Where can you find out more about the research?

Research study website
www.pi-project.ac.uk

Software available from
www.nQuire.org.uk

and for videos on the project
http://www.tlrp.org/tel/

This project is just one of the many innovative research projects being undertaken within the Centre for Research in Education and Educational Technology (CREET). CREET is one of the leading education research units in the UK. It is an internationally respected centre of excellence, pursuing innovative and rigorous research that influences policy and practice.

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www8.open.ac.uk/creet/main

The Centre for Research in Education and Educational Technology (CREET)
The Open University
Stuart Hall Building (Ground Floor)
Walton Hall
Milton Keynes
MK7 6AA

Tel: +44 (0)1908 655364
CREET-Enquiries@open.ac.uk

For information about applying for postgraduate study:
www8.open.ac.uk/creet/main/postgraduate

For research student enquiries:
CREET-Student-Enquiries@open.ac.uk
WHAT IS THE BACKGROUND TO THE RESEARCH?

We live in a complex world, where knowledge is built by engaging in debate and making informed choices amongst contested sources of evidence. So learning how to debate and make these choices is a crucial part of learning at school. School students need to engage in a variety of critical activities (e.g. arguing from sources, collecting and debating evidence) and to make appropriate connections between everyday experiences and formal education. There is evidence that such learning can be enhanced by a combination of new methods of active inquiry and innovative technology. Yet, the number of students electing to take a science subject in schools, a key context in which they learn about and carry out inquiries, has been declining in most Western countries (see, e.g. Ainley, J., Kos, J., & Nicholas, M. 2008).

The aim of the Personal Inquiry project, run jointly by The Open University and The University of Nottingham, therefore, was to support young learners in coming to understand themselves and their world through scripted personal inquiry learning, where scripts are computer programs, like dynamic learning activity or lesson guides. With the help of the nQuire software developed for use on both mobile and desktop computers, children could investigate issues that affect their lives, across different settings - including the classroom, their homes, and discovery centres - through a scientific process of inquiry: gathering and assessing evidence, conducting experiments.
and engaging in informed debate. The personal relevance of the issues that they investigated was expected to lead to high engagement in the inquiry process.

We also put the technology - literally – in the learners’ hands, so that they contributed to data collection, both in the lab and in their everyday world, and took some responsibility, collaboratively, for its authority and provenance.

As well as designing new educational methods of scripted inquiry learning, the project evaluated their effectiveness in helping young people conduct personal inquiries across formal and informal settings.

Six school-based trials were conducted to evaluate the combination of technology and pedagogy, on topics of: urban heat islands, heart rate and fitness, microclimates, healthy eating, sustainability, and effect of noise pollution on birds. Interviews with participants observations and comparative studies across the trials showed evidence of increased understanding of the inquiry learning process by children and teachers alike.

The research addressed five key research questions:

1. How can scripted personal technologies be designed to support effective learning across transitions between formal and informal settings?

2. How can teachers be enabled to author, organise and monitor successful learning activities, aligned to curriculum topics?

3. How are such technologies appropriated as tools for learning?

4. How does the conduct and experience of scripted inquiry learning mediate and change learning activities?
5. How do scripted inquiry learning activities develop children’s learning skills, including to work collaboratively argue and debate from evidence, judge the veracity of source information, deal with noise in data, and construct and interpret appropriate visualisations of data?

WHAT WERE THE OUTCOMES OR IMPACTS?

Findings, in relation to the five questions above, include the following:

1. To support effective learning across transitions between formal and informal settings, an understanding of the inquiry learning process that is shared between teachers, learners and educational designers is needed. The project developed a new inquiry learning framework, implemented as a ‘dynamic inquiry guide’ on the nQuire toolkit. This provides a conceptual tool and visualisation to guide the teaching of scientific inquiry. In addition to its use within schools in the project, the framework was used to support a series of inquiry sessions with Girl Guides in Newport Pagnell, near Milton Keynes, and the development and evaluation of a new badge “Streets Ahead” which was adopted by Girlguiding UK. See http://www8.open.ac.uk/researchprojects/childrens-research-centre/crc-projects.

2. We developed a software authoring environment that represents and supports a sequence of lessons and the inquiry process phases. Using this environment, teachers can be enabled to author, organise and monitor successful learning activities. It helps teachers to allocate students to project groups, integrates student data, supports whole class presentation of results and exports these to standard software applications.

3. The toolkit was successfully used by 300 pupils and 7 teachers during the project in various settings, including teacher-directed lessons and learner-managed homework, and less formal settings such as an after-school club and field trip. Since then, the nQuire website has over 5000 visits.

4. Scripted inquiry learning can support and change learning activities by giving learners a persistent and flexible representation of the inquiry learning process that enables them to understand how the component activities (e.g. deciding on the question, planning an enquiry, collecting evidence, analysing data and sharing results) fit within and
shape the process of scientific investigation. For example, in the voluntary after school club in Milton Keynes, the children were able to choose their own investigations and how they would conduct them.

