interviews with another teacher at the school identified that there were no plans to use the materials in the department “*because we don't know anything about them*”.
- Time pressures and competing priorities – several schools reported that they had “*run out of time*” to use the Survival Rivals experiments as they would have liked to. For example:
 - In one school, plans to use the I'm a Worm experiment were not realised following the introduction of a new timetable, and as a minimum of two lessons were required to undertake the experiment, time limitations led to it not being used.
 - In a second school also previously using I'm a Worm, use had ceased partly because the school is a 'national challenge' school and had been under pressure to raise the level of five GCSE A to C passes, which led to a reduction in time available for 'enhancement and enrichment' activities in the classroom.
 - In a third school plans to use Brine Date in a Year 12 project on sexual and asexual reproduction were not taken forward due to time pressures, with the teacher reporting that the amount of time required to set up the experiment was the main barrier to use. This made it less

likely than I'm A Worm to be used in the school. Other examples were also cited of plans for using the materials coinciding with other unexpected events like inspections and other 'whole school' events, and not going ahead or being delayed as a result.

- Difficulties using the kits – while overall the teachers found the experiments to have worked well, several reported facing difficulties with Brine Date and, to a lesser degree, The X-Bacteria. Examples where difficulties had led to use of the experiments not being continued included:
 - Brine Date – in two schools difficulties experienced with this experiment made its future use unlikely. In both cases the brine shrimp had not grown, and planned use with Year 9, 10 and 12 pupil groups was abandoned. It is worth noting across both stages of the evaluation that eight of the other secondary schools attempting to use the Brine Date experiment also faced challenges, primarily around the growth of the algal culture, which had also led to the use of this particular experiment not being continued. (Three schools have continued to use the other experiments.) In one case a school experiencing similar difficulties had sourced their own algal culture, which had worked well and led to its continued use.
 - The X-Bacteria – in two other schools teachers reported difficulties with the experiment, which meant its use was unlikely to be repeated. In each case the X-Bacteria culture had died, and both schools considered that the experiment was too complex and time consuming to be used again. Other schools also made reference to the perceived complexity of The X-Bacteria, and felt that they did not have the necessary skills in house to deliver the experiment effectively.
- Limited outside space – in several cases restrictions on available outdoor space within school premises had limited the extent to which the I'm a Worm experiment could be used. However one school proposed a creative solution to the lack of appropriate outdoor space, where instead of using spaghetti the intention is to use wool and coloured sheets and to get pupils to act as birds.
- Costs – with one school reporting that they had not continued to use The X-Bacteria experiment due to the cost of replacement materials. Although the experiment was considered to have worked well, and had engaged pupils in undertaking "*real science*", the reported replacement cost of £104 for one experiment was considered prohibitive.

4.5 Use of Additional Support

4.5.1 The Telephone Helpline

Just two of the case study secondary schools reported making use of the additional support provided through the telephone helpline in their use of the materials, reflecting the low level of use of the 'technical support' element across the initiative more widely, where just 36 calls were reported to have been received to the end of July 2010.

In both cases the schools contacted the helpline regarding the Brine Date experiment, which as suggested above, had centred on problems in getting the shrimps provided to grow. In both cases new brine was sent to the schools – and in both cases the same problem continued – so both schools reported being dissatisfied with the support received. As one described: *“They didn’t offer any other advice or help ... they didn’t seem to expect there to be any problems”*. In the second case the school did not follow up their first call as they *“didn’t have the confidence to call back as I didn’t think they could help”*.

As described above, the issue with the Brine Date experiment was found to have influenced its likelihood of being used again. This applied to one of the schools using the helpline, where the difficulties faced meant that the experiment had not been used with pupils and was unlikely to be used again. The second school, however, described plans to try out the experiment *“one last time”* in April 2011 with a senior group, although they remained pessimistic about the chances of success and would ensure the experiment was trialled again in advance.

4.5.2 Re-Ordering Replacement Materials

Just three of the secondary schools reported investigating re-ordering materials to allow the experiments to be repeated. In two cases this related to the Brine Date experiment, and both were as a result of the original materials provided not working. In the third school, replacements for The X-Bacteria were investigated, although the cost of replacing the antibiotics and bacteria, as described previously, was considered prohibitive and led to the materials being unlikely to be used again.

