

EDR and Design Thinking: Enabling Creative Pedagogies

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Abstract: This paper explores the interrelationship between educational design research, design thinking that guides the design process, and the unique opportunities that mobile learning enables. As an example we outline the design thinking principles and processes that informed the development of wireless mobile presentation systems (MOAs) designed to create a flexible infrastructure to enable the exploration of new pedagogies in different educational contexts. The project used design thinking within an educational design research methodology to provide an in house solution to creating a supporting infrastructure to enable the implementation of a new framework for creative pedagogies and curriculum redesign. We reflect upon example implementations of using mobile social media and MOAs as a catalyst for our framework for creative pedagogies, and propose collaborative curriculum design principles for integrating the use of mobile social media within new pedagogical paradigms.

Introduction

Arguably the single defining attribute of mobile devices is their mobility (the first stage of mobile learning (Cook, 2009; Sharples, 2009)), and the mobility of the learner that this affords (the third stage of mobile learning (Cook, 2009; Sharples, 2009)), which by current technology limitations correspond with small screen size. Thus mobile devices are inherently personal communication and productivity devices. Enabling mobile collaboration was a key goal of our projects, thus we explored options for transforming student-owned mobile devices, in particular smartphones, into group collaboration tools. The project design was initially scoped as a collaborative project between the Centre for Teaching and Learning and the Product Design Department lecturers at the University, and a graduate Product Design student was then co-opted onto the project as the lead designer on the advice of the Product Design lecturers. Two approaches were taken, exploring wireless mobile presentation systems for video projectors in large group settings, and wireless small group collaborative mobile workstations using large screen mounted displays. Based upon the work on Mobile Collaborative Workstations nick-named Computers On Wheels, or COWs by Mitchel et al., (2009), we developed MOBILE Airplay screens (MOAs) to enable students to share and interact in groups directly from their mobile devices. Using wireless screen-mirroring technologies such as Airplay (Apple Inc.), Miracast (Microsoft), and Allshare (Samsung Electronics) students can present the screen and audio from their mobile device onto a large-screen mobile display turning their mobile device into a group presentation and collaboration tool. Thus we transformed the idea of COWs from an essentially portable institutionally managed collaborative computing system, to become a portable collaboration system for student-owned mobile computing devices. The MOA acronym provides a New Zealand context to our design that plays on the name of the large flightless bird once native to New Zealand, similar to the Emu, but now extinct. The focus of the design thinking process behind this project was to produce a home-grown solution to enabling student-owned smartphones to become part of the infrastructure hub of a mobile social media framework for new pedagogies centred on student-determined learning. Through a process of collaborative design thinking, we involved key stakeholders in iteratively designing and testing MOA prototypes, leading to a final production model design that is now being used in a variety of different educational contexts enabling new projects throughout the University and resulting in a veritable flock of MOAs. These MOAs can be wheeled into different spaces for students to breakout into teamwork during or in-between classes.

Thus we have expanded the collaboration and connectivity affordances of mobile social media from a personal workspace into a group collaboration space. This allows a refocus in the classroom context from teacher-

directed pedagogy towards student-determined learning or heutagogy (Cochrane & Withell, 2013; Hase & Kenyon, 2007; Luckin et al., 2010).

New Pedagogies

Our context is about fostering innovation in teaching and learning, enabling lecturers in higher education to think differently about teaching and learning and engage with new pedagogies that are based around social constructivism (Vygotsky, 1978), connectivity (Siemens, 2004) and student-determined learning (Hase & Kenyon, 2001; Luckin, et al., 2010). This involves a process of reconceptualising the role of the teacher, the role of the learner, and the role of technology - in this case mobile social media (Cochrane, 2014). In these new pedagogies the role of the teacher is no longer the developer or deliverer of course content, but the designer of learning experiences. For example, using a rhizomatic model of learning, Cormier (2008) conceptualises the role of the teacher as the designer of an ecology of resources (EOR) and triggering events that stimulate student discussion and creativity. However, one of the critical success factors for implementing new pedagogies we have identified is the development of a supporting technological infrastructure, and this was the focus of the MOA development project – to enable small screen mobile devices to become group collaboration tools via wireless screen mirroring. With the maturing of wireless mirroring protocols and the availability of a wide range of mobile devices that now support wireless screen mirroring the opportunity has arisen to leverage this technology within education at an institutionally supported level. What we needed was to design a creative, cost effective and flexible infrastructure solution we could implement in partnership with our institutional IT department. We were also concerned to embed critical reflection and peer feedback into the process of designing new pedagogical strategies within a variety of curriculum contexts. The scholarship of teaching and learning (SOTL (Boyer, 1990; Haigh, 2010; Weaver, Robbie, Kokonis, & Miceli, 2012)) provides an academically rigorous reflective practice framework that can be applied to technology enhanced learning, or SOTEL (Wickens, 2006). Therefore we utilise the scholarship of technology enhanced learning (SOTEL) to critically evaluate the broader impact of our educational design research process. In the following sections we explore the interrelation between mobile learning, design thinking, and SOTEL, all embedded within a educational design research methodology.

