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CHAPTER 5

Using mobile phones to enhance teacher learning in environmental education

Brian Ferry

Abstract:
This study focuses on how action-learning sets helped preservice teachers (PSTs) to use mobile phones to augment their developing pedagogy. These school-based, action-learning sets consisted of groups of PSTs allocated to five schools that participated in the study. For six weeks they worked in pairs to teach a class for two hours per week. During this time the PSTs had access to mobile phones that had an inbuilt camera, Excel, Word, audio recording, video recording, internet, and email features. The phones were used to support and inform the teaching of an environmental education unit that had as its focus on waste and energy management. The findings indicated that the action-learning sets provided a vehicle for sustained and targeted professional growth.

Introduction
For the first time in history many pupils are more adept than their teachers in using a variety of technologies to acquire and transmit knowledge (Kirschner & Selinger, 2003). Jonassen (2000) claims that these pupils are often prolific and fearless users of technology and can assimilate new software and hardware as if it were second nature. Further, Kirschner and Selinger assert that 21st Century pupils are ‘light years ahead’ of their parents and teachers with respect to the possible uses of information and communication technologies (ICT). Much to the dismay of their teachers and parents, some of these ‘net generation’ pupils rapidly become bored and frustrated with school. Education systems may feel obligated to provide teachers with the knowledge and skills to effectively use ICT in the classroom and to work in technology-supported partnerships with their pupils (Kennedy & Krause, 2007). However, if the goal is simply to get teachers to use technology in the hope of appealing to a disengaged group of students then the chances of success are slim.

We have learnt that teachers cannot just be provided with the technology and left to their own devices; they need visions of the educational possibilities that the technology can provide. Just providing the tools is not enough, teachers need to know when, why and how to use these tools, and this requires just-in-time support, the time to experiment and on-going professional development (Ison, Hayes, Robinson & Jamieson, 2004). Thus modern technologies need to be seen as essential tools for teaching and learning, but they are not ‘a panacea for all educational ills’ (Kirschner & Selinger, 2003, p.5).

The purpose of the study was to make use of an action learning framework to provide on-going professional development, some just-in-time support and time to experiment with supplied Palm Treo 680 mobile phones that were used to augment the developing pedagogy of preservice teachers (PSTs) in primary (elementary) schools. The action learning process was documented in order to understand how the PSTs used the mobile phones to enhance their understanding of the impact of their teaching of an environmental education unit in a local primary (elementary) school.
Action learning (Revans, 1982) was adopted as a professional development framework in this context as the approach typically involves a small group of colleagues solving workplace problems utilizing their own processes of sharing, reflection and facilitation. These groups, known as action learning sets, formed the basis for PSTs to plan and design learning environments where the mobile phones could be used to record and support their classroom practice. Proponents of action learning argue that it is particularly suitable for adults, as it enables each person to reflect on and review the action they have taken and the learning points arising. This should then guide future action and improve performance. During this study the author of this chapter took on the role of a facilitator. This role was to use a combination of face-to-face, online and SMS communication strategies to scaffold the PSTs action learning sets.

**Background**

One of the National Goals for Australian schooling is for pupils to ‘be confident, creative and productive users of new technologies, particularly information and communication technologies, and understand the impact of those technologies on society.’ (DEST, 1999). But, like many other western countries Australia falls well short of achieving this goal and in 2007 one of the factors leading to a change of government was a clearly articulated ‘education revolution’ by the incoming Labor Government. In 2008, the Rudd Labor Government began to invest $1 billion over four years to turn every secondary school in Australia into a digital school. This will allow every Australian student in years nine to twelve to have access to their own school computer (Official website of the Australian Labor Party, 2007). All this capital investment is designed to make Australia more competitive in the digital age but there is the potential for disappointment if this strategy just sits pupils in front of a computer with access to the internet.

There seems to be an assumption that better learning will occur as a result of this investment. However, many students already have access to this form of technology at home and are more proficient than their teachers as users of the technology. There is also a danger that teachers will be left behind in this educational revolution and classrooms will be full of computers and other ICTs that are not used in ways that utilise the educational potential of the technology. To address this issue more attention will need to be paid to the ongoing professional development of teachers. The current policy document mentions that existing teachers will be progressively trained and that all new teachers will achieve competence in the use of ICT only – no mention is made about pedagogy. Further, this policy does not address the use of the mobile technologies that are ubiquitous in the lives of many children. For example a survey conducted in 2004 (the Age, September 28th, 2004) found that 89% of teenagers in Sydney and Melbourne had mobile phones. Further, various international surveys about mobile phone usage have been conducted in recent years reporting that the adoption rate among teenagers is so high that in many countries, teenagers are more likely to own a mobile phone than their parents (Netsafe, 2005; Campbell, 2005; Sulake, 2007).
Surveys conducted by Sulake (2008) between October and November 2007 summarized data from more than 58,486 teenagers across 31 countries. These data showed that youth use their mobile phones to text message, play games, listen to music, and take pictures. However, to many, the mobile phone is not a device for making phone calls, but rather, a ‘lifeline’ to the social network and an instrument for coordinating their everyday life (Matthews, 2004).