Elsewhere, the fact that replacement materials could be sourced locally was seen as a strength, particularly regarding I’m a Worm, where additional spaghetti and food dye was easily purchased. This ‘self-sourcing’ route appears to be the most common means of replacing materials after use, as reflected in the scale of ordering replacement components nationally.

4.6 Participation in the Survival Rivals Competition

To stimulate the use of the Survival Rivals materials amongst secondary schools, a competition was organised with prizes including a trip to the Galapagos Islands. The competition required schools to conduct one of the experiments then make a film of, or take photographs of, the results. The first prize was the offer of retracing Darwin’s footsteps on a trip to the Galapagos Islands, with runners up receiving prizes of creative film-making workshops and £650 of film-making equipment.

A total of 61 entries were received for the Survival Rivals competition from schools across the UK, with one of the case study secondary schools reporting submitting an entry to it.

The school participating in the competition described how the use of I’m a Worm had become embedded with their Year 8 pupils, and led to the submission of an entry based on the use of the materials with five groups of Year 7 and 8 pupils, each comprising four pupils. Their entry was prepared

over eight lunchtime sessions, and they used Movie Maker software to produce a presentation of their findings. The teacher observed that the pupils were very enthusiastic about the competition at first, however their lunchtime sessions were less effective as they clashed with pupils' other commitments, such as a popular drama club. This led to the numbers participating trailing off, and once a few sessions had been missed it was difficult to re-engage them in the work. The teacher also reported that a lack of organisation amongst the pupils led to some groups rushing their projects. Despite these issues the teacher felt the exercise had been worthwhile, as it gave the students the opportunity to learn about and use Movie Maker.

The majority of the case study schools, however, reported not being aware of the competition. Eleven reported not hearing about the competition, and when it was described to them a couple considered that they would have been interested in making a submission. The reasons for this apparent lack of awareness were unclear, as the organisers of the competition contacted every named teacher who had ordered the kits, and it is likely that changes in the lead teacher may have accounted for several cases at least.

The final five schools described being aware of the competition but not submitting an entry to it. The most common reason for not participating appeared to be time related – either due to existing time pressures on pupils and staff, or the perception that participation would have required considerable time and effort. Comments received included participation appearing to be “*too much like hard work for a limited benefit*”, and concerns of exerting additional pressures on pupils.

Two schools, who reported frequently participating in wider enhancement and enrichment activities including regional and national pupil competitions, described their reasons for not taking part:

- In the first school the teachers were aware of the Survival Rivals competition, but did not take part because the invitation to participate was one of many received – for example they had recently been invited to enter competitions run by the national space centre and CERN, and they have nominated some students for London Science Student of the Year.
- In the second school the lead teacher had noticed the competition, and was initially interested as it seemed an attractive opportunity as the school already used video and photography frequently in teaching and special projects. However, they described having competing time pressures at the time of the competition, and that it had not been practical to prepare and submit an entry.

While the case study sample is too small to provide firm conclusions about the effectiveness of the Survival Rivals competition, the experiences of the schools and the low numbers of entries submitted overall suggests that the competition was likely to have had only a limited effect on the wider use of the materials. However, as the one school submitting an entry illustrated, participation for them had been worthwhile, even given the issues of competing time pressures and a drop off in interest amongst the pupils.

4.7 Plans for Continuing Use – 2010/2011 and Beyond

When questioned on the likelihood of using the Survival Rivals materials in the 2010/2011 academic year and beyond, 12 of 17 secondary schools reported that they were likely to use at least one of the experiments in the future. These included schools not using the materials in 2009/2010, and in several cases detailed plans were described and the schools were optimistic that these would be followed through.

Plans for future use were largely built on previous, effective use of the experiments, although some schools proposed to use different materials for the first time. In summary:

- I'm a Worm was the experiment most commonly expected to be used, with nine schools describing plans to continue using it in the current academic year and beyond.
- Six schools described the intention to use the X-Bacteria experiment, two for the first time, although in one case continued use depended on securing replacement components at a low cost.
- Five schools described the intention to use the Brine Date experiment, several for the first time, although two reported they would be trying the experiment for the last time following previous failures.

