



Augmenting learning reality: iPads and software as cognitive tools

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In the three short years since the release of the iPad, it has become the object of substantial investment in a number of areas of education. This investment is driving the need for significant research into mobile device related teaching and pedagogy. The focus of this paper is on the first iteration of a design-based research study, which is informed by theories of authentic learning, cognitive tools and mobile learning. This paper is an introductory exploration into the use of iPads, and the apps and services they run, as cognitive tools in an authentic tertiary learning environment. This paper highlights a range of iPad apps and Web 2.0 services used in the study, and methods for their potential use to augment the learning experience in a business education context.

Keywords: Cognitive tools, authentic learning, mobile learning, iPads, business education

Introduction

The iPad has been somewhat of a revelation in the education world. For better or worse, it has stood out from the pack of other technological gadgets and drawn the attention of many responsible for the management and provision of education around the world. Local examples of this include the recent deployment of 12,000 iPads to students and staff at the University of Western Sydney (Whibley, 2012) and the requirement for all students to own iPads (as the preferred device) at Orewa College in Auckland (Orewa College, 2012). However, there is a real need for the development and dissemination of research informed teaching and pedagogy to make the most of this investment. One such applicable area of research is that of cognitive tools (cf, Jonassen & Reeves, 2004; Kim & Reeves, 2007). This paper outlines the preliminary planning and tool selection of a larger investigation into the use of tablet devices as cognitive tools, which augment the student learning experience within an authentic mobile learning environment.

Cognitive tools

Just as carpentry tools enable builders to extend their capabilities to create structures and objects that would be difficult without them, learners can employ 'cognitive tools' to support their learning and assist in the creation of authentic products. Anecdotally, some writers describe how it would be almost impossible for them to write without the support of the word processor as a cognitive tool. Steve Jobs (2006) described computers as 'bicycles for the mind', capable of taking you further and faster than you would expect without them, and Cochrane and Bateman (2009) described smartphones as 'wings' for learning. Also referred to as *cognitive technologies* (Pea, 1985), *technologies of the mind* (Saloman, Perkins, & Globerson, 1991), and *mindtools* (Jonassen, 2000), *cognitive tools* have been described by Jonassen and Reeves (2004) as "technologies, tangible

or intangible, that enhance the cognitive powers of human beings during thinking, problem-solving, and learning” (p. 1). Computers, smartphones, mobile tablets and the software applications they support, are all examples of cognitive tools. Viewing these devices as cognitive tools shifts the focus of the devices from being a medium for the delivery of content to a platform for the creation of knowledge (Oldfield & Herrington, 2012). Jonassen et al. (1998) propose that mindtools have the capability to engage learners in critical, higher-order thinking about content because: the learners are the designers; the focus is on knowledge construction, not reproduction; learning is in partnership with technology; they are unintelligent tools, relying on the learner to provide the intelligence; they distribute the cognitive processing; and they are cost and effort beneficial (p. 13).

While much of the previous research into cognitive or mindtools has focused on the tool and the learner, Kim and Reeves (2007) suggest that the learning activity is also a critical component to be considered. They state that the learner, the tool and the activity form a joint learning system, where the *expertise* element of learning that is used by the learner is reflected in both the tool and the activity. They have aligned the theories of distributed cognition and expertise to paint a clearer picture of the meaning of cognitive tools. In doing so, Kim and Reeves (2007) propose the following redefinition of cognitive tools: ‘Cognitive tools are technologies that learners interact and think with in knowledge construction, designed to bring their expertise to the performance as part of the joint learning system’ (p. 18). This functionality could be used to support authentic learning, as is explored in the next section.

