



# Books And Stories In Children's Science

BASICS Project

Final Report

September 2007

Stranmillis University College Belfast

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# **Books And Stories In Children's Science**

## **BASICS Project**

### **Final Report**

#### **Section 1: Executive summary**

This report outlines the progress of the Books And Stories In Children's Science (BASICS) project from September 2006-August 2007. The project involved a cluster of five primary schools from the greater Belfast area working with tutors from Stranmillis University College Belfast and local education board science advisers. During the project undergraduate student teachers taught science, their specialist subject, in each of the schools, thus providing the opportunity for the classroom teachers to directly observe and reflect on their practice. It was hoped that this approach would promote the use of books and stories in enquiry-based science in lower Key Stage 1. The aims of the project were:

- to develop and support the schools' use of books and stories within science;
- to provide a fresh learning context for classroom observation and reflection;
- to enhance teachers' confidence and competence in adopting an enquiry-based approach to science at Foundation Stage and Key Stage 1.

Following a training seminar on enquiry-based science and the use of books and stories, 12 undergraduate students taught one morning a week over a period of six weeks in the project schools. During this time the host teachers observed and reflected on the methods and approaches taken. A concluding seminar allowed the findings, in the form of the evaluations from all participants, including the pupils, and the examples of activities and resources used, to be disseminated to all involved.

All participating schools reported that the project had greatly supported their development in lower primary science. The schools were keen to continue with the project and to build on this work. Additional funding was granted by the AstraZeneca Science Teaching Trust to further support the schools in integrating and embedding the principles of the project into their science lessons.

The teachers reported a large increase in their confidence regarding the use of an enquiry-based approach to science and a significant development in their appreciation of the merits of using books, both non-fiction and story books, as a context for supporting science. Teachers also reported benefiting from the opportunity to focus on science process skills and their progression from Foundation Stage into Key Stage 1. The student teachers reported a huge increase in their confidence in both teaching science and in their general classroom practice.

The principals and science coordinators considered that the project had greatly enhanced the profile of science in their schools and had provided much needed support as they plan for the implementation of the Revised Curriculum for Northern Ireland. As the project continues into 2007-2008, when the classroom teachers will now be leading the teaching, and the findings are disseminated across other schools and stakeholders, it is hoped that the project will continue to act as a catalyst for improvement in the quality of pupils' experience of lower primary science.

## **Section 2: A description of the BASICS Project and its aims**

The project involved a partnership between the project team, 12 student teachers, principals, science coordinators and teachers from each of the schools during the period September 2006 –June 2007 (See Appendix 1.) The students, supported by the project team and their host teachers, planned and taught science over a period of six weeks. The science lessons were enquiry-based and used a book or story as an introduction and often during the concluding discussion. During the lessons the classroom teachers supported the student and at times engaged in structured observation activities. A training and planning seminar was held before the teaching phase, and a concluding seminar allowed the findings and exemplars of best practice to be disseminated across all the schools.

### **Project Aims**

Although the project aims are set out clearly in the original project proposal (See Appendix 2), it is worthwhile considering the overall guiding aim of this project.

*This project aims to promote the smooth transition of children's science experience from Foundation Stage into Key Stage 1 by supporting a common approach to best practice in Years 2 and 3.*

The 'best practice' approach is one which is:

- stimulating and relevant to children (Books and Stories);
- child-centred (Enquiry-based).

Transition will be supported and developed by:

- a common agreed approach in years 2 and 3;
- joint planning for years 2 and 3;
- classroom observation and reflection.

The specific aims of the project were to:

- work with head teachers and their governing bodies to identify and support development needs, specific to each school, with respect to the transition from Foundation stage to the more formal approach to teaching and learning in science adopted at Key Stage 1;
- develop the confidence and competence of teachers in adopting an enquiry-based approach to science in the lower primary school;
- promote the use of books and stories as an effective strategy for providing a stimulating and relevant context in which science enquiry activities may be carried out;
- encourage and support the greater integration of the primary science and literacy curriculum;
- develop and support science coordinator's strategies for promoting best practice in science teaching throughout Foundation stage and Key Stage 1 within each of the participating schools.

### **Project delivery**

The project consisted of four phases.

### **Phase 1. 'Preliminary reflection and preparation (September-December 2006)**

The principals, governing bodies and science coordinators of all participating schools were consulted and supported in identifying areas for development in relation to lower primary science and the transition from Foundation to Key Stage 1, specific to their school. As a result each school produced a development plan. During this phase the student teachers attended a series of seminars and workshops outlining best practice in enquiry-based science and the use of books in lower primary science.

### **Phase 2. Seminar 1 'Getting Started' (December 2006-February 2007)**

This whole day seminar provided in-service training for the teachers, student teachers, and science coordinators in the areas of enquiry-based science and the use of books and stories in lower primary science. The focus included planning for progression across the Foundation/Key Stage 1 transition and the issues pertinent to the introduction of more formal approaches to learning at Key Stage 1. Support for the planning, resourcing, and teaching was provided within the context of the particular topics within each of the curricula with particular consideration given to continuity and progression. During this seminar teachers and students began to plan together and identify strategies and resources.

### **Phase 3. 'Teaching, observing and reflecting' (March-May 2007)**

During this six-week period the student teachers taught, supported by the teacher, in their allocated class for one morning a week. This provided the opportunity for the classroom teacher to directly observe their pupils within a pupil centred learning environment. In addition this arrangement allowed for teachers to observe classes on the 'other side' of the Foundation Stage/Key Stage 1 transition, and compare and reflect on both teaching approaches and pupil interactions. Each morning consisted of a literacy lesson, using science as the context, followed by an investigative or enquiry based hands-on science activity.

### **Phase 4. 'Dissemination of best practice and recommendations' (June 2007)**

This whole day seminar allowed student teachers and classroom teachers, from each of the different schools and classes, to share their experiences, evaluate approaches and resources and consider recommendations for future practice. The

seminar used the data from the interviews with pupils to highlight the merits of the teaching approaches taken. The student teachers each presented posters outlining their work and their experiences.

### **Section 3: Project calendar and development**

Prior to the project start date of September 1<sup>st</sup>, preliminary visits to the five participating schools were made on 16<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> June 2006. The first meeting of the project team was held on 27<sup>th</sup> June 2006.