For their empirical investigation, having studied the sustainability cycle in school, they decided to inquire into some of the factors that affect food preservation by investigating food rotting: in particular, the role of packaging and different types of food. Do organic bananas last longer? Does packaged cheese rot faster? They had an hour each week in the afternoon club to develop their inquiry. Then, assisted by the nQuire toolkit, they were able to continue at home, taking measures of temperature and humidity, entering data into the computer to follow the inquiry process. Back in the club, they shared and discussed results in relation to their inquiry questions. The questions and discussion that followed the inquiry presentations suggested that the children did indeed appreciate important aspects of the inquiry process such as the need to control variables and the challenges of doing this when the different cheeses were rotting in different pupils’ houses. In interviews after the study both pupils and parents reported changes in their purchasing behaviour (e.g. refusing plastic bags.)

5. We found that scripted inquiry learning activities can be associated with positive learning outcomes, significantly greater than those of a control class, maintain children’s enjoyment
of science lessons (by comparison with a control class), enable a fluid transition between individual, group and whole class activity, and support learning across formal and non-formal settings. Engagement levels were particularly high in the student led inquiries in the less formal settings of a nature reserve and an after school club.

IMPLEMENTATION

We designed the technology and pedagogy together, by creating scenarios for effective learning, implemented in software that allows teachers to author, modify and use inquiry learning scripts (dynamic learning activity guides) for learners. The scripts run on mobile devices and desktop computers to support and manage the learning.

Evaluation was integrated into the development process and the outcomes of each evaluation session informed the next stage of the development or fed into an iteration of an earlier stage. We were fortunate in working with enthusiastic and knowledgeable teachers throughout the project. They have acted as design partners in shaping the lesson plans and design of the trials, as well as directing the teaching sessions.

Producing an inquiry activity with sufficient engagement proved to be a challenge, initially, especially for learner led inquiries in more formal settings that were constrained by curriculum requirements. This led to rethinking our conceptualization of personally relevant inquiries and subsequent inquiries were very successful in engaging students across the different contexts.

HOW WAS THE RESEARCH CARRIED OUT?

In the project’s early stages, an iterative series of technology prototypes at Nottingham and the Open University were evaluated through expert usability evaluation and user testing. These were integrated into a combined personal inquiry toolkit (nQuire) which was evaluated during the trials in 2009 and through further development and usability testing during 2010.

Extensive and comparative evaluations of the method and technology developed by the project were conducted in 2009. For the Urban Heat Island trials at Milton Keynes (57 participants), the evaluation consisted of pre and post tests of domain knowledge and methodology knowledge, video recording of lessons, interviews with students and teachers, student-conducted interviews during the field-trip and examination of coursework.
For the Effect of Pollution on Bird Feeding trials at Nottingham (Intervention, 28 students; Control, 27 students), evaluation comprised a) pre-, post- and delayed post-intervention tests of science attitudes, for intervention and control groups, b) pre- and post-intervention tests of knowledge of the inquiry process (using an evaluation instrument developed for the project), for both groups, c) qualitative data collected during the interventions from video recordings of all classroom lessons, plus the field trip and activities in the school grounds, logfiles of the computer interactions, and 11 interviews with teacher and pupils.

Initial training for teachers helped them to understand how the process for each inquiry can be supported by the technology toolkit, how lesson plans can involve learning both inside and outside the classroom, how the inquiry can be validated, shared and presented in class, and how to manage contingencies including students’ inability or unwillingness to manage their inquiry activities outside the classroom.

The collected data from the interventions at Milton Keynes and Nottingham were analysed for pre-post differences in domain knowledge, knowledge of the inquiry process, and attitudes to science. Qualitative analysis included a critical incident study of the videotapes of classroom interactions, to uncover evidence of breakthroughs and breakdowns in learning activity, further probed by showing the videotaped incidents to the students to prompt their recall of the events. The outcomes of the trials and participatory design workshops informed the subsequent design of learning activities and the nQuire toolkit.

WHAT MIGHT THE IMPLICATIONS OF THE RESEARCH BE FOR POLICY MAKERS/ PRACTITIONERS

The nQuire toolkit was implemented as an Open Source application, available for free download (www.nquire.org.uk). We anticipate that it will have an impact on the adoption of scripted inquiry learning in UK schools. Teachers, educational designers and systems developers can run demonstration inquiries through a web-based interface, or can download the software to extend existing inquiries or author new ones. The software can run on a Windows, Macintosh or Linux PC, and on mobile devices web browsers such as the Apple iPad, or can be downloaded to a USB data-stick which allows it to be run from the stick (e.g. in a school) without the need to install software on the computer. The intention is to make the toolkit fully accessible to the teacher and academic community, in the UK.
and worldwide, to try, use, design, author, and share scripted personal inquiries. The project has created an online community with facilities for uploading new inquiries, adding teaching materials and initiating a newsfeed and discussion area for each new inquiry.

European researchers engaged with the ‘orchestration’ theme of the STELLAR Network of Excellence in Technology Enhanced Learning have integrated the concept of ‘orchestrating inquiry learning’, e.g. in the STELLAR deliverable “The relevance of ‘classroom orchestration’ for Technology Enhanced Learning”.
Personal Inquiry

Eileen Scanlon, Mike Sharples and Ann Jones
The Open University
eileen.scanlon@open.ac.uk, mike.sharples@open.ac.uk, ann.jones@open.ac.uk

Key Publications


Two project videos were made freely available on social media. Learning with Technology was made publically available on Apple’s iTunesU platform. This short video is also on YouTube, resulting in over 4500 views. A second project video was produced for the project Open Day in June 2010. Both videos are available at http://www.tlrp.org/tel/ and http://youtube.com/tlrptel

Book


References