The figures in 2008 are likely to be even higher, and rather than restrict or ban mobile phones, schools may be better off integrating them into their normal routine. However, this will challenge schools as often mobile phones are seen as a disruption to a school’s routine when students use them inappropriately. For example surveys such as those by The Age (2004) and Sulake (2007) show that more than half of teenage students leave their mobile phones switched on during lessons, leading to unauthorized messaging that disrupts their learning.

A number of studies have been conducted about the use of mobile phones as a tool for learning and functions such as the calculator, creating messages and the alarm reminder have been reported (Ison, Hayes, Robinson & Jamieson, 2004). Some of these studies targeted disengaged youth and found that these devices were helpful in building teacher-student relationships; this in turn facilitated improved learner engagement. Teachers in higher education in the UK have made use of SMS (short messaging service) as prompts for course requirements, polling classes and pop quizzes with some universities experimenting with phone exams where the user’s voice print identifies them as the test-taker. However, there is some evidence that young people resent this as they see the messages as an intrusion (Geser, 2005). In general, universities have made use of personal digital assistants (PDAs) that may or may not be integrated with mobile phones to store and retrieve information such as e-books, courseware, and timetables. Many research studies report on the transmission of information that is created and sent out by the teacher to students using podcasts (e.g., McCombs & Liu, 2006; Pownell, 2006; Scott, Nishimura & Kato, 2006; Miller & Piller, 2005), but little opportunity is given for the students to demonstrate their own understandings using these or other devices. Modern mobile phones can be used to help learners access web-based content, remix it, share it, collaborate with others, and create media-rich deliverables for the classroom teacher as well as a global audience. Such functionality provides learners with new opportunities to demonstrate their understandings and this study represents a contribution to this area of research by focusing on the use of mobile phones as a tool to augment the developing pedagogy of preservice teachers in primary schools.

**Teacher as learners with technologies**

While education systems have focused on the use of mobile phones to communicate information for administration (e.g., attendance, homework, security alerts, communication with parents) as well as support for student learning (e.g., surveys, audio recording, video recording, web browsing, testing), less attention has been paid to the professional development of teachers. But, the ever-presence of
mobile phones, does not necessarily mean that teachers are willing or capable of integrating such technologies into their classroom practice. Even if education systems ensured that teachers were as proficient as their students in using new technologies such as mobile phones, there is still no guarantee that teachers will want to integrate mobile phones into classroom practice as in many cases the technology does not enhance what they already do and only adds an extra layer of complexity.

Most teachers do not belong to the generation of young people who Prensky calls the ‘digital natives’ generation (Prensky, 2001). The ‘digital natives’ generation was brought up with this technology, and their teachers either struggle to keep up or just give up in the race to understand and use the latest technology. Often the ‘digital natives’ concept is offered as an explanation or excuse for the disappointment expressed by education administrators when the latest technological innovation fails to fulfil its promise in the classroom. However, as Bennett, Maton and Kervin (2008, p. 783) assert ‘young people’s relationship with technology is much more complex that the digital native characterisation suggests’. Therefore, it may be more productive to consider how educators can take steps to meet the challenge of these new technologies within their educational context as ‘there is no evidence of widespread or universal disaffection’ with schooling as is often claimed in the popular press (Bennett, et al., 2008, p. 783). Rather, there is a need to integrate appropriate technologies into existing education systems. This view supports the work of Ison, Hayes, Robinson and Jamieson (2004) who reported that during the Txt Me project the pre-existing technology skills of teachers were less important than their teaching and learning philosophy. Teachers who were keen to develop and sustain meaningful connections with their students felt motivated to acquire the necessary technological skills. They argued that professional development programs need to focus not only on the technology, skills and knowledge required to implement mlearning strategies, but also on the skills and knowledge needed to support a blended learning environment that makes appropriate and targeted use of technologies that support the overall learning goals. The question then arises as to what form should a professional development program take?

