Interacting with Technology

Lecture 2: Mobile technologies and sensors

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Overview

Introduction & Lecture 1: Children, schools and technology
Lecture 2: Mobile technologies and sensors
Lecture 3: Mobile and tangible technologies for children
Lecture 4: Case study: Children and technology
Lecture 5. Exploring spatial cognition with novel technologies
Lecture 6: Aiding spatial cognition in children
Lecture 7: Evaluating 'in the wild'
Content

• Exploring how newly available technologies such as bespoke educational sensors, 3G mobile phones and internet applications such as Google Maps can be appropriated for use in scientific investigations in schools.

• Hands-on approach placing the emphasis on learning practice rather than teaching findings.

• Highlight key aspects of the work including the need for retaining context to aid interpretation where this has explicitly led from observational analysis to targeted study design.
UK Science Education Policy

• “Science and Innovation Policy for the 21st Century”
• Concerns about what is seen as a lack of interest in science amongst many schoolchildren and the public
• Science education -> further study & higher education
  – Teaching content
• Science education -> scientifically literate public
  – Teaching process
• Process-oriented model receiving increasing attention (Woodgate and Stanton Fraser, 2005)
Brief Background

• New forms of interactive technology may enhance learning by doing (Kafai and Resnick, 1996)

• Our own work on designing and evaluating technologies with children has highlighted possibilities
  – Kidstory
  – SHAPE
  – Ambient Wood

• Relationships between content-oriented teaching and day-to-day application of scientific knowledge are weak

• Projects begin to enable children to communicate with scientists and each other to understand and compare data (Pea et al., 1997)
The SENSE project: a context-inclusive approach to studying environmental science within and across schools

- **Aims**
  - To explore how emerging eScience technologies can enhance science education
  - Hands-on approach to learning science in schools
  - Children learn about presence and impact of pollution
  - Encourage an understanding of the scientific process
  - Support collaborative activity between different schools and with scientists
Activities
Children as active scientists

• 2 schools involved
  – Glenbrook Primary in Nottingham
  – Varndean Secondary in Brighton
• Sessions to familiarise children with pollution
• Children use mobile carbon monoxide sensors to measure pollution levels in their local environment
• Use software tools to analyse their data in the classroom and to share with others
Mobile Sensors

- Children collect pollution data
- Mobile sensor records and gives instant feedback
Analysing data

Textual annotation

Video replay

Time series

Interest point
Connectivity, schools and scientists

• Children in same school
  – Scientific Teams

• Children in different schools
  – Connectivity, Community

• Children and scientists
  – Learning from the Experts
Results

Results of video analysis and teacher interviews suggest that this context-inclusive approach is significant for three reasons:

1. Allows individuals to reflect on method as part of data collection.

2. Provides an aide-memoir to groups who have collected data together in interpreting results.

3. Enables new participants who have engaged in similar processes to understand new perspectives on their own and others’ data (e.g. across schools).
Some of the challenges

- Research often pilot projects engaging one or two schools
- Involves enthusiastic, volunteering teachers and does not reach many schools or affect policy
- Hands on approach, learner centred – labour intensive
- Motivation for teachers, children and parents to engage in the learning?
- Challenge of engaging children in formal schooling but also in their everyday informal settings (In UK children turned off due to SATS and delivery style)
- Consent issues
  - New technologies generate new forms of data without clear ethical guidelines
- Integrating with the curriculum
- Innovating the curriculum
- Assessment measures
Towards a full-scale project

- Scale up to include a large number of schools across the UK (without intensive research time in each school, but enabling activities to be teacher and child led)
- Public participation
- Include media companies to facilitate access to further schools and downloadable software
- Expert scientists suggest activities
- Requires low cost sensor kits
- Widespread mobile computing e.g. mobile phones
- Address issues around privacy of children’s data while enabling personalisation
- Developing usable, motivating, accessible interfaces
- More in-depth evaluation (benefits to education, psychological impact)
Pervasive Computing for Mass Participation in Environmental Monitoring (PARTICIPATE)

- TSB/EPSRC project; £3.8m funding over 3 years.
- Collaboration between University of Bath and MRL, University of Nottingham, BT, BBC, Microsoft, Science Scope and Blast Theory
- 3 Themes: Education, Community, Gaming
- A 3-level structure
  - 1. to allow members of the public to upload sensor data through personal devices, establishing a general background picture of quality of life factors across the county
  - 2. Schools carry out focused investigations of their local environments, drilling down into the background data in more detail
  - 3. Teams of environmental experts working with broadcasters collate this information and carry out scientifically rigorous investigations of a few key locations and provide feedback to participants using broadcast and online media
School Trials 1

- 14 June and 12 July 2006, involving approx. 50 students between 13 and 15 years of age (Years 9 and 10), in two schools in the Bath area.
- Activities centred around the idea of journeys
- Students used equipment supplied by the project on their journey home from school, collecting data on environmental parameters such as carbon monoxide, sound and temperature, to provide a picture of the conditions they experienced on a daily basis.
School Trials 1