Project brief

Students enrolled in a first year business information systems course were loaned an iPad for the duration of a semester course. There were 60 students in the course, spread over two different streams, one with a single three hour class at night, and the other with two 2-hour classes during the day. The course was designed based on the key elements of authentic learning, proposed by Herrington and Oliver (2000; Herrington, et al., 2010) focusing on a series of authentic tasks within the context of an animal-themed adventure tourism company. The course design enabled collaboration between students within a strongly scaffolded learning environment. A key aspect of the course design was the incorporation of iPads to be used as cognitive tools (Jonassen & Reeves, 2004) in a manner informed by the mobile learning critical success factors developed by Cochrane (2010).

The cognitive tools

All students in the course were issued an iPad in the first week of class. There were two models of iPad used in this project: 35 iPad2s (16GB wifi only) and 30 iPad minis (16GB wifi only). These were the least expensive models of iPad that were on sale at the beginning of this project. It was decided that equipping the students with the devices was the best option for this study as it would remove any existing inequities amongst the students and enable the full participation of any student who wanted to be involved in the project.

Why the iPad?

The iPad has dominated the new tablet category that it created since its launch in 2010. Despite the launch of hundreds of models of Android tablets, and the release of Windows 8, the iPad continues to be the market leader. Many businesses and other larger organisations are either trialing or implementing the iPad. Some recent high profile examples of iPad adoption include the New Zealand Police issuing iPads and iPhones to all front line police (New Zealand Police, 2013), and airlines making iPads part of their flight entertainment kit (Apple, 2013). It has also become a popular tool in education, with many New Zealand schools requiring the devices. Perhaps the most significant example of this is the roll out of 12,000 iPads at the University of Western Sydney for all commencing students (Whibley, 2012).

There are also a number of practical reasons for the use of the iPad. The Apple iOS platform is more secure than the Android platform (one of the reasons why it is popular with business). This is largely due to the controls that Apple place on both the operation of the device and its App Store, which is the only place to download applications. The iPad and iOS experience is also consistent across devices, for example the iPad2 and iPad mini devices work in exactly the same way, so it is easy for the teaching staff and student peers to provide support for their use. As a general rule, Apple devices, and they are seen to be user friendly, as can be seen from the results of recent customer satisfaction surveys (Power, 2013). Utilising products that are user friendly and have high levels of customer satisfaction should reduce the need for support intervention. The iPad also enables students to perform a wide range of authentic tasks that would be transferable to a real business environment. Airplay is a significant feature of iOS devices that allow the wireless sharing of a screen image. Anyone in the class could send an image from their screen to an Apple TV device that was connected to the projector at the front of the

room. This allowed for more dynamic discussions where anyone could easily show content to the whole group.

Which apps and Web 2.0 services are used as cognitive tools?

Significant investigation, testing and exploration have been performed by the researchers to find the most applicable suite of apps for use in the course. For practical reasons, and to reduce barriers, the researchers made the decision to only recommend the use of free apps and Web 2.0 services in the course. The following apps and Web 2.0 services have been introduced to the students gradually over the duration of the course:

iBooks: All course materials provided by the lecturer were provided in the iBook format. This format is unique to the iPad and requires the use of the free iBook app. The iBook format is an advanced eBook format that provides significant benefits over traditional printed texts. iBooks can include a variety of forms of multimedia and interactive elements such as video, Keynote presentations, quizzes, web-based feedback and polls. The lecturer developed a comprehensive set of iBooks to give grounding in each area of the course, and to provide the details of the authentic tasks to students.

Google Drive: Previously known as Google Docs, Google Drive is a free service provided by Google to allow the storage and sharing of files. It also allows user to create and collaborate on documents and spreadsheets on any device they like. This service was used extensively during the course as it enabled the student teams to work collaboratively on their authentic tasks and assessments.

Google Hangout: Google Hangout is a relatively recent service offered by Google that allows groups of users to “Hangout” and chat together, via text, audio or video communication. It is an excellent free tool for bringing people together. Through the course, students have used this tool extensively to support their teamwork and break down the physical barriers during times that they are unable to physically come together.