Examples of plans for use within the 2010/2011 academic year are provided below.

Examples of Proposed Survival Rivals Use in 2010/2011

Twelve of the 17 case study secondary schools described intentions to use the Survival Rivals materials in the current academic year, including those continuing to use experiments that have been used previously and found to work well, and others trying out different experiments for the first time.

- One school described plans to use The X-Bacteria for the first time at the end of the current academic year. The school expected to experience challenges – mainly that they do not have the specific equipment required for bacteria work – which was likely to influence whether it is used or not. However the teacher reported “*definitely using I'm a Worm again, especially because it is so cheap to re-stock*”. Here the only constraint on use would be the weather, so use was scheduled into the spring term.
- In one case a shortage of technician staff had limited the use of the materials in 2009/2010. However, having recruited replacement staff, the school intend to attempt the Brine Date experiment with A level students in the summer.

Elsewhere the materials had been targeted for use with specific

pupil groups, for example:

- In one school I'm a Worm was planned to continue to be used with extraction classes, primarily due to its ease of use, and that it can be used at short notice and flexibly with different pupil groups with different needs.
- In another, I'm a Worm has been earmarked for use with a low-ability Year 11 group. The school also plans to use Brine Date with Year 13 students to demonstrate the response of an organism to environmental conditions.
- In a third school the special needs teacher is planning to extend the use of the I'm a Worm experiment to include building bird houses in the winter term. The experiment will contribute towards a Princes Trust qualification on a BTEC scale, which is equivalent to two GCSEs. Changes for the project this year include experimenting in the new garden (the school benefited from the Building Schools for the Future programme and have moved to a new site with more a suitable outdoor environment).

4.8 Key Success Factors and Areas for Improvement

While the Survival Rivals experiments were different to those available to primary school pupils, many of the key success factors for their use, and their continued use, were similar. Key success factors reflected those identified in the previous interim report.

Based on the case study schools' reflections of their experience of the materials, the following success factors were identified:

- The high quality and professional appearance of the materials – this attracted teachers' interest, with one teacher summarising the views of many that "*the materials looked very professional, they looked the part*".
- The fact that the kits contained everything to get started – this reinforced views on their quality and made their use more likely. The materials/instructions were found to be extremely helpful and easy to understand. The provision of relevant books within each kit was an "*added bonus*".
- Clear and explicit links to the curriculum – allowing teachers to make the link between their teaching plans and the use of the experiments to maximise their impact. The experiments were considered strong in this regard, with one teacher describing how they had "*mapped on well to the curriculum, and complemented what teachers were already teaching*".
- The fact the materials were free – this was emphasised by several schools at a time when budgets are tight and expected to get tighter: "*They were free, that always helps*". One school anticipated suffering from year on year budget cuts which would rule out buying kits of this quality. They were taking part in a Morrisons token offer – with such free kit offers

being an important supplement to the science department budget in future. Although a few schools referred to the cost of replacement materials negatively, others reported the reverse and had sourced appropriate materials locally.

- The importance of the kits working first time – first to evidence their ease of use, and secondly so that implementation in the classroom will be a good use of pupil and teacher time. As one school described: *“If it doesn’t work first time many other teachers will give up, especially new teachers”*. The variable experiences of the use of the Brine Date experiment reported previously, and their influence on continued use, provide good evidence of this point.
- The importance of enthusiastic teachers, and supporting heads and senior management teams, in ‘championing’ the materials and driving use forward. However this also comes with the risk that experience and enthusiasm can be lost if the teacher moves on and wider adoption amongst other teachers has not happened
- Having sufficient time to plan and use the materials. There was some suggestion that the need to deliver the experiments over more than one ‘session’ was viewed negatively in certain schools, while others considered this a positive as it allowed a topic theme to be continued.
- The above point was also linked to the timing of the delivery of the materials. Like the primary schools, mixed views were expressed on the best time for the materials to arrive. However the teachers expressing an opinion considered that the optimum time for receipt was the summer term (June/July ideally), as this would allow their inclusion in planning for the next academic year as well as giving teachers time to review them on receipt;
- Pupil enjoyment of the experiment was vital, being linked to their engagement with it, and supporting their wider engagement with science. As one school described: *“It got the pupils engaged – the kids did enjoy it. It also gave me a chance to do stuff that I would not have thought of”*. A second teacher commented *“The children liked the worm experiment. It was fun and a good exercise to do in science club”*.