Educational Design Research and Design Thinking

Educational design research (EDR) is also referred to as design-based research (DBR). EDR is concerned with the development of practical principles for curriculum redesign, and stands in contrast to the typical comparative analysis approach of much of the educational technology research literature (McKenney & Reeves, 2012; Reeves, 2005). EDR has similarities to action research that is concerned with transformational change through a series of iterative cycles, but adds the development of transferable design principles as a goal, bringing together research and design (Educause Learning Initiative, 2012; McKenny & Visscher-Voerman, 2013). Within the context of mobile learning research a review of the literature (Wingkvist & Ericsson, 2011) indicates that the predominant research methodology has been case studies (24%) followed closely by normative (comparative analysis) research (21%). According to Wingkvist and Ericsson, (2011), less than 5% of published mobile learning research evidences an action research methodology or meta analysis. An earlier analysis of 102 mobile learning projects published between 2002 and 2007 revealed that the majority of mobile learning projects published in the literature focused upon supporting novice learners via content delivery to mobile devices, rather than leveraging the unique affordances of mobile devices to support innovative pedagogies. “Despite the fact that mobile phones initially started as a communication device, communication and collaboration play a surprisingly small role in Mobile Learning projects” (Frohberg, Goth, & Schwabe, 2009, p. 307). Similarly Rushby (2012) calls for “research findings that offer proof of educational, economic and social outcomes and impacts” (Rushby, 2012, p. 355). There is therefore a gap in the mobile learning research literature. EDR as a research methodology provides opportunities to explore the unique contribution of mobile learning to supporting and enabling new pedagogies. In this paper we explore the use of design thinking to guide the design process within educational design research.

To guide the development of the MOAs we adopted a design thinking approach. Bannan, Cook and Pachler (2015) argue that design thinking provides a methodology that aligns with the inherent messiness of mobile learning, which transcends the traditional boundaries of space, time and place associated with more traditional classroom focused educational paradigms. Design thinking is not about design per se, it is about thinking differently and strategically (Scott-Webber & Corcorran, 2013), to come up with creative solutions to real world problems leading to improved outcomes. Design thinking has become popular as a framework for creative thinking within a variety contexts, and particularly within education, where “students are challenged to embrace rapid prototyping,

present multiple ideas, and test each one” (Educause Learning Initiative, 2014). Leinonen and Durall (2014) argue that design thinking provides a solution for “the need to adopt human-centered design principles in research and design of computer-supported collaborative tools” (Leinonen & Durall, 2014, p. 107). Design thinking involves three main elements: observational research, visual sense making, and rapid prototyping. A typical design thinking process is a cycle of: empathize/observe, define, ideate, prototype, test. Embedding a design thinking process within our interest in the process of academic development and the scholarship of teaching and learning, design thinking guides the design phase of educational design research. In this project our specific problem we addressed involved creating an innovative infrastructure to support the use of mobile learning in a variety of different educational contexts.

A Mobile Social Media Framework for Creative Pedagogies

Mobile learning presents unique opportunities for enabling creative pedagogies that should be informed by foundational learning theories and frameworks. Over several iterations of mobile learning research design we have developed a framework that informs the curriculum design approach to a project. Our mobile social media framework is essentially a mashup of concepts that we have found particularly useful to support the introduction of creative pedagogies via mobile social media. These include: the concept of the Pedagogy-Andragogy-Heutagogy continuum (Luckin, et al., 2010), and Puentedura’s (2006) SAMR model (Substitution, Augmentation, Modification, Redefinition) of educational technology transformation. Both of these pedagogical frameworks resonate with Sternberg, Kaufman and Pretz (2002) view of creativity involving incrementation (or modification of a current idea) followed by reinitiation (or redefinition). Using this framework we have designed and integrated the types of activities and pedagogies that support creativity and move beyond substitution towards redefinition, and move from teacher-directed pedagogy towards student-determined heutagogy (Table 1).

	Pedagogy	Andragogy	Heutagogy
Activity Types	Content delivery Digital assessment Teacher delivered content Teacher defined projects	Teacher as guide Digital identity Student-generated content Student negotiated teams	Teacher co-learner Digital presence Student-generated contexts Student negotiated projects
Locus of control	Teacher	Student	Student
Cognition	Cognitive	Meta-cognitive	Epistemic
SAMR (Puentedura, 2006; 2011)	Substitution & Augmentation: Mobile device as personal digital assistant and consumption tool	Modification: Mobile device as content creation and curation tool	Redefinition: Mobile device as collaborative tool
Creativity (Sternberg et al., 2002)	Reproduction	Incrementation	Reinitiation
Knowledge production	Subject understanding	Process negotiation	Context shaping
Self perception	Learning about	Learning to become	Active participation within a professional community

Table 1: A framework for creative pedagogies using mobile social media (modified from Luckin et al., 2010)

Danvers (2003) argues that developing student creativity involves providing a learning environment that supports creativity and gives students the freedom to explore new ideas.