#### **11<sup>th</sup> September 2006**

Introductory seminar with students (Year 3 Science specialists). Outline project aims and programme including their use of a 'Student Journal'.

#### **20<sup>th</sup> September 2006**

Meeting of project team. Planning for seminar on 8<sup>th</sup> December 2006 and evaluation strategy.

#### **20<sup>th</sup>/21<sup>st</sup>/22<sup>nd</sup> September, 3<sup>rd</sup>/10<sup>th</sup> October 2006**

Detailed planning meeting with principals and science coordinators of participating schools. Schools begin formulating Action Plan.

#### **28<sup>th</sup> September 2006**

Meeting with Colette Murphy and Jim Beggs (External Assessors) to discuss project

#### **17<sup>th</sup> October 2006**

Planning meeting with Glenda Walsh (Project team) to discuss use of modified Quality Learning Instrument in evaluation.

#### **2<sup>nd</sup> November 2006**

Seminar with students, focussing on enquiry-based learning and the use of books and stories in primary science. Agree format for recording lesson plans and Student Journal.

**14<sup>th</sup> November 2006**

Meeting of project team to confirm programme for Seminar on 8<sup>th</sup> December.

**22<sup>nd</sup> November 2006**

Meeting with Glenda Walsh to confirm the format of the modified form of the Quality Learning Instrument (See Appendix 3).

**27<sup>th</sup> November 2006**

Guidance notes and questionnaires sent to participating schools. Invitation and programme for 8<sup>th</sup> December also included.

**8<sup>th</sup> December 2006**

Seminar 1 held at Stranmillis University College Belfast (For Programme see Appendix 4).

Collection of completed questionnaires.

**22<sup>nd</sup>-26<sup>th</sup> January 2007**

Students visit host schools. Observation of classes and planning meetings with teachers.

**22<sup>nd</sup> February 2007**

Students' seminar on progression of science enquiry skills (John McCullagh) and on using books and stories in lower primary (Sandra Ward).

**1<sup>st</sup>/8<sup>th</sup> March 2007**

Students teaching in schools.

**26<sup>th</sup> April/3<sup>rd</sup>/10<sup>th</sup> 17<sup>th</sup> May 2007**

Students teaching in schools. Post-lesson focus group interviews with pupils.

**3<sup>rd</sup> May 2007**

Visit of Dr Keith Bishop (External assessor) and Dr Mike Rance (Chair AZSTT) to Gilnahirk PS Belfast, Millenium Integrated PS Carryduff, and meeting with project team at Stranmillis University College Belfast.

**23<sup>rd</sup> May 2007**

Additional teaching and video recording of student teaching at Gilnahirk PS Belfast.

**1<sup>st</sup> June 2007**

Seminar 2 held at Stranmillis University College Belfast (For Programme see Appendix 5).

**June 2007**

Visits to participating schools to collect questionnaires and interview teachers, science coordinators, and principals.

Interviews with student teachers.

Student teachers submit teaching notes, resources, and Student Journals.

**6<sup>th</sup> June 2007**

Proposal for funding to extend the BASICS Project submitted to AZSTT (Appendix 6).

**11<sup>th</sup> June 2007**

Funding to extend the BASICS Project granted by AZSTT.

**14<sup>th</sup> June 2007**

Findings of BASICS Project presented at the annual conference of the Irish Association for Social, Scientific and Environmental Education (IASSEE) at the University of Limerick by John McCullagh and Julian Greenwood.

**14<sup>th</sup> August 2007**

Proposal to present the findings of the BASICS Project at the Association for Science Education annual conference at Liverpool in January 2008 accepted.

## **Section 4: Evaluation and project outcomes**

### **4.1 Methodology and evaluation timescale**

The project evaluation sought to collect and analyse data with respect to the overall aims of the project. The impact of the project was evaluated from the perspective of;

- principals;
- science coordinators;
- classroom teachers;
- student teachers;
- pupils.

#### **Methodology**

Data was obtained by use of,

- course evaluation data for planning seminar (8<sup>th</sup> Dec 06) and evaluation/dissemination seminar (1<sup>st</sup> June 07);
- Action Plans (drawn up by principals)
- questionnaires (before and after teaching phase of project);
- semi-structured interviews (after teaching phase of project);
- teachers' classroom observation data from the modified Quality Learning Instrument;
- teachers' classroom observation of progression using report sheet;
- focus-group interviews with pupils;
- students' journals;
- video recording of lessons.

### Project aims and success criteria

| <b>Project aim</b>   | <b>Evaluation data</b>  |
|--|---|
| <ul style="list-style-type: none"> <li>• To work with head teachers and their governing bodies to identify and support development needs, specific to each school, with respect to the transition from Foundation stage to the more formal approach to teaching and learning in Science adopted at Key Stage 1.</li> </ul> | <ul style="list-style-type: none"> <li>➤ Action Plans drawn up before project and reviewed at end</li> <li>➤ Teachers' observation data relating to progression across P2/P3</li> <li>➤ Interview with principals at end of project</li> </ul>  |
| <ul style="list-style-type: none"> <li>• To develop the confidence and competence of both teachers and student teachers in adopting an enquiry-based approach to science in the lower primary school.</li> </ul>   | <ul style="list-style-type: none"> <li>➤ Teacher and student questionnaires before and after project</li> <li>➤ Interviews with students and teachers at end of project</li> <li>➤ Student project Journals</li> <li>➤ Course evaluation data for planning seminar (8<sup>th</sup> Dec 2006) and evaluation/dissemination seminar (1<sup>st</sup> June 07)</li> </ul> |
| <ul style="list-style-type: none"> <li>• To promote the use of books and stories as an effective strategy for providing a stimulating and relevant context in which enquiry-based science activities may be carried out.</li> </ul>  | <ul style="list-style-type: none"> <li>➤ Teacher questionnaires and interviews before and after teaching phase</li> <li>➤ Student lesson plans and teaching materials</li> <li>➤ Student journals</li> <li>➤ Video recording of lessons</li> <li>➤ Focus group interviews with pupils</li> <li>➤ Pupils' comments recorded by students</li> </ul>                     |

|   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• To encourage and support teachers regarding the greater integration of the primary science and literacy curriculum.</li> </ul>   | <ul style="list-style-type: none"> <li>➤ Teacher questionnaires and interviews before and after teaching phase</li> <li>➤ Teachers' data from use of the modified form of the Quality Learning Instrument (QLI)</li> </ul>  |
| <ul style="list-style-type: none"> <li>• To develop and support science coordinator's strategies for promoting best practice in science teaching throughout Foundation stage and Key Stage 1 within each of the participating schools.</li> </ul> | <ul style="list-style-type: none"> <li>➤ Science coordinators' questionnaire and interview before and after project</li> <li>➤ Evaluation data for planning seminar (8<sup>th</sup> Dec 06) and evaluation/dissemination seminar ( 1<sup>st</sup> June 07)</li> </ul> |

### **Evaluation timescale**

**September 2006** – Each student teacher will begin to record their experiences in their Student Journal.

**October 2006** – Individual meetings of project leader (J McCullagh) with principal and science coordinator to draw up an Action Plan for each school.