In addition to the above, a particular strength of the materials cited by the case study secondary schools was that they allowed additional opportunities to participate in practical experiments, as one described, *“to introduce pupils to real science”*. Several teachers welcomed the opportunity to try new experiments with pupils, get feedback and provide teachers with new ideas.

With the exception of the teachers experiencing difficulties using the Brine Date and X-Bacteria experiments, few offered suggestions for improvement. Where suggestions were made, they related to receiving materials in time to plan, and in a couple of cases reducing the amount of written materials provided. However this second point was countered more often than it was made, with the majority of teachers welcoming the coverage and level of detail provided, which was seen as a valuable resource.

5 Conclusions

This section provides our conclusions based on the final contacts with the case study primary and secondary schools, with an enhanced series of 'lessons for the future' for other large scale educational initiatives.

5.1 Conclusions

As the previous sections of this report have shown, both the Great Plant Hunt and the Survival Rivals materials have continued to be used by many of the case study primary and secondary schools. While the findings from a sample of 26 schools who participated in the final stage of the study should only be seen as indicative, they suggest that:

- Use of both sets of materials continued into the 2009/2010 academic year in six of the nine primary and ten of the 17 secondary schools;
- Use in the 2009/2010 academic year included both the continued use of materials used previously, often on an initial trial basis, as well as the use of materials for the first time, particularly the three Survival Rivals experiments; and
- Many schools intend to use the materials in the 2010/2011 academic year and beyond – although as the final interviews illustrated, schools' plans for use may not always come to fruition.

5.1.1 Experiences of Using the Materials

The findings from the final interviews with teachers reflected many of the principles identified and described in the previous interim report, where the majority of schools using the materials found them to be:

- Of a high quality – being well researched, professionally presented and attractive to teachers seeking to use them;
- Easy to use – with both the content of the experiments and guidance to support their use being viewed extremely positively in the main, although experiences of Brine Date and to a lesser degree The X-Bacteria were more variable amongst the secondary schools;
- Sufficiently flexible to use in different circumstances and with pupils of different ages and abilities – with many examples of age specific materials being used across different pupil groups; and
- Capable of being re-used through the replacement of individual components – although these appear to have been sourced locally in the case of Survival Rivals rather than using the replacement service offered by Philip Harris, as reflected in the national statistics on the use of this option.

The Great Plant Hunt

The resources provided in the Great Plant Hunt chest continue to be viewed positively, with their flexibility for use from small pupil groups through to class and whole school activities being widely appreciated. The identikits and associated documentation appear to have been particularly effective, with their use outside the classroom being both new for some schools and linking in with other environmental activities in others.

The benefits and impacts of continued use for pupils and teachers continue to reflect those identified in the interim report. These include increased opportunities for pupils to try 'hands on' activities, which they enjoyed and were considered to have increased their interest in, and engagement with, science at school.

Survival Rivals

Here, I'm a Worm was found to be the most frequently used of the three experiments provided, largely due to its ease of use, overall simplicity, capacity for delivery again at minimal cost and clear learning benefits. The other two kits were used less frequently, and while both offered strong learning benefits, teachers raised questions about their use:

- Brine Date did not always work due to difficulties growing the shrimps, and while some schools had sourced new food supplies, others reported being less likely to use it again because it had been unsuccessful. This experiment illustrates the importance of providing clear instructions on use, in particular in this case to ensure that the algae provided are refrigerated on receipt.
- The X-Bacteria also posed challenges, and raised concerns about the level of resources required to deliver it and the ability/availability of suitably experienced teachers and technicians. However the experiment offered a significant 'pay off' in terms of learning, and was considered to be very effective by users.

Finally, the last follow-up interviews showed that as well as the early successes described in the interim report, this is evidence that good progress is being made towards the achievement of the 'legacy ambitions' of the initiative, with a stock of resources being made available for teachers where continued impacts on practice can be expected.

