Classroom in your pocket

Kathy Stewart
Macquarie University, Sydney, Australia

Debbie Evans
Macquarie ICT Innovation Centre

Andreas Utomo-Kuswara
Macquarie University

Cate Fredrickson
Macquarie ICT Innovation Centre

Jenny Madsen
Macquarie ICT Innovation Centre

John Willis
Macquarie ICT Innovation Centre

ABSTRACT

This is a report on the work-in-progress of a project aiming to contribute to building a science and environmentally literate citizenry, by supporting teaching and learning located in the local environment. Social constructivist theory and authentic pedagogical approaches provide project educators with frameworks for approaching learning and teaching that immerse and engage students in science in their middle years of schooling. Project research demonstrates that multi-age groups of students can conduct fieldwork that could make a meaningful contribution to community biodiversity monitoring. The LEP (Local Ecostudy Project) aims to develop more student-directed approaches that support students as they frame their own inquiries into their local environment. Our project incorporates the use of mobile devices and collaborative technologies to provide students with tools and the capabilities to use these to maximize the learning potential of their access to the local community and their environment. Mobile mentors, mobile monitors, mobile learners.

Keywords: mobile learning, authentic pedagogy, student-led inquiry

Introduction

The Local Ecostudy Project (LEP) is one of the programs of the Macquarie ICT Innovations Centre (MacICT) which is a partnership between Macquarie University and the NSW Department of Education and Training. The Centre focuses on facilitating and supporting innovative teaching practice that incorporate the use of ICT. Centre projects are characterized by long-term involvement, commitment to evidence-based practice and communication of emerging pedagogies. In the case of the LEP, the MacICT team consists of an environmental educator (and Team Leader), an ICT teacher, primary school teacher, PhD student (and ICT specialist) and an academic partner.

This paper reports on the work of the LEP in 2010 involving over 330 students and their eleven teachers from six schools in the Sydney area. The rational for the project is to create links between high schools and their feeder primary schools to focus on the design and implementation of an inquiry-based classroom program focusing on the biodiversity of the local environment. The first section of the paper describes theoretical approaches of the LEP, this is followed by a description of aspects of the operation of the LEP. The last section of the paper is a commentary on some of the features of the project to date. The information and findings contained in this paper are based on evaluation reports prepared by the LEP team annually and at the end of each 10 week cycle of the project. The LEP is in its third year at the time of the STEM Conference (2010).

The context of the LEP: theory, policy and practice
The work of the LEP is underpinned by a range of theoretical perspectives relevant to teaching and learning especially in science and environmental education. The social constructivist perspectives of the theorists of late last century (e.g. von Glasersfeld, 1995; Vygotsky, 1978) coupled with widely available research of learners and learning (e.g. Newmann & Associates, 1996; National Research Council, 1999; NSW Department of Education and Training [NSWDET] 2003a) are biting deep into the practice of teaching and learning in our schools. Endorsed by global (e.g. Organisation for Economic Co-operation and Development [OECD], 2008) and national policy (Ministerial Council on Education, Employment, Training and Youth Affairs [MCEETYA], 2008), pedagogies are being designed to support student-directed, collaborative learning based in real world contexts. The Melbourne Declaration provides a description of successful learners and includes the capacity to be effective users of ICT, furthermore building partnerships between school and community is seen as a desirable action to provide quality learning for young Australians (MCEETYA, 2008).

Common elements of current discourses around high quality teaching and learning involve student-centred approaches based on deep understanding of key concepts that are linked to the student's real world contexts with access to real sets of data and information (e.g. Department for Education and Skills [DES], 2004; NSWDET, 2003b). Students clarify and build their understandings by engaging in sustained conversations around the ideas and concepts that they encounter in their learning activities (Laurillard, 2007; NSWDET, 2003b). Add to this scenario the increasing mobility of digital, networked, location aware computing devices and tantalizing opportunities arise to support and extend student learning in environments beyond the classroom.

The LEP supports more student-directed, less teacher-dominated pedagogies where the role of the teacher is to facilitate, encourage, negotiate and support active student learners. In this context the construction of student learning moves from the sole province of the classroom teacher to co-construction by shared communities of practitioners. These wider communities of practitioners currently include primary and high school teachers, ICT educators and environmental educators. Not only do teachers have the opportunity to re-conceptualise their classroom practice, they can then trial their newly conceived pedagogies supported by a team of educators committed to this shared ideal. Furthermore classroom teachers can elect to continue their involvement with the LEP to develop new pedagogies and technical capability over a number of years.

The concept of mobile learning embraces the ideal of learners engaged in substantial inquiry where learning occurs across time and across a range of rich learning environments (Taylor, 2007). Networked portable computing devices support learners as they select, collect, analyse and manage information that they perceive to be relevant to their inquiry. The accumulated and aggregated information is shaped across time and space to form a digital product such as a wiki, information report, presentation, action plan etc.

Science content based in the local environment has the potential to be relevant and significant to both students *and* their communities. Furthermore models for developing community-based biodiversity monitoring are evolving with increasing need for more eyes to conduct more monitoring (e.g. Lawrence, Paudel, Barnes, and Malla, 2006). The LEP supports schools and their students making an active contribution to community-based

projects such as environmental monitoring. Hence the project values science-based processes, evidence-based products and student-based action.