Mindmeister: Mindmeister is a web based collaborative mind mapping tool. It offers free accounts that allow up to three maps to be shared online at a time, or paid accounts with fewer restrictions. The students were encouraged to use the service through both a web browser interface and a free iPad app. The tool enabled students to work together on the same mind map, supporting their tasks both in and out of class sessions.

Wordpress: Wordpress is the preferred blogging platform for the course. Students were required to create and maintain a reflective blog, which chronicled their experiences and views throughout the course. Students created their blogs using the free, hosted wordpress.com service, which allowed them basic blogging functionality in their own personalised environment. The Wordpress platform offers user-friendly web browser based tools to create and manage blogs in addition to a powerful mobile app. Students made use of both methods during the course, and were free to choose which suited them best.

Aurasma: Aurasma is an augmented reality platform that layers electronic content over the top of real world content. Students made use of Aurasma to add value to their marketing posters, which they developed at the beginning of the course. A number of them also chose to use Aurasma later in the course at various stages, such as to create an interactive product list.

Prezi: Prezi is a web based collaborative presentation tool. It differs from traditional linear presentation tools such as PowerPoint and Keynote as it provides the user with a large open canvas and allows them to place content wherever they like. In addition to the web browser interface, many students made use of the free Prezi app in order to present their work.

Gantter: Gantter is a free web-based project management tool. It allows groups of users to work together on a gantt chart with similar features to the expensive Microsoft Project, which is the industry standard. Students were required to use this tool to plan their two report assignments, and some also used it for other non course-related tasks.

Microsoft Office: A significant portion of the course involved the use of the traditional business productivity suite Microsoft Office. During the course, students created a range of authentic business outputs in the form of posters, letters, reports, presentations, spreadsheets and databases. While the Office software was not available on the iPad at the time of the course, students found ways to integrate their work with the iPad through the other cognitive tools mentioned earlier.

Administrative Tools: Some students made use of note taking apps, such as *Evernote* and *Penultimate* to keep

track of important thoughts and developments both in and out of class. These apps make it easy to collect, organize and share their notes, either through typed, handwritten or multimedia formats. Others recorded video using the built in camera app, which they then used for augmented reality, blog posts or as part of their presentations.

The research design

A design-based research (DBR) study is currently being conducted to explore how tablet computers can be used as cognitive tools to support and enhance learning in an authentic learning environment, in particular by investigating the affordances of the devices, design and implementation issues, and cognitive and affective outcomes. The research will be conducted guided by Reeves' (2006) model of DBR, including: an extensive literature review and exploration of the problem through discussion with colleagues within Business Departments and through an iPad Community of Practice; a re-imagined and re-designed Information Systems and Applications course; iterative implementations of the revised course; and the creation of design principles for 'Mobile Authentic Learning'. This course will continue to be used by the host organization and it can be used as a partial template for the development of other similar courses.

The study is currently in the data collection phases, including eight in-depth interviews with students after course completion. The results of these interviews will help shape future iterations of the project to further progress the capability of the iPad and its apps as cognitive tools to augment the student learning experience.

The theories underpinning cognitive tools have the potential to greatly improve the effectiveness of technology in education. Much of the use of technology devices in the past has revolved around learning *from* the technology (Kim & Reeves, 2007). This is a replication of the way educational resources such as textbooks, whiteboards and television traditionally have been used. Initial attempts at moving beyond the idea of learning *from* the technology have been criticized as they have focused on *how* to use the technology. Oppenheimer (1997) for example has likened these attempts to teaching "hammer" instead of teaching "carpentry". Computing devices, however, offer a much greater potential as cognitive tools for learners to learn *with*—in a considerably more powerful partnership between learner and tool. Most research into cognitive tools to date has focused on computers rather than more recent mobile devices. With the arrival of the iPad in 2010, the world of mobile devices has undergone significant change. Further studies such as the one outlined here will help to identify the means for these devices to be readily employed as powerful cognitive tools.

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