5.2 Lessons for the Future

The Darwin Education Initiative has also provided a series of lessons for the future development and implementation of initiatives of this nature. As the interim report described, these included lessons for:

- The planning and development of large scale education initiatives – including that considerable time is required to ensure that high quality resources can be both developed and robustly piloted;

- The management of such initiatives. Given that multi-partner or consortia approaches are likely to be required, effective management structures are key, with both 'internal' and 'contracted out' management arrangements proving to be effective with Survival Rivals and the Great Plant Hunt respectively;
- The effective communication and promotion of materials use within schools – based on the success of the initiative in terms of materials use (and order levels for the Survival Rivals materials), while acknowledging that even though there seems to be no 'best time' for their arrival, the summer term seems to be a preference for the secondary schools at least; and
- Helping to ensure that the materials leave a legacy of continued use. Key success factors are found to be: explicit links to, and degree of fit with, the curriculum; support from schools' senior management; the capacity of the teaching staff; ease of sourcing new materials; and the costs of repeating experiments .

The findings from the final study stage have provided further evidence of the factors which support, and are potential barriers to, continued use. While the factors in the final bullet above all apply, the final interviews suggest that additional considerations include ensuring that:

- Awareness and use of the materials is distributed across teaching staff more widely. Activity in several schools ceased when the lead or 'champion' teacher left the school, while wider adoption led to more varied and cross-curricula use;
- The design of the materials maximises the likelihood of the experiments working in schools with varying capability with regard to technical support – referring here to the Brine Date experiment, where several schools reported challenges in getting the shrimps to grow. While specific instructions were provided regarding the storage of the algae supplied, these were not necessarily followed, and we would suggest that the inclusion of 'time limited' materials in future initiatives of this kind should be avoided;
- Any materials produced can be used with schools in different environments and with different resources. Several of the case study primary and secondary schools reported that some experiments could not be used as they had no suitable outside space for their use. We have found evidence that fostering outdoor working has been one of the strengths of the project, but building in a flexibility for schools with limited access to outdoor working would be helpful;
- All guidance materials are informed by actual use with schools – in the case of Darwin the restricted timetable for implementation meant that piloting of the materials in the school environment was limited. As well as identifying any problems in advance, more robust piloting would have allowed the experiences of use to inform the guidance, potentially including good practice and key 'dos and don'ts', based on practical use. For example, clearer labelling of the Brine Date boxes to ensure they

were stored correctly prior to use might have reduced the difficulties experienced in growing the algal culture and the shrimps;

- The guidance materials are clear about the time required to undertake each experiment – a point that appeared to not always be clear to some of the teachers interviewed. In addition, the guidance should make any links to the curriculum explicit and clearly displayed, for example on the outside of the boxes; and
- Other agents should be considered to promote the materials and their use at the individual school level, including organisations such as the Science Learning Centre network and CPD providers. As the Darwin experience has shown, the provision of good quality resources and guidance should mean that ‘support’ provision is rarely required, and efforts should concentrate instead on maximising use.

However well prepared an initiative is, and however good the support and guidance, this support is not always used. When brainstorming possible lessons on the basis of teacher feedback, our team identified a number of potential things that might have been included in paper or online guidance only to find (on checking) that they already were.

Finally, it appeared from the interviews with schools that there are certain areas of the curriculum where appropriate practical activities are less prevalent, and which represent areas of unmet demand which could be addressed through interventions of this type. Given several schools reported that the teaching of evolution was one such area, as well as more detailed examples in secondary curricula across the UK, this is an area where further preliminary research with schools could add value to the development process.