**November 2006** – Student teachers, classroom teachers and science coordinators complete pre-project questionnaires

**8<sup>th</sup> December 2006** – Completion of Seminar Evaluation Form (after Seminar 1)

**January-February 2007** – Teachers carry out observations using the Quality Learning Instrument (before student teaching phase)

**March-May 2007** – Student teachers continue to record their experiences during the teaching phase of the project in Student Journal; teachers observe progression and

record comments on report sheet; focus-group interviews with pupils after lessons; video recording of sample of lesson.

**May 2007** – Student teachers complete post-project questionnaires; semi-structured interviews with sample of student teachers; teachers use the QLI again after student teaching is completed.

**June 1<sup>st</sup> 2007** – Student teachers present examples of their work at Seminar 2.

**June 2007** - Collection of evaluation data from teachers and student teachers, (questionnaire, QLI, progression report sheet). Semi-structured interviews with a sample of classroom teachers and student teachers.

**June 2007** – Student teachers submit teaching notes and materials and Student Journals. (A sample lesson plan is included in Appendix 7 and an extract from a student journal in Appendix 8.)

**June 2007** – Post-project questionnaires and semi-structured interviews with science coordinators.

**June 2007** –Interviews with school principals and reflection on Action Plan. Plan for follow-up evaluation in the next academic year.

**September 2007** - Evaluation report completed.

#### **Section 4.2 Project outcomes and success criteria**

The success of the project can be gauged by a consideration of the extent to which the aims of the project and success criteria have been met.

Project aims:

- to work with head teachers and their governing bodies to identify and support development needs, specific to each school, with respect to the transition from Foundation stage to the more formal approach to teaching and learning in Science adopted at Key Stage 1;
- to develop the confidence and competence of teachers in adopting an enquiry-based approach to science in the lower primary school;
- to promote the use of books and stories as an effective strategy for providing a stimulating and relevant context in which science enquiry activities may be carried out;
- to encourage and support the greater integration of the primary science and literacy curriculum;
- to develop and support science coordinator's strategies for promoting best practice in science teaching throughout Foundation Stage and Key Stage 1 within each of the participating schools.

Project success criteria

***The project has supported principals in the development of primary science within each of their schools, particularly with respect to the transition from Foundation Stage into Key Stage 1.***

All five principals identified the development of lower primary science in their Action Plans. The Action Plans also focussed on the development of teachers' classroom observation and critical reflection. Areas specific to individual schools included:

- developing the role of science within a topic based approach in keeping with the Northern Ireland Revised Curriculum;
- enhancing the teachers' confidence in adopting an enquiry-based approach to lower primary science;
- making greater use of books and stories within lower primary science;

- increasing children's enjoyment of science.

During their post-project interviews, principals reported great progress in their plans and welcomed the opportunity to continue with the project in order to embed the good practice evident throughout the project. The principals are now planning to incorporate some of the approaches adopted in the project across other year groups. The merits of teachers having the opportunity to observe first hand the students' use of stories and the enquiry-based approach was outlined by the principals. The principals also reported how the project has enthused the staff and increased their confidence in teaching science as evidenced by this sample of comments:

*"It has helped with confidence, the puppets, the books and having someone in there showing the staff has inspired staff. It is filtering out to all staff, with people asking to come in and watch the lessons. It has brought a level of inspiration and stimulated the idea of continuing next year."*

*"I have asked ( named teacher) to take a session in August telling the rest of the staff what she did and how the rest of the staff could try it, so that will be the first step, to let this filter out to the staff. When you change the perspective it makes a great difference."*

*"Books are already in the school but we have seen how to draw out the science. Next year's focus in the whole school development plan is the area of planning for the new curriculum, teaching with a greater focus on thinking skills, and so the science will help in a whole cross-curricular approach. So the project will help in a number of school's areas of learning."*

*"Actually seeing the six lessons has been really helpful. It is now less airy-fairy, we can see it in practice."*

*"Very worthwhile project, a building block in our development in terms of the new curriculum, look forward to continuing this."*

*“The project dovetailed nicely into our focus on development of science at KS1. Our teachers were able to use their classroom observation and follow up science lessons in their PRSD work.”*

*“The teachers involved now feel to some extent empowered and enthused. I am keen to get these ideas disseminated across the whole school, down to P1 and up into P4.”*

***The BASICS Project has enhanced teachers’ confidence and developed their competence in adopting an enquiry-based approach to science.***

The pre-project baseline questionnaires showed that science had only been the focus of INSET in one of the schools in recent years. As a result schools have been restricted in the extent to which an enquiry-based approach to science has been developed. Science coordinators cited teachers’ lack of confidence, guidance and the competing priorities of numeracy and literacy as restricting their efforts to promote enquiry-based science. The teachers scored themselves lowest in enquiry-based science pre-project, yet reported a high level of awareness of the merits of this approach.

The questionnaires and interviews after the teaching phase of the project indicate a marked increase in teachers’ confidence. The teachers found the opportunity to directly observe the enquiry-based approach in action to be hugely beneficial and as a result feel they would now be much more likely to adopt this approach. Areas which the teachers felt the project developed included:

- identifying particular enquiry-based skills;
- ideas for practical activities;
- use of everyday resources;
- classroom management of practical activities involving small groups;
- using a book or a story to introduce the practical activities.

