

Mobile Learning – Designing the Learning Context

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ABSTRACT

This paper contributes to the conceptualisation of school-based curriculum design processes that incorporate high quality mobile learning and considers the work of a recent m-learning project where classroom teachers embedded use of mobile technology into their working school programs. Project teachers devised a set of principles based on current education theory and practice to inform their curriculum design process. These principles incorporated socio-cultural perspectives of learning coupled with recent research of pedagogical processes that result in high quality learning experiences. Units of classwork written by small teams of classroom teachers interpreted these principles as they applied to their students, school and the local community. Feedback from project participants indicates that the use of mobile technology contributed to sustained levels of student engagement with their learning and work of greater than expected quality.

Author Keywords

Curriculum development, mobile learning, quality teaching and learning, science education, environmental education, pedagogy

INTRODUCTION

Research that informs the practice of mobile learning is available as a growing group of documented case studies of innovative practice (eg Rentoul et al 2003; Klopfer et.al 2002; Zembal-Saul et al 2002). Recent trends evident in the literature reveal a call for both research that embeds mobile learning into classroom practice (Naismith et al 2004) and development of a theory of mobile learning (Sharples et al 2005; Laouris and Eteokleous 2005). The work reported in this paper represents early stages in the exploration of the nature of high quality mobile learning in a school situation. The paper identifies themes and issues emerging from direct experience with designing school-based curriculum that embeds mobile learning and the use of mobile technology into classroom practice.

The project team was inspired by case studies focusing on learning in the local environment from both a Sydney-based primary school (Bennett, 1998) and from the United Kingdom (Rogers et al., 2002). The former project resulted in a database of plants and animals from a local wetland available as a web site for the local community. Project teachers aspired to incorporate processes that would result in a resource of similar availability and use to their local community. The latter project incorporated the use of novel technologies constructed to augment student learning in a local woodland. This model of creative hardware and software development was used to engage undergraduate students who were given the opportunity to choose to develop novel devices or software for a project school.

The mobile technology available to the project included tablet personal computers (tablet pcs). The unique properties of mobile devices that contribute to their effectiveness in education are outlined by Klopfer et al (2002) and include: portability, context sensitivity, connectivity, social interactivity and individuality. The project team intended to utilise these properties to unlock students from desk-bound computers and support their inquiries in learning environments beyond the classroom. It is important to consider that, at the start of the project, none of the classroom teachers involved had seen or interacted with the tablet pcs that would support their students' learning. Close collaboration between project ICT and education specialists became an essential component of its work.

This paper will report on the school-based curriculum development processes of the project. Theoretical underpinning of this work will be identified as well as the process and products of school-based programming. Teachers' reflections on the project highlight their expectations for student learning as well as unintended outcomes of conducting their unit of classwork. Student work samples demonstrate the high quality of learning associated with this approach. The paper identifies emerging themes and issues for further research around the processes of curriculum development for mobile learning described in this work.

CONSIDERING A THEORY OF EDUCATION

The wide application of mobile learning and its growing use in schools, museums and learning in other contexts requires consideration of theory that can inform education practice across these situations. The need to consider a theory of education was expressed by Hein as making an "effort to think through the underlying principles on which we base educational activities" (Hein, 1998, p. 15). He proposed three areas requiring a theoretical stance: the nature of knowledge, a theory proposing how people learn and a theoretical basis for teaching practice. Scholarly deliberations about the nature of knowledge were considered to be beyond the scope of the present project, however the project team adopted the position that knowledge is obtained

through active processes occurring within the learner. These active processes require the learner to re-work or to reconstruct understandings and processes they encounter, making sense of new information in the light of previous understandings and experiences (Windschitl, 2002).

The project sought to view students as knowledge communicators where they have access to knowledge and understandings held in their community about the local environment. There was a tacit understanding that students would work with this knowledge and re-present their understandings in a form that then becomes available to their local community. This view of learning as knowledge construction coupled with the project's use of collaborative and consultative processes relates directly to Vygotsky's (1978) social constructivist approaches to learning.