Hoban (2005) reported that it has been well documented that action learning is an effective methodology for many teacher professional development programs but it needs to be supported by a facilitator whose role is to scaffold practitioner collaborative learning using, for example, a combination of face-to-face, online and mobile synchronous and asynchronous communication strategies. This study contributes to the professional development of teachers in the appropriate use of mobile phones to enhance their pedagogy by focusing on how action learning helped preservice teachers to use mobile phones to augment their understanding of the impact of their teaching.

**Methodology**

During this study action learning was used as an educational process whereby the participants studied their own actions and experience in
order to improve their performance as a teacher. This is done in conjunction with others, in small groups called action learning sets. Each action learning set was located in one of the five participating schools. The 22 preservice teachers involved were divided into action learning sets as follows: four action learning sets each contained four PSTs, and one set contained six PSTs.

This following section is divided into five parts the equipment, the participants, training, teaching and the data gathered.

Equipment
The participants had access to PalmTreo 680 mobile phones. These devices not only function as a mobile phone, they also have email, messaging, and web access capabilities. In addition they can be used as PDA, as a digital camera (static and video), audio recording and as well as an MP3 device and internet radio. The PalmTreo 680 also supports Word, Excel, PowerPoint and PDF files.

When this study was conducted many of the more advanced features of the phone were only available through the older version of General Packet Radio Services (GPRS) and this was more expensive than more modern 3GSM. As the budget was limited web browsing and email functions were not used.

Participants
The 22 participants (1 male, 21 females) were third year PSTs enrolled in a Bachelor of Primary (Elementary Education degree). All owned a mobile phone and were very familiar with the basic functions. Three of the 22 participants owned BlackBerry mobile phones and were familiar with the advanced features offered by this device.

Training
All training took place in a computer laboratory that contained 20 computers. The PSTs were organized into action learning sets based on their school groups. Each action learning set was to discuss how they could use the mobile phones to record and reflect on their teaching. In addition, they were to consider how they could use the mobile phones with the pupils in the classes they would teach. These ideas were then shared with other action learning sets.

When the mobile phones were issued the facilitator conducted a two-hour session about how to use the mobile phone. A user-friendly manual had been prepared and this was used as the basis of the training session. After the session the PSTs took the phones with them and spent the intervening week practicing the skills they had learnt. The following week they re-met in action learning sets to demonstrate the skills they had practiced and learnt. During this second two-hour session preservice teachers were supplied with a USB card reader and they were shown how to use it to transfer video and digital photographs captured with their phone. By this stage they had also met their classes and the host teachers and were aware of the school policies regarding the use of the phones. All schools had parental consent for children’s learning activities to be recorded, in addition there were no restriction on the use of mobile phones for educational purposes.
Teaching

The mobile phones were used in an elective subject that focused on environmental education. The major assessment task for this subject required preservice teachers to work in pairs to prepare, implement and evaluate a unit of work about waste, water and energy management with a class of year five or six students (10 to 12 years of age). In each of the five host schools, pairs of preservice teachers were allocated to a class to teach for two hours per week for six weeks. During this time each pair of preservice teachers shared a mobile phone that they could jointly use.

Teaching commenced the week after the second session. At the conclusion of each teaching session action learning sets were required to meet in the computing laboratory to download files and to share their teaching experiences. The facilitator attended these meetings where further ideas about using the phones were shared and additional training was provided on a just-in-time basis by a combination of peer teaching, facilitator teaching, and on one occasion, the expertise of an academic who had proficiency with all features of the phone.

Data gathered

Each week a pair of preservice teachers was allocated the task of leading the follow up discussion with their action learning set as this provided a valuable professional development experience for them and allowed the researcher/facilitator to act more as an observer. Another pair of preservice teachers from each action learning set was assigned to act as recorders and at the end of each meeting their summary was emailed for sharing among action learning sets. In the interim SMS messages were sent among members of the action learning sets to arrange meetings. At the end of the teaching experience an open-ended survey was used to follow up key themes that emerged from the emailed summaries. These data were also supplemented by the final assignments (a reflective e-record of their teaching) and the pupil PowerPoint presentations that occurred at a combined school culmination meeting. The audience at this meeting consisted of parents, teachers and pupils from participating schools and the researcher.

Results

The results are presented in four sections. The overall results are outlined in table 1, then these data are expanded to describe how the mobile phones were used by the PSTs and their pupils. The strengths and weaknesses of the phones as a tool are presented and finally the data that supports the use of mobile phones to augment the developing pedagogy of PSTs are presented.