Teachers' comments included:

*"I really enjoyed this fresh and dynamic approach and feel inspired by this to use similar tactics during my own lessons."*

*"I especially liked observing the amount of discussion time allowed throughout each lesson both with partners, groups and the teacher. I plan to incorporate more of this."*

*"Through this project I have come to realise how much better children learn and remember when they have been involved in their own research and investigations. .... It certainly is a very exciting way forward and has given me confidence to be freer in my teaching and more of a facilitator."*

*"I feel the timing of this project was perfect with the implementation of the Revised Curriculum (Northern Ireland). The enquiry-based approach provides opportunities for me to plan for the development of skills. I certainly have become more confident and realised you don't have to be a 'scientist' or to have all the answers."*

*"I feel more confident after watching the student organise groups and circulate activities."*

*"I would generally have used an enquiry-based approach to science previous to the project. The project has reinforced this and given me some new ideas. I also think that the types of questions that I ask in future will relate more to the thinking skills that were promoted."*

***The project has effectively promoted the use of books and stories as an excellent strategy for providing a stimulating and relevant context in which science enquiry activities may be carried out, and encouraged and supported the greater integration of the primary science and literacy curriculum.***

Both questionnaires and interviews indicate that these related aims have been comprehensively met. The data from the questionnaires show that all teachers report an increase in their awareness of both the range of books which could be used, and the possible strategies for adapting books for follow-up science enquiry. The teachers reported how the use of stories had motivated and enthused the pupils, encouraged and supported language development, and set the scene for the follow-up science activity. Prior to the project teachers would have made much greater use on non-fiction than fiction books. As a result of the project the teachers now appreciate how fiction and children's stories can be used to motivate and support children. A sample of comments includes:

*“I realise what a valuable introduction this can be (using books) and how it engages the children immediately through what they are familiar with.”*

*“My children really enjoyed the stories and were then really motivated for the investigation. A valuable introduction to each lesson.”*

*“Being involved in this project has made me more aware of how much ‘science’ is an integral part of our everyday lives. The information we can glean is not just restricted to ‘facts’. Fiction in stories, poetry and song can provide a jumping off point and reinforce the learning process. I am enjoying resourcing ‘stories’ and poems for future projects.”*

*“I feel the project exemplifies how literacy can fit so naturally into science. Young children love to learn through the use of Shared Reading. During the project the children responded so positively to the stories- this put the science into context for them- they can always refer back to the story book.”*

*“Books and stories are invaluable in introducing a topic and leading the children in the direction of the science that will be taught. It has made me more aware of observing the children and listening to the ‘science’ language they are using.”*

*“I would have used books a lot in my science but never really stories. I now see how they can be used as a helpful link to science and a good introduction and conclusion.”*

*“I think I will be more inclined to use fiction books or a combination of fiction and factual books in the future. I will also be in the look out for science opportunities in the books that we already cover.”*

***The project has greatly supported Science Coordinators in the efforts to develop lower primary Science.***

The pre-project questionnaire showed that there had been little or no focus on science in recent years and welcomed the opportunity to help develop it at lower primary level. The aspects of the project which coordinators found the most useful were:

- an increase in the profile of science and its role within the more integrated approach required by the Revised Curriculum;
- the opportunity for teachers to directly observe and critically reflect on best practice in science lessons within their own classrooms and amongst their own pupils;
- the development of ideas for activities and possible resources;
- the making of stronger and sustainable connections between science and topics covered in lower primary.

A selection of comments includes:

*“The project has reminded us all of how practical science ought to be. Sometimes there can be a tendency for science to be too ‘booky’ and ‘wordy’. A science scheme can be passed on or inherited which is too ‘booky’ or ‘wordy’. The project has highlighted how much the children enjoy doing things.”*

*“We have been trying to introduce more shared reading experiences in the lower primary and so the science has contributed to this.”*

*“I know the teachers involved will be taking onboard the students work in their future teaching, that is the first thing. I think as well we need to look at our overall schemes again.”*

*“The focus has not yet been on science as we are a new school and the focus so far has been numeracy and literacy. The main restriction has been getting time to focus on science so the project has been really good in that it is happening alongside our daily teaching.”*

*“It has given our staff innovative ideas about teaching science. Both the teachers involved have come away with ideas, particularly the puppet and the use of the Big Books. We had been using Big Books, but were impressed with the way the students used Big Books not necessarily on science, so the children get to enjoy the literacy side of the story and then you can bring in the science.”*

#### 4.3 Additional project outcomes

***As a result of the project the student teachers reported a huge increase in their confidence and competence in both primary science and their overall classroom teaching.***

The pre-project questionnaire showed that the students were least confident in the areas of ‘enquiry-based science’ and ‘using books and stories in science lessons’, describing their confidence as ‘low’. Following the project the questionnaires shows their confidence in both these areas to be ‘high’. The data collected after the project also reports a large increase in these and other aspects of their work. In addition to completing questionnaires and taking part in semi-structured interviews, the student teachers also kept a ‘Student Journal’ during the course of the year. All three data sources describe how the

project has developed the students' classroom practice by providing a learning experience beyond the regular teaching practice placement. The most commonly reported areas of development were:

- confidence in teaching lower primary science;
- classroom management;
- critical reflection and evaluation;
- management of resources;
- using books and stories;
- the use of questions and development of pupils' language;
- planning lessons to develop individual science process skills.

The features of the project, beyond their annual school-based placement, which they found so beneficial, were:

- the large amount of time teaching science;
- the opportunity to work through a topic scheme in science as opposed to 'one-off' lessons;
- visits from a science specialist tutor enhanced the level of discussion and critical reflection;
- the relationship with their class teacher was seen more as a partnership with reciprocal learning opportunities for both student and host teacher.