Closely linked with such considerations of learning are those of designing a teaching approach that incorporates an active, learner-centred pedagogy. Over the past decade considerable research has endeavoured to illuminate characteristics of pedagogy that contribute to effective learning for all students. The 'authentic pedagogy' movement (Newmann and Associates, 1996; Newmann, 2000) articulated "three broad criteria for authentic intellectual work:

1. Construction of knowledge: using or manipulating knowledge as in analysis, interpretation, synthesis and evaluation, rather than only reproducing knowledge in previously stated forms.
2. Disciplined inquiry: gaining in-depth understanding of limited topics, rather than superficial acquaintance with many; and using elaborated forms of communication to learn and to express one's conclusions.
3. Value beyond school: the production of discourse, products, and performances that have personal, aesthetic, or social significance beyond demonstration of success to a teacher." (Newmann 2000, p. 2)

Newmann's research has been adapted to an Australian context and articulated for schools in New South Wales (NSW) as the Quality Teaching model (NSW Department of Education and Training 2003a; 2003b). This model "identifies generic qualities of pedagogy that have been successfully applied in a range of school contexts and are shown to lead to improved student learning" (NSWDET, 2003a, p. 5). Inquiry that seeks to describe quality mobile learning can utilise the shared language and understandings of this model to articulate and evaluate the pedagogical aspects of the work.

Project teachers engaged with the theoretical aspirations of the study outlined in this section and used them to form a set of principles to guide both curriculum development and pedagogical approaches for the project. These principles are described in the next section.

DESIGNING THE LEARNING CONTEXT – FROM THE GROUND UP

A framework of common understandings about learning and teaching created by the project team, based on the theoretical considerations outlined in the previous section, is presented in this paper as the following set of guiding principles.

- Students are actively engaged in collaborative, student-directed inquiry.
- This inquiry is significant to both the student and to the wider community.
- The study involves opportunities for substantive communication between students; between students and teachers; between students and other adults including professionals and other community members.
- Knowledge constructed by this inquiry is integrated within and across subject areas and represents a sound contribution to scientific and cultural understanding of a local area.

Once this framework of common understandings was reached, project teachers, working in school-based teams developed their units of classwork that incorporated mobile learning and utilised mobile technology. The unit of classwork is viewed by the project as the formal plan that provides the learning context that involves student-lead inquiry and generates the need for the use of technology to support the mobile learner. Teachers developed a unit of work that was specific to the needs of their students, relevant to the curriculum of their school and located in the community and local environment of the school. Topics chosen by project schools included investigation of plants in the school grounds, insect diversity in a local park, the journey of a drop of rain after it falls on the school playground and investigation of human impact on the local water catchment area. The units of work, student work samples and teacher reflections for this project can be viewed at <http://coco.edfac.usyd.edu.au/mobilelearning>

Units of classwork

The units of classwork contain statements about the learning outcomes that teachers want to achieve and the assessment strategies that will indicate the achievement of these outcomes. Conversations between project

teachers generated by this approach to programming served a range of purposes including clear articulation of the nature of products that would demonstrate students' learning as well as providing a focus on the nature and scope of activities that could be achieved in a typical teaching term.

The unit plans provide some detail of the sequences of teaching and learning activities and typically commence with student familiarisation with the technology and move on to application of these skills the context of the inquiry. The teaching and learning sequence reveals that students will be engaged in at least two field trips to their local environment. Local naturalists and other adults are also involved both in classwork and with the field trips. There are no details of actual lessons within the sequences – this would have provided further insight into actual strategies teachers have utilised to introduce the unit, to provide motivation for the students, to scaffold student-led activities etc. Group work processes are not detailed within these units and form the subject of a further paper at this conference.

The unit plans provide insight into the affordances provided by mobile technology particularly in the area of supporting mobile learning. These included the following:

- recording data collected in the field
- providing a 'seamless' transfer of data between the classroom and the field
- incorporation of data directly into 'working' inquiry processes
- communication with experts via wireless access to the internet
- sourcing further information from the internet via wireless access.

Tablet pcs proved to be a highly reliable, flexible and effective tool to support this range of learning activities. The portability of the tablet pc saw their use within and beyond the school. It was common to see one or two students take a tablet pc and stretch out on the floor or move to a quiet corner to continue their work. The need for specialised instructions for using the computer itself or its software was minimised by the pc's ease of use and its capacity to support generic rather than specific software. Documents created on different systems were available across each system. The tablet pc supported communication in a variety of learning environments. It was common to see groups of students clustered around the open face of the pc. While further research is required to determine the exact nature of the conversations within this cluster, it was obvious that students were either contributing to the content of the group's records or making suggestions about the use of the computer.

The large area for handwriting on the face of the tablet pc enabled students of all ages to create extensive, permanent and transferable records of their field work. The quality of this digital record surpassed that of a paper record. Indeed many groups of students requested to be able to work directly on documents that in effect moved their level of cognitive processing beyond identification and description to on-the-spot analysis and reporting. Further work is continuing on the development of a location-aware interactive website available within a closed network of pcs. Students are able to upload new records and update continuing records on their site.