- Each school:
  - laptop PC with Google Earth and Science Scope’s Datadisc software installed, and five sets of data collection equipment
  - 1 Science Scope Logbook WL datalogger, with a selection of sensors from which students could choose.
  - 1 Nokia 66 series mobile phone, with sound sensing software, and Bluetooth connectivity capability to both the Logbook device and a GPS unit.
  - GPS unit
  - Disposable camera
  - Notebook
School Trials 1

- Activities included
  - Pre-trials meeting to introduce activities
  - Introduce the technology
  - Data collection
  - Teacher-led science sessions
  - 60 Second Scientist workshops
Example 60sec Scientist

Issues around using new technology to monitor your environment
Schools Trial 2

- Teacher workshop – March 2007
- Schools signed up to activities – scaled up 10-15 schools
- Website developed
- Google trails further developed

- Second round of activities started June 2007.
- Schools taking part on differing levels, some supported, others unsupported but borrowing sensors for weekly periods. All schools will use the website.
- More in depth evaluation taking place at 3 schools
Stage 2 School Trial

- 15 schools at various levels of engagement.
- Children collect their own environmental data, around the area of the school, or on field trips.
- Data collection kit comprises a Science Scope datalogger with associated sensors (can choose from a wide range), a GPS and a digital camera.
- PC with JData3D software (developed within the project) installed.
- Data from loggers and GPS, together with digital photos, downloaded to JData3D, and saved as a KMZ file.
- Time and location stamped data are displayed as trails in Google Earth, or Google maps as preferred.
- In Google Earth, photos can be opened by clicking on placefinders along the data trails.
A data trail showing CO levels
A secure website for sharing data

• To support the storage and sharing of schoolchildren’s data, a secure website has been developed.
• The site also provides tools for children to create short films and digital posters, to help them reflect upon their activities and findings.
• Teachers can control the setting up of pupil groups, and upload of their data trails, films and posters.
• The site enables the controlled sharing of data and other materials between member schools, while still maintaining security and privacy of children’s personal data.
• www.participateschools.co.uk
What is Participate?
Participate is a large-scale research project, which explores at how we can use new and emerging technologies to encourage people to engage in environmental issues.

Already a Partner School?
If you are a school who is already working on the project, sign in via the Members Area Login.

Interested in joining Participate?
Want to know more? Check out the About and Resources pages to see what kinds of tools we have developed and join Participate!

FEATURED WORK

- Sulphur Dioxide in Hong Kong
  Published: 18/07/2007
  — read more

- Comparing Carbon Monoxide and Sulphur Dioxide pollution in Hong Kong
  — read more

NEWS

12/03/2007
Langtree School at 21cc, BBC
On the 12th March 2007, Langtree Secondary School. Reading attended a Participate workshop at 21cc, BBC, Whiteley. Sixteen, Year 8...
— read more

11/03/2007
Teachers and educators workshops at 21cc, BBC
Primary and secondary school teachers, LSA coordinators and ICT specialists came together on the 11th March 2007 at the 21cc...
— read more
Evaluation

Video analysis of one school’s entire process through the activities

Questionnaire pre and post test examining domain knowledge, collaboration and usability

Analysis of interaction on the collaborative website.

Observation of one school exploring other schools’ data

Teacher interviews
As our work, and that of other people, have shown, providing information on the context in which children collect their scientific data, is important to their understanding of the data. In this trial, context is mainly provided by data trails in Google Earth or Google Maps.

Observations, video analysis and feedback from teachers and pupils indicate that both the activities and the visualizations are very compelling, and children can instantly see whereabouts on their route the levels of what was being measured were higher or lower.

However, data trails in Google Maps may be more useful than Google Earth in getting across some scientific concepts (example of conductivity in a river).
Early Findings 2

• However, in our first trial blander material such as printouts of line graphs and poor quality photographs also engaged children, because of the personal nature of the material, in that it was a record of their own experiences. In fact, poorer quality materials appear to elicit more discussion among the pupils. Example of World Scout Jamboree study.

• Question: what is the optimum quantity and type of contextual data? This may vary according to circumstances, and ages and abilities of children
Early Findings 3

- Producing and sharing material based upon the activities and scientific findings motivate children to reflect upon what they have learned, and to seek out more information on the topic.

- Reflection on scientific process as well as data.
Quantitative study around context

Our observation work has led to some hypotheses around self collection of data which we are now exploring through targeted experiments.

For example a current study is specifically looking at the importance of context in data collection and interpretation. We hypothesise that:

- Understanding will improve for data with context (self collected)
- Ability to describe a graph will improve for graphs generated by students themselves (by hand and using software)
- Pre-generated graphs will be better understood if students took the recordings
Questions to consider

• Should we be as controlled/experimental as possible/as the pre-determined factors allow?
• Is the only benefit of exploration and engagement in the field to provide ideas for experiments?
• Is lab-based work appropriate in studying field-based use?
References


References (2)