Comments made by the students included;

*“When I have taught science before during teaching practice the time has been restricted so I did not get the opportunity to plan to teach the different parts of the lesson. The BASICS Project has allowed me for the first time to focus on the planning, the carrying out, and then the evaluation and discussion. This has been so useful.”*

*“I have learned so much about teaching science in Key Stage 1 and the different levels the children were working at in science. It was great chatting*

*to the other student who is teaching the year group just above me, so we could identify what the different levels were within an actual topic or set of lessons. It was great to experience progression, as opposed to just talking or reading about it in college.”*

*“In teaching practice the focus was mostly on the doing of the activity and a bit on recording. The project has shown the importance of introduction and using children’s ideas to plan. I have learned so much about all the ways, apart from just writing, that children can record. The use of the Discovery Dog in the planning was really helpful. This can be a difficult and dull activity but this approach is really exciting and the children all took part and enjoyed it.”*

*“It was great to get the opportunity to work along with an experienced teacher. In school-based teaching practice you are slotting in and out, but on the project it was more team teaching and I could see how the experienced teacher was handling situations which I was involved in. I picked up so much day to day teaching tips.”*

***The teachers reported having benefited greatly from the opportunity to directly observe their own class, particularly when using the Quality Learning Instrument (QLI). The additional opportunity to observe the class above or below their own has helped support teachers planning for progression in primary science.***

Teachers reported finding the QLI a challenging but very worthwhile experience. They found the approach useful in helping to identify and focus on particular aspects of the pupils’ learning experience. Comments included;

*“The observations have given us an opportunity to identify markers which are useful in planning future lessons. It was also very useful in identifying individual children’s performances and considering what were the motivating aspects of the lesson.”*

*“I found it useful to compare how some of the children are motivated and willing to use scientific language.”*

The teachers also commented on how useful it was to get the opportunity to observe science lessons at a level above or below them. This unique opportunity allowed the teachers to focus on one or two science process skills and identify the indicators of pupil performance at each level. Teachers’ comments included;

*“It was really useful to see the deeper and more probing type of question used with the older age group. I could see what I am working towards with my class. I can see the progression in questioning and pupils’ responses.”*

*“Good to see the development of children’s enquiry skills and thinking processes. Their organisational skills are so much more developed and they are less dependent on teacher input.”*

***The use of stories and the enquiry-based approach provided the pupils with a rich and very enjoyable learning experience.***

The student teachers recorded the comments of the pupils, regarding what they had and had not enjoyed at the end of each of their science lessons. In addition a number of focus group interviews were conducted with pupils after science lessons. Both sets of data show that:

- pupils recalled both the story and the science activity;
- all the pupils enjoyed the experience of ‘hands-on’ activities and ‘testing’ and ‘finding out’;
- pupils liked using the story with the science lesson;
- the story/book made the science activity ‘easier’;
- pupils did not like having to write for too long and preferred alternatives like discussing their work and drawing.

Comments from pupils suggesting that the book or story supported the science activity included:

*“Yes, because you know what you are going to do and you know what it is about.”*

*“Because you can look at the word and this helps you write it.”*

*“Because it is easier when it is just like a poem. The story teaches us more stuff. It helps us when we write it down.”*

*“Because the story told us what the animals were doing and Miss Johnston asked us that and we had our hands up and we knew the answer before she even asked the question.”*

*“The feely box helped me learn new words”*

*“Bertie Bunny helped me realise that some things can be made from more than one material, like a spoon in the kitchen, metal and plastic.”*

*“ I often spill things in the kitchen at home and now I know never to use a plastic bag to wipe it up! – like Naughty Nora.”*

*“I now know why my Daddy use bricks instead of straw.” (Three Little Pigs)*

Comments from pupils suggesting they enjoyed the ‘hands-on’ activities include:

*“I enjoy making different noises I like having fun.”*

*“I enjoyed feeling the wet socks and putting them on the radiator.”*

*“I like when it is fun to see what one floats.”*

*“I only don’t like science when you don’t have a turn doing stuff, when you don’t get to do it.”*

*“It was fun and it was like we weren’t learning but we actually were.”*

#### 4.4 Students’ Posters

The student teachers, working in pairs presented their work in the form of a poster. Copies of the posters are displayed in Stranmillis University College, the participating schools and the headquarters of the South Eastern Education and Library Board. (Two of the posters are shown in Appendix 9. Appendix 10 shows some photographs of a typical lesson).

### **Section 5: Sustainability of the project and project extension 2007-2008**

All parties involved in the project, (project team, participating schools and student teachers) consider it to have been a great success and are very keen to continue this work into the academic year 2007-2008. The participating schools are keen to embed these practices within their science teaching schemes. At the ‘Evaluation and Dissemination’ seminar on 1<sup>st</sup> June the following model for future work was developed.

#### **2006-2007 Modelling phase**

During the past year the student teachers have modelled the enquiry-based approach and the use of books and stories in lower primary science. This has provided schools with the opportunity to observe and reflect on their current practice.

#### **2007-2008 ‘Scaffolding’ phase**

During the coming year a new cohort of student teachers will be placed in the participating schools. The students will play a supportive role in the planning and teaching, as the classroom teachers uses books and stories within an enquiry-based approach.

## **2008-2009 'Autonomous' phase**

During this final stage of the project the schools continue to teach in this way without the support of the students. Progress monitored by project team.

## **Section 6: Dissemination of findings and publicity relating to the project**

The project team aims to disseminate the findings of the project as widely as possible across science education stakeholders in Northern Ireland and beyond. This dissemination will take the form of:

- A number of the participating schools have planned to include this work during their INSET training during the school year.
- Posters displaying the students' work is to be displayed at the headquarters of the South Eastern Education and Library Board.
- The preliminary findings of the project were presented at the annual conference of the Irish Association for Social Scientific and Environmental Education ( IASEE) at the University of Limerick in June 2007.
- A proposal to present the findings of the project at the Association of Science Education annual conference in January 2008 has been accepted.
- The findings of the project will be presented within Stranmillis University College at a research seminar to which colleagues from other initial teacher education institutions will be invited.
- The Northern Ireland Committee of the Association for Science Education (ASE) plan to hold a workshop at Stranmillis University College Belfast for local primary teachers based on the findings of the BASICS project in February 2008.
- The findings of the project will be presented at the ASE/ ISTA conference in Letterkenny Co. Donegal on 12<sup>th</sup> April 2008.
- The findings of the project and the teaching materials will be accessible to the public on the Stranmillis University College website in the near future.

- Suggestions of best practice and ideas for resources regarding the use of books and stories within lower primary science will be submitted for publication in the ASE's publication 'Primary Science Review'.
- A detailed analysis of the findings will be submitted to a peer-reviewed journal.

