Development of a research plan for use of ambient technology to test mobile learning theories

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MLEARN 2004 programme committee
Overview

- Objective
- Framework
- Progress so far
- Conclusions
Objective

A research plan, which if followed, aims to enable ambient technology to be used as a tool which researchers can use when testing theories of learning with mobile devices and which developers can use when evaluating mobile learning systems.
Framework (i)

• MOBIlearn roadmap
  – “road map for further research into the theory and practice of learning in a mobile environment supported by new technologies” (MOBIlearn, (2002))
Framework (ii)

The aim of a science and technology research roadmap is to provide a consensus view or vision of the future landscape available to decision makers, and the roadmapping process provides a way to identify, evaluate, and select strategic alternatives that can be used to achieve a desired science and technology objective.

(Kostoff and Schaller, (2001))
Framework: T-plan approach

• developed to support the rapid initiation of roadmapping;
• provides a customised approach, which includes guidance on the broader application of the method beyond its primary purpose of supporting product planning;
• developed during a three year program in which more than 20 roadmaps were developed, and it has been applied more than 40 times
• the general principles of the approach have been used to develop multiorganization (or collaborative) roadmaps.

(Phaal et al., (2004).)
Framework: T-plan approach

• Define layers
• Four facilitated workshops
  – One per layer + one to bring it together
• “Often a considerable part of the initial roadmapping effort will be directed at defining the layers and sublayers that will form the roadmap” (Phaal et al., (2004))
T-plan: standard process

“Know why”

Workshop 1 Market
• Performance dimensions
• Market/business drivers
• Prioritisation
• SWOT
• Gaps

Workshop 2 Product
• Product feature concepts
• Grouping
• Impact ranking
• Product strategy
• Gaps

Workshop 3 Technology
• Technology solutions
• Grouping
• Impact ranking
• Gaps

Workshop 4 Roadmapping
• Linking technology resources to future market opportunities
• Gaps

“Know what”

“Know how”

• Setting up the process
• Managing the process
• Following on from the process

(Phaal, Farrukh et al. 2001b; Phaal, Farrukh et al. 2004)
Roadmap (i)
Roadmap (ii)
Progress

• “Often a considerable part of the initial roadmapping effort will be directed at defining the layers and sublayers that will form the roadmap”

(Phaal et al., 2004)
Sources

1. Existing academic research which examines theories of learning;
2. frameworks for evaluating educational software;
3. information about relevant existing and emerging technologies.
The envisioned future learning activities and operational environment:
- Envisioned learning activities
- Operations and operators
- Organisational models

“Know why”

Activities and environment

“Know what”

Theoretical foundations
- Topics and directions for theoretical developments
- Necessary knowledge domains
- Validation / evaluation

“Know how”

Organisation and infrastructure
- Technological developments
- Infrastructural developments

Road mapping
- Link technological developments to activities and theories
- Consider gaps

Setting up the process
Managing the process
Following on from the process

1 Existing academic research which examines theories of learning
2 Frameworks for evaluating educational software
3 Information about relevant existing and emerging technologies
Theoretical foundations

Mobile learning

“Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies.”

Theoretical foundations

Evaluation

• Initial focus on learning opportunities offered by mobile technologies
  – It is the system plus the environment that must be evaluated, using a task-centred approach.

Objective

Initially focus on:
investigating the potential of ambient technology to obtain quantitative data about learners’ interaction with materials such that the context of the learner’s tasks is naturalistic, and that the learners are unaware of the processes of data capture.
## Evaluation framework

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Context</th>
<th>Interactions</th>
<th>Attitudes and outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aims and the context of use</td>
<td>Data about students interactions with the software allows some analysis of the process.</td>
<td>It is important to try to assess learning outcomes but also to consider effective outcomes, e.g. perceptions and attitudes.</td>
<td></td>
</tr>
<tr>
<td>Designers and course team’s aims. Policy documents and meeting records</td>
<td>Records of student interactions. Products of students work. Student diaries. On-line logs</td>
<td>Measures of learning. Changes in students attitudes and perceptions</td>
<td></td>
</tr>
<tr>
<td>Interview CAL designers and course team members. Analyse policy documents</td>
<td>Observation. Diaries. Video/audio and computer recording.</td>
<td>Interviews. Questionnaires. Tests</td>
<td></td>
</tr>
</tbody>
</table>

The CIAO! framework  
(Context Interactions Attitudes and outcomes)  
Jones et al., (1999)
Techniques in CIAO! framework

- Both qualitative and quantitative techniques
- Difficulties with quantitative techniques
  - validity of interpretation of observations
  - problems with moving from statistical to causal relationships between observed events
- Recognise that similar difficulties will remain if the observations are a result of ambient technology rather than of a human observer

See e.g. Wegerif and Mercer, (1997).
Previous research

- Existing academic research which examines theories of learning
- Existing academic research which reports utilisation of mobile learning
- Hypothesise how ambient technology could improve recording of observational data
Initial hypotheses

• Record data about social processes that occur during learning episodes that may not otherwise be accessible to researchers;

• generate additional information about learner behaviour during longitudinal studies of temporally and spatially distributed learners;

• validate information gained via questionnaires and interviews.

Organisation and Infrastructure

- Initial hypotheses re. evaluation/validation imply need for
  - positional data (people and things)
  - temporal data (people and things)
  - audio and/or video data (social interactions)
Example: listen reader

Antenna in binding

RFID reader

A/D converter with serial output

WINNT PC w/ Director
Ambient technologies

Platform classes

Hill et al. (2004)
Ambient technologies

• Platform classes
• “While the capabilities, cost, and size of each class of device will change with technological advances, these four fundamental classes of device will likely remain for the foreseeable future.”

Hill et al. (2004)

• Software developments
Conclusions

• Huge potential

• Research issues
  – Interpretation of observational data
  – Recording of qualitative data
  – …and its interpretation
  – Development/utilisation of appropriate hardware
  – …and software toolkits to utilise it

Security and privacy issues!
UserLab
Benchmarking the Next Generation of E-Learning Tools

Research focus
UserLab conducts research and development creating the next generation of e-learning tools, as well as undertaking research into the usability and usefulness of such tools for teachers and learners.

Activities
UserLab is currently participating in US-funded and EU projects that are at the forefront of research into technology-enabled adaptive teaching and learning.

Through international funding, UserLab is also working with educational establishments and corporations worldwide concerned with building and managing this new learning economy.

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Key research tools
- Learning objects
- Metadata
- Educational modelling languages

Theoretical basis:
The theoretical building blocks for our user studies are:
- Socio-cultural approaches
- User-centred design
- Evaluation methodologies