Appendix 1 – Case study schools

Primary School Case Studies

Region	Characteristics	First Contact	Second Contact	Third Contact
Belfast, Northern Ireland	Roman Catholic Maintained; 600-800 pupils; Urban, Deprivation Decile: 4 th	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Nottinghamshire, West Midlands, England	Roman Catholic Voluntary Aided; 400-600 pupils; Urban; Deprivation Decile: 1 st	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Cardiff, Wales	Church of Wales School; 1-200 pupils; Urban; Deprivation Decile: 3 rd - 4 th	Autumn Term 2009	Planned for Spring Term 2010	Autumn Term 2010
Cornwall, South West England	Community School; 200-400 pupils; Town and Fringe; Deprivation Decile: 5 th	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Essex, East England	Roman Catholic Voluntary Aided; 200-400 pupils; Urban; Deprivation Decile: 10 th	Summer Term 2009	Autumn Term 2009	No final contact – teacher promoted
Glasgow, Scotland	State Funded; 1-200 pupils; Urban; Deprivation Decile: 1 st	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Lancashire, North West England	Community School; 1-200 pupils; Village, Hamlet and Isolated Dwellings; Deprivation Decile: 6 th	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
London, England	Community School; 200-400 pupils; Urban; Deprivation Decile: 2 nd	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
London, England	Community School; 400+ pupils; Urban; Deprivation Decile: 2 nd	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Oxfordshire, South East England	Church of England Voluntary Aided; 200-400 pupils; Town and Fringe; Deprivation Decile: 7 th	Summer Term 2009	Autumn Term 2009	Autumn Term 2010

Secondary School Case Studies

Region	Characteristics	First Contact	Second Contact	Third Contact
Belfast, Northern Ireland	Controlled School; 500-750 pupils; mixed Urban and Rural; Deprivation Decile: 7 th	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Belfast, Northern Ireland	Roman Catholic Maintained; 1000-1250 pupils; Urban; Deprivation Decile: 1 st	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Birmingham, West Midlands, England	Community School; 500-750 pupils; Urban; Deprivation Decile: 1 st ; Maths and Computing specialist school	Autumn Term 2009	Spring Term 2010	No final contact
Kent, South East England	Foundation School; Modern School; 750-1000 pupils; Urban; Deprivation Decile: 8 th ; Technology specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Cardiff, Wales	State Funded; 1000-1250 pupils; Urban; Deprivation Decile: 9 th -10 th	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Eastriding, Yorkshire and Humberside, England.	Community School; 1250-1500 pupils; Town and Fringe; Deprivation Decile: 3 rd -4 th ; Languages specialist school	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Edinburgh, Scotland	Roman Catholic; 750-1000 pupils; Urban; Deprivation Decile: 8 th	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Edinburgh, Scotland	State Funded: 1000-1250 pupils; Urban; Deprivation Decile: 10 th	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Goole, Yorkshire and Humberside, England	Community School; 1000-1250 pupils; Urban; Deprivation Decile: 2 nd ; Maths and Computing specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Kent, South East England	Church of England Voluntary Aided; 750-1000 pupils; Urban; Deprivation Decile: 7 th ; Music specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Leicester, East Midlands, England	Community School; 1250-1500 pupils; Urban; Deprivation Decile: 4 th ; Business and Enterprise specialist school	Summer Term 2009	Autumn Term 2009	No final contact
London, England	Foundation School; 1250-1500 pupils; Urban; Deprivation Decile: 4 th ; Sports specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
London, England	Roman Catholic Voluntary Aided; 1250-1500 pupils; Urban; Deprivation Decile: 10 th ; Training School; Engineering specialist school	Summer Term 2009	Autumn Term 2009	Autumn Term 2010

London, England	Church of England Voluntary Aided; 1250-1500 pupils; Urban; Deprivation Decile: 3 rd ; Music specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Newcastle upon Tyne, North East England	Community School; 1000-1250 pupils; Urban; Deprivation Decile: 2 nd ; Technology and Arts specialist school.	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Newcastle upon Tyne, North East England	Roman Catholic Voluntary Aided; 1250-1500 pupils; Urban; Deprivation Decile: 2 nd ; Technology, Arts and Leading Edge specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Nottinghamshire, East Midlands, England	Community School; 750-1000 pupils; Urban; Deprivation Decile: 1 st ; Business and Enterprise, Arts and Leading Edge specialist school	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Somerset, South West England	Community School; 750-1000; Urban; Deprivation Decile: 8 th ; Technology specialist school	Autumn Term 2009	Spring Term 2010	Autumn Term 2010
Stafford, West Midlands, England	Community School; 750-1000 pupils; Urban; Deprivation Decile: 3 rd ; Maths and Computing specialist school	Summer Term 2009	Autumn Term 2009	Autumn Term 2010
Wrexham, Wales	State Funded; 500-750 pupils; Rural; Deprivation Decile: 9 th -10 th	Summer Term 2009	Autumn Term 2009	No final contact

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