#### Publicity relating to the project

- Article on the project in ASE Region 11 ( Northern Ireland) Issue 4: December 2006
- Photograph and short article on project in Irish News (9<sup>th</sup> December 2006) (Appendix 11)
- Details of project posted on Research area of Stranmillis University College Belfast website at <http://www.stran.ac.uk/research/FundedProjects.html> and project events reported on news and events section at <http://www.stran.ac.uk/news/>

# **Appendix 1**

## **Project team**

Dr John McCullagh, Stranmillis University College Belfast (Lead Person)

Dr Julian Greenwood, Stranmillis University College Belfast (Science Education)

Dr Glenda Walsh, Stranmillis University College Belfast (Early Childhood Studies)

Mr Peter McAlister, South Eastern Education and Library Board/ASE

Mrs Valerie McCartney, South Eastern Education and Library Board

Mrs Sandra Ward, N. Ireland Regional Leader for Pushkin Prize

Dr Colette Murphy, Queen's University Belfast (External assessor)

Dr Jim Beggs, St Mary's University College Belfast (External assessor)

Dr Keith Bishop, University of Bath, (External assessor)

## **Participating Schools and classes involved**

Cairnshill Primary School Belfast (Two classes at P2 and two at P3)

Gilnahirk Primary School Belfast (Classes at P2 and P3)

Millenium Integrated Primary School Carryduff, Co. Down (Classes at P2 and P3)

Newtownbreda Primary School Belfast (Classes at P2 and P3)

St. Joseph's Primary School Carryduff, Co. Down (Classes at P2 and P3)

## Appendix 2

### Project proposal

#### **Project title: Books And Stories In Children's Science (BASICS)**



**Lead person:** Dr John McCullagh, Stranmillis University College Belfast

**Others involved in the project:**

Dr Julian Greenwood, Stranmillis University College Belfast (Science Education)

Dr Glenda Walsh, Stranmillis University College Belfast (Early Childhood Studies)

Mr Peter McAlister, South Eastern Education and Library Board/ASE

Mrs Valerie McCartney, South Eastern Education and Library Board

Mrs Sandra Ward, N. Ireland Regional Leader for Pushkin Prize

Dr Colette Murphy, Queen's University Belfast (External validator)

Dr Jim Beggs, St Mary's University College Belfast (External validator)

#### **Summary**

This is a cluster project which aims to support and develop science across the potentially challenging transition from Foundation stage into Key Stage 1 in a group of five local primary schools. School development plans will be developed in the key areas of investigative/enquiry-based science and the use of books and stories to develop learning and teaching. The project continues and develops our partnership approach to teachers' continuing professional development adopted in the AstraZeneca funded SSIPS (Science Students in Primary Science) Project (2002-2003) by including literacy.

#### **The Project Aims to:**

- Work with head teachers and their governing bodies to identify and support development needs, specific to each school, with respect to the transition from Foundation stage to the more formal approach to teaching and learning in Science adopted at Key Stage 1.
- Develop the confidence and competence of teachers in adopting an 'investigative approach' to science in the lower primary school.
- Promote the use of books and stories as an effective strategy for providing a stimulating and relevant context in which investigative science activities may be carried out.
- Encourage and support the greater integration of the primary science and literacy curriculum.
- Develop and support science coordinator's strategies for promoting best practice in science teaching throughout Foundation stage and Key Stage 1 within each of the participating schools.

**This project will seek to embed good practice by:**

- Providing the opportunity and support for planning for continuity in children's science learning experience across the Foundation/Key Stage 1 interface.
- Enabling teachers of Foundation and Key Stage 1 to plan together and to observe good practice in science lessons on the 'other side' of the transition interface.
- Increasing teachers' competence and confidence in the areas of enquiry-based learning and 'investigative science'.
- Developing teachers' awareness of the potential for science to support children's acquisition of literacy skills and the key role of literacy within the science curriculum.
- Reflecting on current literacy practice so that areas where science can be included are identified and development strategies planned and resourced.
- Providing the support of a science specialist student teacher, therefore enabling the classroom teacher to observe and reflect on teaching and learning.
- Training science coordinators in how best to disseminate, monitor and evaluate effective teaching and learning strategies within the context of their School Development Plans.
- Allowing for the discussion and sharing of best practice and resources, across the full range of topics within the Foundation stage and Key Stage 1 science curriculum, between teachers from all participating schools.

**As a result of being involved with the project it is expected that governing bodies, head teachers and science coordinators will have:**

- Improved the quality of teaching and learning in science at both stages and across the Foundation /Key Stage 1 transition.
- Put in place strategies for the ongoing monitoring and evaluating of progress in science education in their school.

**As a result of being involved with the project it is expected that teachers will have:**

- Developed their awareness and appreciation of the opportunities for continuity and progression across the two stages.
- Observed teacher-pupil interactions during science lessons at the next, (Foundation teachers) ,or previous (Key Stage 1 teachers) phase of transition.
- Enhanced their insight into the progress and development of their pupils as a result of direct observation during science lessons.
- Increased confidence and competence in adopting an investigative approach to teaching science.
- A greater sense of how to adopt a more holistic approach to Language and Literacy by taking account of the integral nature of the areas of Talking and Listening, Early Reading and Early Writing and how they can be developed through the science curriculum.
- A deeper appreciation of how science may be made more accessible and relevant to young children.

**As a result of being involved with the project it is expected that *pupils* will have:**

- Developed their self-esteem and confidence through positive classroom activities and relationships.
- Been introduced to their Key Stage 1 teacher during ‘taster lessons’ in which a more formal approach is adopted (Foundation level children).
- Revisited and built on their Foundation level experiences with the support of their Foundation level teacher (Key Stage 1 children).
- Experienced enjoyable and stimulating science activities.
- Increased levels of scientific literacy through seeing science to be relevant and important.
- Made connections between science inside and outside their classrooms.

**Project delivery**

The project will involve science education and Early Childhood specialists from Stranmillis University College Belfast, the South Eastern Education and Library Board, together with undergraduate student teachers, all working with schools to develop and sustain best practice in science across the Foundation/ Key Stage 1 transition. It will consist of three phases.

**Phase 1 ‘Preliminary reflection and preparation’**

The head teachers, governing bodies and science coordinators of all participating schools will be supported in identifying areas for development in relation to lower primary science and the transition from Foundation to Key Stage 1, specific to their school. As a result a school development plan will be produced.

**Phase 2 Seminar 1 ‘Getting Started’**

This whole day seminar will provide in-service training for the teachers and science coordinators in the areas of enquiry-based science and the use of books and stories in lower primary science. The focus will include planning for progression across the Foundation/Key Stage 1 transition and the issues pertinent to the introduction of more formal approaches to learning at Key Stage 1. Support for the planning, resourcing, and teaching will be provided within the context of the particular topics within each of the curricula with particular consideration given to continuity and progression. During this seminar teachers and students will plan together and identify strategies and resources.