Table 1 shows that the preservice teachers and their pupils often used similar functions on the mobile phones.
Table 1: The main uses of the mobile phones by preservice teachers and primary pupils

<table>
<thead>
<tr>
<th>Feature used</th>
<th>Camera</th>
<th>Video recording</th>
<th>Audio recording</th>
<th>SMS</th>
<th>Other</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-service teacher use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recording of key teaching events for later review and sharing with action learning set</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Video of instruction of pupils about how to make a worm farm. Image of students weighing paper waste. Audio recording of questions about recycling paper.</td>
</tr>
<tr>
<td>Interviews with children to identify misconceptions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Video of a child drawing a diagram to show how the greenhouse effect occurs. Audio recording of a child’s explanation of how evaporation takes place.</td>
</tr>
<tr>
<td>Record feedback from supervising teacher and partner PSTs</td>
<td></td>
<td></td>
<td>kk</td>
<td></td>
<td></td>
<td>Audio recording of teacher and partner feedback.</td>
</tr>
<tr>
<td>Record brief reflective comments</td>
<td></td>
<td></td>
<td>kk</td>
<td></td>
<td>✓</td>
<td>Short audio comments on pupil progress in creating their worm farm</td>
</tr>
<tr>
<td>Recording pupil performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pupil presentation to parents</td>
</tr>
<tr>
<td>Send supportive message to peers</td>
<td></td>
<td></td>
<td>kk</td>
<td></td>
<td></td>
<td>eg. ‘Hope the composting went well’</td>
</tr>
<tr>
<td>Respond to SMS enquiry about progress</td>
<td></td>
<td></td>
<td>kk</td>
<td></td>
<td></td>
<td>eg. ‘Can email you a copy of your lesson plan’</td>
</tr>
<tr>
<td>Calculator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>To tally weights and to calculate averages with the children</td>
</tr>
<tr>
<td>Pupil use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recording aspects of their work that they were proud of</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>Images of steps in a process such as measuring the waste paper produced each day. Video of pupil explanation of how to mix compost.</td>
</tr>
<tr>
<td>Recording steps in a process e.g. composting</td>
<td></td>
<td>kk</td>
<td></td>
<td></td>
<td></td>
<td>Video of pupil explanation of how to mix compost.</td>
</tr>
<tr>
<td>Short progress reports</td>
<td></td>
<td>kk</td>
<td></td>
<td></td>
<td></td>
<td>Students produce a short report on the progress of their worm farm</td>
</tr>
<tr>
<td>Record a brainstorm session</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Ways of reducing paper waste</td>
</tr>
<tr>
<td>Calculator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>To tally weights and to calculate averages</td>
</tr>
</tbody>
</table>

Pre-service teacher use of the mobile phones

The most successful preservice teacher use of the mobile phones was as a video recording device or as a digital camera. In both cases the preservice teachers were capturing episodes from their lessons that illustrated the impact of their lessons on pupil learning. While the audio function was seen as useful when teaching, the difficulty in transferring audio files to a computer limited its use as a follow-up tool for reflection. Some of the other tools such as the cut down Microsoft Office suite of applications were of limited use as the size of the keyboard was seen as a problem for rapid data entry. Instead preservice teachers used standard computers that were available at their schools. Email and web browsing functions were not used, as it was cheaper and more convenient to use existing university facilities.

Pupil use of mobile phones during lessons

The pupils focused on episodes that reflected achievements that they were proud of such as their worm farm and compost bin. Examples were the posters they created, a role-play they created and their design of an earthworm farm.
They also enjoyed the audio recording facility and used this feature to conduct peer interviews about events such as the construction of their worm farm or a brief survey of members of their group about a recycling question. They used the playback function during lessons and were not concerned about downloading their recordings to a computer. However, they did want to download their digital photographs into PowerPoint presentations that they could use at school so their PSTs loaned them USB card readers for this purpose. The quality of the PowerPoint presentations was high and these were not only presented to peers but also to parents. This allowed the school to showcase its work in the area of recycling and this was clearly appreciated at the parent meeting observed by the researcher.

The photographic examples in Figures 1 and 2 show the sorts of activities that the children and teachers captured. The first is an audit of the school’s water usage and the second is paper making using waste paper.

**Strengths and weaknesses of mobile phones**

All PSTs responded that they found the phones easy to use and it was easy to transfer photographs and video to the computer for later review. The size of the device made them convenient to use for just-in-time recording of a significant event during their teaching. However, sound files were difficult to transfer to the computer. Those who persisted played back the sound file and re-recorded it on a personal iPod, but this created an additional layer of complexity. Some also had difficulty turning the phone off as the off button needed to be pressed for an extended period of time.

Another problem encountered was the limited charging capacity of the phone batteries. In general the Palm Treo 680 phones needed to be charged daily whereas many other phones that preservice teacher had used in the past could last three or more days between charges. As a result some Palm Treo 680 phones ran out of charge during their initial use in schools.