LEP: evaluation, technology, mentoring and community involvement
Practicing classroom teachers (with their students) opt to become involved in the LEP and are then supported by the LEP team throughout the six months of the project cycle. Over the three years of the LEP, the minimum involvement of a classroom teacher has been for a cycle of six months; maximum involvement currently stands at three years.

Evaluation: The research framework of the LEP derives from a case study approach where project development is informed by evaluation of specific aspects of a project cycle. These aspects are negotiated by the project team as part of the project planning process. The overarching research questions for project evaluation are based on the work of Sharples, Lonsdale, Meek, Rudman, and Vavoula (2007) and these are:
1. Does the technology work or not?
2. Does the technology help or hinder learning?

Data is collected using a number of approaches including on-line pre and post project surveys for students and classroom teachers, video and audio recording of a selected student group conducting field work, field notes and reflections of the LEP team captured on a project blog. At the end of each 10 week cycle the data from these sources is analysed and prepared as a report from the team to the MacICT Centre. Annual reports are also prepared by the LEP team which summarise the work of the project through the year and respond to the two overarching research questions of the project.

Project technology: The basic technology co-opted by the LEP in 2010 consists of internet-enabled mobile phones with digital camera. Purpose built, location aware learning sequences were delivered on site to students via the internet on the mobile phone. This device was supported by hand held computers with data logging capabilities as well as word-processing and drawing software compatible with more generic software used in the school environment. Digital cameras could also used in their capacity to produce high quality landscape and macro images of environmental features.

Web 2.0 technology (a wiki) and video conferencing are used as tools to support a range of collaborative activities including support of a discussion forum between teachers, between teachers and students and between the students themselves. The wiki serves as a site for each group of students to record, store and access their fieldwork data from a number of locations including their school, home and MacICT. The video conferencing facility enables schools to present their findings and discuss their experiences of the project with students currently involved and those ready to be involved in the next round of the LEP.

Mentoring: A student mentoring program was established as an operating principle for the LEP. High school students are trained in the use of project technologies and these students, in turn, train small groups of upper primary students. This student mentoring was established to address a number of issues identified by the LEP team and these include:
1. building closer relationship between high schools and their feeder primary schools
2. student transition from primary school to high school may be facilitated when younger students have already built a supportive relationship with students in the high school
3. the need to engage adolescents in their school work and more particularly in science

To encourage re-thinking and re-design of curriculum to that of a more student-directed approach the LEP operates with the classroom teacher and their class of 30 students rather than with a teacher and selected small groups of students. This operational principle can mean that in practice there are 30 high school students and 60 primary students involved in a single project. These large numbers present many challenges to both the LEP team and to the participating teachers. Teachers from both schools need to work together to organize student groups and consider any transport arrangements. Furthermore the physical impact of 90 students on remnant bushland requires careful management to minimize tramping damage to the area. Potential alternatives to one major event involve organising groups so that

smaller numbers work on the LEP over a number of days. However this may not alleviate the difficulties as extra time is taken away from other school commitments for the teachers and high school mentors.

The LEP has trialled a number of student management options over the three years of the project including optimal group size and composition. It appears that factors such as the quality of the mentoring, increasing reliability of the project technology, large number of teachers (at least eight attending a field event) overcome many concerns about student numbers on LEP field days. The high quality of secondary school student mentoring remains an outstanding feature of the LEP.

Community involvement: The LEP is designed to support meaningful partnerships between schools and the local community. Environmental educators based in organisations managing remnants of local bushland close to project schools are invited to participate in the LEP. Without exception these educators demonstrate active engagement with their local schools. This includes working with teachers in the early stages of the project to help organise the field days, provide resources specific to the local area and contacts with local community groups. As the cycle of the project continues these educators actively participate in field days and brief students about the local area. They are aware of the potential of schools making a contribution to local community biodiversity monitoring.

LEP: Implementing the ideal
Project events: The five stage cycle of the LEP commences with a teacher training day held at the MacICT Centre. Teachers meet and are encouraged to use the mobile devices and project software in much the same way as students will use them as part of fieldwork. Precious time for planning generally sees teachers map out dates for school visits by the LEP team and for the two field days included in the cycle. Considerations of curriculum and pedagogy seem difficult to facilitate and it appears that teachers require more time to discuss and re-conceptualise these aspects of their practice.

The second stage of the cycle occurs when the LEP team visits the high school to meet with a class of 30 student mentors. Over a morning students have the opportunity to work with the project team discussing their role as mentors in the project and learning how to use its devices.

Two classes of primary school students (60 students) meet their high school mentors for the first time at the MacICT Centre following the high school training day. Students are divided into groups containing two high school mentors and up to four primary students. This third stage is a busy day spent with groups getting to know each other as they trial fieldwork techniques and project devices in nearby bushland. Groups download their fieldwork data onto an accessible network and begin to construct their wiki entries. By the end of this fieldwork day students are aware of the activities that they could complete at their own local fieldwork site.