**Phase 3 ‘Teaching, observing and reflecting’**

During this six-week period the student teachers will teach, supported by the teacher, in their allocated class for one morning a week. This will provide the opportunity for the classroom teacher to directly observe their pupils within a pupil centred learning environment. In addition this arrangement will also allow for teachers to observe classes on the ‘other side’ of the transition and compare and reflect on both teaching approaches and pupil interactions. Each morning will consist of a literacy lesson, using science as the context, followed by an investigative or enquiry based hands-on science activity.

**Phase 4 ‘Dissemination of best practice and recommendations’**

This whole day seminar will allow student teachers and classroom teachers, from each of the different schools and classes, to share their experiences, evaluate approaches and resources and consider recommendations for future best practice.

### **Project Timetable**

| <b>Phase</b> | <b>Proposed date</b>                            | <b>Who will be primarily involved?</b>   |
|--------------|---|--|
| 1            | September 2006                                  | Head teachers, Governing bodies, Science Coordinators, Project Lead person                           |
| 2            | December 2006                                   | Science Education and Literacy Specialists (Stranmillis University College, SEELB)                   |
| 3            | February-April 2007<br>(including Easter break) | Head teachers, Science Coordinators, teachers, student teachers, pupils                              |
| 4            | May/June 2007                                   | Science Education and Literacy Specialists (Stranmillis University College, SEELB), student teachers |

### **Key Features of the project**

- This project aims to enhance the quality of lower primary science by focusing on the Foundation /Key Stage 1 transition within each of the participating schools. This will involve working closely with the head teachers and governing bodies to identify areas for improvement and development with particular reference to continuity in children's learning experience in science. This approach will allow for needs specific to each school to be addressed, for example, resources for science activities, levels of literacy within the school, special needs provision, , science specialists among the teaching staff, parental involvement, school environment.
- This project directly addresses the challenging issue of transition from Foundation into Key Stage 1 by providing teachers with the opportunity to experience science lessons at both stages, thereby promoting and supporting planning for continuity in pupils' learning experience.
- Recent research reports the lack of quality professional development for teachers in the area of science. This project will provide teachers and science coordinators with training from specialists in investigative or enquiry based science education and the use of literacy within science. Training will also be provided for science coordinators in the dissemination, monitoring and evaluating of good practice in science throughout the whole school.
- The project will be supported by specialists in Science Education, Early Childhood Studies, and Literacy from Stranmillis University College Belfast and the South Eastern Education and Library Board, TACT Wildlife Centre Co. Antrim and the regional leader of the Pushkin Prize
- Anticipated outcomes include the enhanced quality of science teaching and learning in all participating schools together with publication of a full research report and peer reviewed research papers ( International Journal

of Science Education, Primary Science Review), and conference presentations (ECER September 2007)

- A coherent and thorough evaluation strategy will be built into this project from the start. The research methods and results will be externally verified by Dr Colette Murphy (Queen's University Belfast and Dr Jim Beggs (St Mary's University College Belfast). Research tools include questionnaires accessing quantitative (Likert scale) and qualitative (views and perceptions) data, semi-structured interviews with a sample of participants (head teachers, science coordinators, teachers, student teachers), focus group interviews with pupils, teacher and student teachers' diaries.
- This project comes at a time when schools are preparing for the introduction of "The Revised Northern Ireland Primary Curriculum" with its key features of Foundation Stage and the more integrated curricula at Key Stages 1 and 2, for teaching beginning in September 2007. The project will support schools' development of science at both Foundation Stage and across transition into Key Stage 1. In the new curriculum science is now included in the topic 'The World Around Us'. This project will support schools in integrating science throughout the curriculum. Research has shown that the recent focus on Literacy has in some cases sidelined science in terms of classroom teaching and INSET time. This 'BASICS' project supports the development of children's scientific literacy (as does the 'Discussions in Primary Science' project at The University of York) but it also addresses issues relating to science process skills and literacy skills.
- The project is building on previous work with primary schools. Stranmillis University College were part of the SSIPS (Science Students in Primary Schools) project funded by AstraZeneca (2002-2003). We have continued this work with a local primary school (The Holy Rosary Primary School Belfast) over the last three years. Thorough evaluations of this work show it has made a great impact on the teaching of science, particularly investigative science, the use of 'Big Books' at Key Stage 1 and 'Writing and Communicating Science at Key Stage 2'. Details and findings from this work have included a presentation at the IASSEE (Irish Association for Social Scientific and Environmental Education) annual conference (June 2005), the research paper entitled "Partners in Progress: An evaluation of an ITE Institution-School Partnership Project" shortly to be submitted to the peer reviewed journal "*Teacher Education*", and the paper accepted for presentation at ECER conference September 2006 "An evaluation of how a partnership between an Initial Teacher Education College and a Primary School can support the development of both literacy and enquiry-based learning in science education."

### Estimated Project Budget.

| <b>Summary of costs for project</b>                                     |                |
|---|----------------|
| <b>Substitute Cover<br/>(26 teachers for 2 days)</b>                    | 10400          |
| <b>Conference facilities/catering<br/>(for 44 people for 2 days)</b>    | 1300           |
| <b>Resources for participating schools<br/>(5 schools at £500 each)</b> | 2500           |
| <b>Guest Speaker costs</b>  | 500            |
| <b>Travel costs - Teachers</b>  | 500            |
| <b>- Students</b>   | 500            |
| <b>Administration/Academic Support</b>                                  | 1800           |
| <b>Total</b>  | <b>£ 17500</b> |

### Background to project.

This project comes at a period of change for science education in Northern Ireland. The introduction of the Revised Northern Ireland Primary Curriculum with its Foundation Stage and the inclusion of science within the curricular area 'The World Around Us' will require schools to revise their approaches to science education. Recent evaluation of the 'Early Years Enriched Curriculum' by Sproule et al (2005,p7) reports support for this approach but identifies "*clear differences between the experiences of Year1/2 teachers and Year 3/4 teachers with regard to the availability of training and resources.*" The potential exists for disruption to children's progress if teaching moves too abruptly to the more formal approach of Key Stage 1 and the principles of the Foundation Stage are not fully developed.