The wireless capabilities of the tablet pc were utilised by students when they accessed remote experts who could assist them with expert information such as identification of found species. Once a species name was known, students could access further information by using wireless access to the internet. Access to the internet in the field was achieved initially by the use of a wireless router located in a nearby classroom. The possibility of wider access afforded by an external internet provider is currently being explored however there are issues relating to the desirability of direct and open internet access available to young students.

Teacher reflections

Project teachers tended to express their expectations of the project in terms of their students having access to special technology and the opportunity to increase their skills in using a range of technologies in a real world situation. Use of tablet pcs and other technologies appears to have been a motivating factor for the students who are reported to have been highly engaged in all tasks associated with the unit of work. Teachers reported that an unexpected element was the level of student engagement, enthusiasm and perseverance from even the youngest students involved in the work. Students not only incorporated the facilities of the new technologies into their learning processes both in the field and in the classroom, they willingly shared new found expertise with their classmates and with their teachers. Two classroom teachers involved with the project made the following observation about the use of technology in their classwork.

"From both the teachers and students involved this was an exciting project, mainly because it enabled the students to have many meaningful experiences using different forms of technology. Also, they were using

the technology to assist their learning in real life situations for a real purpose and not just for the sake of ticking the technology box.” (Hosking and Lloyd, 2006)

At the end of the unit of work the project team was able to consider the range of learning outcomes that were achieved by students during the unit. Aside from the formal outcomes described in each unit of classwork, a range of further outcomes were identified in the following areas.

1. Communicating scientifically: a group of outcomes relating to selecting, writing and presenting scientific information for a range of audiences; interacting with knowledgeable adults to elicit, record and communicate information.
2. Researching scientific information: a group of outcomes relating to critical selection and use of scientific references that ‘make sense’; recognising and decoding scientific words and terms that are unfamiliar.
3. Working scientifically – in the field: a group of outcomes relating to collecting, organising, storing and retrieving digital records collected in the field.

Further research and professional development is required to consolidate this skill-set that relates specifically to mobile learning.

Student work samples

The digital works produced by the students involved in the project can be viewed at the project website. We will turn our attention to the work of the youngest class (6-8 year olds) and consider their information sheets in the light of the assessment rubric created for this piece of work. The task asked students to use pictures and text on a computer to present scientific information about their species that would be interesting to another student in the school. The following elements were discussed with students as components of their information report: the final product; factual text; digital photograph and scientific communication. Achievement at each of five levels was also made explicit to the students. A grade of ‘C’ was described as a pass i.e. students were achieving at the level we expected. Students were presented with two grades either side of this pass grade, describing work of higher and of lower achievement. It appears that the young students viewed this set of criteria as something of challenge and opted to aim for the higher gradings.

One of the outstanding features of students’ work is their digital photographs. Basic competence in capturing a digital image of their plant was achieved and surpassed by each of the 30 students in the class. Students selected photographs that utilised a range of measuring techniques (eg rulers, paper tags) to convey scientific information about their plant. One student mastered a technique of photographing parts of his plant through the binocular microscopes that were available to students. Another student utilised the macro facility of the digital camera to capture the seed head of her plant. The high standard of visual images produced by students in every project school is a characteristic of this work that needs further research to explore its potential as part of student learning.

Overall the standard of students’ work surpassed the expectations of the project team. It became clear that access to the human and electronic resources of the project was a major factor in providing students with tools they required to achieve and surpass their learning goals in the time available.

CONCLUSION

Clearly ‘rich’ learning situations that place students in some control of their own learning, that locate learning in environments beyond the classroom and that incorporate technologies, are emerging with the increasing availability of portable computers. This project demonstrates that, as mobile learners, students are more than capable of incorporating the use of powerful computing capabilities into their own investigations of their local environment. The results of this project contribute to a collective of high quality educational experiences incorporating emerging technologies that support mobile learning. This project has contributed to the following areas.

1. The contextualisation of mobile learning developed ‘from the ground up’ rather than being imposed from the designers down to the classroom teacher. This model places teachers, supported by a range of key personnel, in the position of curriculum developers and pedagogical experts, clearly able to provide high quality learning contexts for the mobile learner.
2. A theoretical framework for mobile learning which incorporates current learning theory and a theory of teaching. This emerging theory will benefit from critical feedback envisaged at this conference.
3. Exemplars of units of classwork that provide a framework for student-led inquiry incorporating mobile technology to support learning beyond the classroom.

The processes of theory building from a growing base of experiences with mobile learning are continuing as we attempt to make sense of our experiences, seek commonalities and make tentative explanations of our

work. Alongside this theory building process, practical research of the classroom context for mobile learning needs to continue and a raft of questions including those identified in this paper await illumination.

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