The LEP team then participates in a fourth event – a school-based fieldwork day, assisting teachers and students to conduct their site-based activities, data downloading and wiki construction. The high school and primary school meet at their local study area, form their mentoring groups and complete their fieldwork activities. On returning to the computer facilities of one of the two schools, students download the data they have collected in the field and continue with their inquiry.

The final part of the cycle occurs some weeks later and consists of a video conference where students share and celebrate the final products of their inquiry. At this event both high school and primary school students present their findings and make recommendations for further action and inquiry. Teachers and students from the next LEP cycle often join the video conference and can ask the current groups for their insights and advice.

LEP features for 2010
This section of the paper considers aspects of the progress reports for the LEP this year which are described in the points below.

- This year the project has been successful in delivering location aware learning sequences to students engaged in fieldwork in their local environment. Data suggests that students are engaged in these activities for extended periods of time (up to 90 minutes at one sitting) – with minimal intervention from their accompanying teachers. The capability of this instruction system allows the project to research the extent to which student groups engage with the learning sequence. The on-line learning sequence itself is subject to continued development in an attempt to design a more flexible system that can accommodate student choices.
- 14-15 year old students are excellent mentors. They are an example to us of patience and persistence. They communicate positively with their younger students, encouraging them to engage in and complete tasks. They take their role seriously yet are prepared to have fun and be involved with their group of youngsters.
- 14-15 year old students do fieldwork really well. They peg out transects, use dataloggers effectively, save and retrieve field data; they think about conducting fair tests; they effectively manage younger helpers. Can the project provide adolescents with the opportunity to step back and consider the purpose of their fieldwork? Can their high level of field work skills be further developed into conceptualising, designing and then conducting their own field work?
- Educators based in the community and other active members of the local community have a dynamic view of the local context. The interaction between these specialists and school students needs to be supported. How can these interactions be facilitated to maximise the opportunities for the idealised learning to occur? How can students communicate the products of these events to the wider community? Can the work of the student groups contribute to community-based biodiversity monitoring?
- The activities of student-led groups working in the local area can appear off-task, disorganized, unfocussed and messy. A closer investigation of the working pattern of the group over time often reveals that these groups are involved in extended engagement with their learning activities. Indeed teachers can often disrupt and needlessly try to re-focus the efforts of a seemingly ineffective group. The patience and respect displayed by adolescent mentors in the face of this intrusion to the working of their group is both highly commendable and noteworthy. What is the role of the classroom teacher when students are directing their own learning?
- Project surveys reveal that teachers involved in the LEP hold high expectations of themselves. They are candid in their appraisal of their own capabilities in incorporating the use of ICT into their classroom practice and value the role of the project in supporting this aspect of their professional development.

Comments and future directions
Learning in the LEP looks different. We need to be able to recognize this learning when it is occurring and also to re-conceptualise the roles of the teacher and of the student in this mobile learning situation. Future directions in the LEP will see high school students provided with support to develop their own inquiry into their local environment. These students may then be able to engage more directly with their younger charges, managing fieldwork to achieve their research goals.

In NSW the Institute of Teachers has accredited teachers' involvement with the LEP - creating extra incentive for involvement in this program and recognition of the exacting nature and quality of the LEP itself.

A committed project team is required to overcome a myriad of difficulties associated with trialling and using new, wireless, mobile, battery powered devices with new software in the outdoors, offsite with a minimum of 45 students, two classroom teachers, local community educators. Further commitment is required to working seamlessly across school based ICT systems located behind (necessary) firewalls, assisting students to download and store their rich, unique information collected in the field on the morning of the same day. This considerable effort is rewarded a thousand times over when, for example, adolescent

students at the end of the project cycle propose direct action to solve an environmental issue they have identified in their fieldwork or a primary student communicates observations of the biodiversity of their favourite local area.

The high school component of the project often lies outside traditional classwork even though clear links can be made to learning outcomes in junior secondary science and geography syllabus documents. Some high schools involved in this year's round of the project, unable to commit a teacher and a class of students, called for student volunteers to participate in the LEP. An interested high school (science or geography) teacher liaised with the MacICT Centre and the partnering primary school and coordinated the group of mentors. While the calibre of mentors is exceptionally high, the opportunities for more explicit learning outcomes for the secondary students appear to be reduced. What does it take to unlock the traditional structures and systems that bind many high schools to rigid timetables and siloed subject areas?

The original project ideal to contribute to community biodiversity monitoring is taking a little longer to achieve. The partnerships required between school and relevant community groups show positive signs of development, with all LEP schools working with their local council, state government organization and/or volunteer group linked to their local bushland.

Conclusion
The link between the need for effective monitoring of the biodiversity of a local environment and the demonstrated fieldwork skills of groups of school students can result in bushland that is familiar and cared for. It can also result in adolescents engaging in meaningful learning and assisting younger students to make the transition into high school. The realisation of this potential can involve rich learning experiences where the boundaries of learning are not defined by the four walls of the classroom. Furthermore this learning is supported by increasing mobility and capability of digital devices that capture, share and communicate these rich experiences. The profound difference that having the classroom in your pocket can make to learning is being captured by the LEP and we have only scratched the surface!

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