It is now over a decade since Harlen (1995) reported that Scottish primary school teachers felt less confident about teaching Science than either English or Mathematics. Despite the progress made by primary science (OFSTED 2002)) since its inclusion in the National Curriculum, science teachers still continue to feel less confident in this area. Dillon *et al.* (2000) point out that it is 'investigative science' that causes most concern for primary school teachers. It is this investigative approach to science teaching which Murphy *et al.* (2004) contend develops children's interest and liking for science. More recently the extensive scoping study by Murphy and Beggs (2005) identified a lack of knowledge, expertise, confidence and training to be the major concerns of primary teachers. Murphy and Beggs (2005) also report that

only a small fraction of teachers use stories during their science lessons and that this is an aspect of science teaching in which they do not feel confident. Oliver (1999) points out the important role of literacy within science education.

### **Bibliography**

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# Appendix 3

## Modified Quality Learning Instrument

Time of lesson: \_\_\_\_\_ -

Number of children: \_\_\_\_\_

Title of lesson: \_\_\_\_\_

Learning Intentions:

Brief Description of Lesson:

Evaluation of Lesson based on QLI:

| Indicator   | Rating | Comments |
|---|--------|----------|
| Children's Motivation   |        |          |
| Children's Concentration                                      |        |          |
| Children's Confidence   |        |          |
| Children's Observation and Communication Skills               |        |          |
| Children's Predicting, Problem-Solving Decision-Making Skills |        |          |

The observation activity

How useful have you found this activity? Please explain.

What aspects of this approach to observation have you found the most challenging?

Any other comments.

## **Appendix 4**

### **BASICS Project**

#### **Seminar 1 Friday 8<sup>th</sup> December 2006**

#### **Programme**

|             |   |                   |
|-------------|---|-------------------|
| 9.00-9.10   | <b>Registration</b>   | Slemish           |
| 9.10-9.15   | <b>Welcome</b> – Prof McMinn (SUC)  | Slemish           |
| 9.15-9.30   | <b>Introduction and aims of project</b> – J. McCullagh (SUC)                | Slemish           |
| 9.30-10.00  | <b>The Foundation Stage and Science</b> – G. Walsh (SUC)                    | Slemish           |
| 10.00-10.15 | <b>Enquiry-based learning in Science</b> – J. McCullagh (SUC)               | Slemish           |
| 10.15-10.30 | <b>Tea/ Coffee</b>  | Lounge            |
| 10.30-11.30 | <b>Enquiry-based Science workshop</b> - P. McAlister & V. Macartney (SEELB) | Binnian           |
| 11.30-12.30 | <b>The Puppets Project</b> – Stuart Naylor                                  | Slemish           |
| 12.30- 1.00 | <b>Lunch</b>  | Chatz             |
| 1.00 – 1.15 | <b>Tea/Coffee (Book Display)</b>  | Lounge            |
| 1.15-2.00   | <b>Using books with young children-</b> S. Ward (SUC)                       | Slemish           |
| 2.00-2.45   | <b>The Quality Learning Instrument</b> – G. Walsh (SUC)                     | Slemish           |
| 2.45-2.55   | <b>Planning time</b>  | Slemish & Binnain |
| 2.55-3.00   | <b>Questions, Next step, Evaluation, Finish</b> – J. McCullagh (SUC)        | Slemish           |

## **Appendix 5**

**Programme for Seminar 1<sup>st</sup> June 2007**

### **Evaluation and Dissemination**

- 9.30-10.00** Project Evaluation (JMcC)
- 10.00-10.45** Story Books and Story Walks (CG & R H)
- 10.45-11.00** Coffee
- 11.00-11.30** Viewing of students' posters
- 11.30-12.15** Presentation of posters and discussion
- 12.15-1.15** Lunch
- 1.15 -1.30** Next steps, seminar evaluation and finish (JMcC)

**Parallel session 11.00-11.30 (Principals & Science Coordinators)**  
**What next?- How can the project impact across the rest of the school?**

## Appendix 6

### Letter of application for additional funding



STRANMILLIS  
UNIVERSITY COLLEGE

A College of Queen's University Belfast

Science Department  
Stranmillis University College, Belfast

6<sup>th</sup> June 2007

Dear Trustees,

I am writing to you to request some additional funding (£2,800) for our BASICS Project (Books And Stories In Children's Science). This funding, together with the estimated surplus remaining from the original sum (£4,500), is necessary to ensure that this very successful project achieves its full potential by enhancing lower primary science here in Northern Ireland. I have attached details of these further costs and some additional material in support of this request. Let me assure you that this additional support would not merely be used to repeat the work of the project to date, but would allow us to develop our work with the schools and the local Education Boards in order to establish this cluster of schools as examples of excellence in lower primary science. As a relatively inexperienced researcher I was cautious regarding how successful I expected the project to be and how much funding to bid for. I now fully realise that with proper dissemination the project has a huge potential for enhancing practice across a great many schools.

The BASICS project has already made a huge impact on the Principals, Science Coordinators, and teachers involved. As a result of their observations of the students' classroom practice and the Evaluation and Dissemination Seminar (1<sup>st</sup> June), all participants are convinced of the merits of this approach to primary science and are keen to take this further. So far in the project the students have taken the lead in the classroom and in their teaching they have 'modelled' the various aspects of best practice. Together with the schools themselves, I now feel it is vital that the teachers get the opportunity to take over the teaching, with the support of the student, in what we envisage would be a 'scaffolding phase'. This phase is important for two reasons. Firstly it will provide the teacher with the opportunity to consolidate these approaches and embed them in their work. This will therefore have a real impact on a whole school level. Secondly we hope to be able to use these practicing teachers to disseminate their work across other schools at cluster meetings. Throughout the project we have recorded some of the students' lessons and are compiling a collection of clips exemplifying best practice. We would welcome the opportunity to continue this work and involve classroom teachers. This material would then be available for supporting science in other schools.

In conclusion I feel that this additional support would provide the opportunity to make a significant impact on lower primary science. At a time of great change in our curriculum, with the future of science more uncertain than ever, it would be unfortunate not to maximise the potential benefits of this work to date. As project leader I feel passionately about this work and hope that through our development and dissemination, the wonders of science enquiry and the joy of story can reach a greater number of children.

Best Wishes,

Dr. John McCullagh  
(Project Leader)