**Use of mobile phones to augment the developing pedagogy of PSTs**

PSTs recordings and photographs typically included exemplars of a successful teaching episode, an example of a student misconception that they had to address (e.g. often children link ozone depletion and global warming), an unsuccessful teaching episode (usually related to a classroom management issue) or a creative student work (e.g. a poster, table of data in Excel, PowerPoint slide or except from a pupil’s journal). The presentations of successful teaching episodes were kept to a maximum of five minutes as this enabled all set members to share experiences during meeting times. These teaching episodes included explanations, conservation games, activities such as composting and recycling, pupil led activities such as weighing and recording paper waste, and pupil plays. The misconceptions presented related the greenhouse effect, ozone depletion, evaporation and condensation, and energy transformation – in particular the understanding that when energy is transformed the process in not 100% efficient.
Classroom management issues could be categorized into two themes; those that related to the management of the lesson and those that related to behaviour management of individual pupils. The second was mentioned less because of the nature of the schools that participated. Management issues arose when the PSTs worked in less formal settings and with a variety of equipment and much of what was presented related to the PSTs’ inexperience in such contexts. Over time these problems were less evident and it seemed that the support and advice of set members contributed to this developing pedagogy. The recordings and photographs helped to focus discussion and to provide a context and it could be argued that a digital camera would have been just as good. However, the mobile phones allowed a supportive network among set members and SMS messages were used to follow up on issues raised in set meetings. This provided encouragement and immediate support. Typical messages were:

PST 1: How did u go?
Response: Good better organized? U?
PST 1: Awesome my role-play was great. Kids made a video so u can c it.

In the above example the students were following up on goals they had set for themselves at their previous meeting.

The weekly meetings of action learning sets in the computer laboratory provided a vehicle for sharing progress and the function of the mobile phones was to provide evidence that acted to focus and stimulate discussion. The formal assignment of roles such as leaders and recorders helped to create productive meetings that were able to concentrate on improving pedagogy. Thus members of the set had many opportunities to either provide constructive feedback that could lead to further improvement or to share ideas that could be used to solve similar problems. Also, the members of the action learning set shared the responsibility for their professional improvement among all members of the group. In this situation the facilitator had a supportive role in creating a climate that fostered professional growth. During this study the class was a small group of committed PSTs, however, if the group had been larger it may have been necessary to formalise the roles within the action learning sets and to make these roles assessable. In this situation this strategy would help to ensure that all action learning set members made a strong contribution.

Conclusion

There are some generalizations that can be made about the professional learning that took place and the lessons that may apply in other contexts. First, in this context action learning provided a vehicle for sustained and targeted professional growth that focused on short-term, clearly defined goals that would be reported on in a subsequent meeting. Second, the phones provided a means of providing evidence of this growth as well as evidence of problems that may have arisen. Third, the SMS function allowed for almost immediate affirmation of success or a call for help from a supportive peer. Fourth, the meetings allowed the PSTs to develop and share appropriate learning strategies that may or may not have included the use of mobile phones.
The main messages for professional development that arise from this study are similar to those raised in the study by Ison et al., (2004) and these are summarised below. An m-learning professional development program should include two aspects - a technology aspect and a pedagogy aspect. The technology aspect needs to include a basic understanding of telecommunication networks and providers sufficient for participants to know the cost implications of approaches they may adopt, an understanding of the mobile phone functionality and the ability to send, receive and manage messages using an SMS. The pedagogy aspect needs to include some understanding of the mobile phone communication culture of young people, and some understanding of the learning styles of young people. This needs to be supported by a professional learning framework such as action learning in order for teachers to develop the skills and knowledge needed to successfully integrate m-learning strategies into teaching programs. Any form of m-learning needs to be used judiciously and in ways that enhance the work of teachers and their pupils. Action learning sets provide a vehicle for critical discussion and feedback on evidence that could be provided by mobile phones or other recording devices. To support such professional learning education systems would need to provide time for the action learning sets to meet and the resources (mobile phones, card readers and computers). Most of the resources are available so the challenge is for education systems to provide the time. Often this requires money and one way would be to start with a single, action learning set and then target other sets in subsequent years.

As Kirschner and Selinger (2003) have said ‘… today’s technology are essential tools of the teaching trade.’ And while many pupils may be more adept than their teachers in using technology, young children in particular need dedicated teachers to create rich learning environments that allow them to make effective use of the technology to acquire, create and display the knowledge that they are gaining. It is hoped that this chapter makes a contribution to this exciting field of learning.

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