Creativity thrives in an atmosphere that is supportive, dynamic, and receptive to new ideas and activities. The learning environment has to encourage interactions between learners in which: action and reflection are carefully counter-balanced; open-ended periods of play and 'blue-sky' thinking alternate with goal-oriented problem-solving; stimulating inputs and staff interventions are interwoven with periods in which learners develop ideas and constructs at their own pace; critical thinking and robust debate co-exist with a supportive 'space' in which risk-taking, imaginative exploration and productive failure are accepted as positive processes of learning and, the development of meanings and interpretations is inseparable from material processes and production. (Danvers, 2003, p. 52)

This type of creative learning environment is what we wanted to achieve and therefore informed our educational design research process. Bannan, Cook and Pachler (2015) explore the intersection between mobile learning and EDR, and propose a four stage integrated design research process for mobile learning design research: informed exploration, enactment, evaluation of local impact, evaluation of broader impact. Bannan, Cook and Pachler (2015) argue that the purpose of exploring the intersection between these theories and processes “is to bring the creative (e.g. the design-seeking activity of the research team) and analytic together in a systematic but flexible manner” (Bannan, et al., 2015, p. 4). In a similar way we explore the intersection of mobile learning with EDR by embedding our mobile social media framework, design thinking, and the scholarship of technology enhanced learning (SOTEL) within an overarching EDR methodology (Table 2).

Methodology	Educational Design Research			
	Informed Exploration	Enactment	Evaluation: Local Impact	Evaluation: Broader Impact
4 stages	Theory	Practice	Participant Feedback	Critical Reflection
Connecting theory and practice	MSM Framework informing curriculum redesign	Rhizomatic Learning: Developing an EOR Designing Triggering Events	Participant Feedback	SOTEL
Design Thinking	Observe & Define	Ideate & Prototype	Test	Wider testing

Table 2: The intersection between mobile learning, design thinking, and EDR

A key element of implementing new pedagogies is the provision of a supporting infrastructure. Design thinking was used to guide the development of a flexible infrastructure for enabling student-owned mobile devices to become collaborative tools. Therefore there were two research questions informing this project:

1. How can mobile social media be used as a catalyst to enable student-determined collaboration in and beyond the classroom?
2. How can this be supported by the design of mobile screen-mirroring systems that turn a personal mobile device into a collaborative tool?

Methodology

We have observed through several mobile social media projects that a key step in moving beyond substitution of previous pedagogical strategies and activities with new technologies is enabling lecturers to reconceptualize the role of technology (Cochrane, 2014). In order to do this we formed communities of practice partnering educational researchers with groups of departmental lecturers to explore and experience mobile social media. One of these COPs was comprised of Product Design lecturers and the researcher, and it was out of discussions around reconceptualising mobile social media from a social domain to an educational domain that the concept of a large screen wireless mobile presentation system was developed. The concept was initially brainstormed within the Product Design COP, and consequently a graduate student was invited to take on the design process as an authentic project. We used a design thinking approach to iteratively refine the design and implementation of the MOAs, with each implementation involving collaborative redesign of course activities and assessments focusing upon student-directed learning enabled by the MOAs and mobile social media. In this section we outline the design thinking process that guided the design phase of our overall educational design research project, specifically the cycle of: define, ideate, prototype, test.

Define

We wanted to enable student-owned mobile devices, such as smartphones and tablets, to become collaborative tools utilizing social media such as Twitter, blogs, YouTube, and photo sharing. To do this we needed to devise an infrastructure for mirroring the screen of mobile devices to a larger screen or MOA. This needed to be

as simple a process as possible so that the technology did not become a barrier to use, and the system needed to be as portable as possible with minimal setup required.

Specifications:

- All connectivity except power must be wireless between the mobile devices and the MOA
- The total cost must be kept below \$3000NZ per MOA unit
- The cost of each individual component must be under \$1000NZ
- The system must support quality video and audio reproduction
- Internet connectivity is via the students own mobile device using the institution's WiFi network
- The MOA must be portable and encourage students to move it around – therefore it must feel stable and solid and yet move easily.

Our budget determined that we needed to build our own custom moveable TV stand, as commercially available products were too expensive. The price point also dictated that the optimal TV screen would be a 50-inch plasma or LED with basic HDMI and optical audio connectivity.

Ideate

The design process involved two steps: the design of the technology required, and the design of a mobile stand to house and move the technology. Wireless connectivity was achieved simply using an AppleTV (for iOS devices) or a Samsung wireless Allshare media streaming hub (for Android devices) connected via WiFi to students' mobile devices, and connected via HDMI to a 50 inch TV screen. Audio was enhanced by connecting the optical audio output of the TV to a high quality portable sound system mounted on the MOA stand. All devices were mounted on the stand, leaving only a single power cable to be plugged in. We decided upon laminated wood as the material for the stand, mainly from an aesthetic perspective in comparison to the spartan designs of commercially available metal moveable TV stands. This meant that a single sheet of laminated plywood could be used for each stand with all parts cut from a single sheet of plywood using a CNC machine, minimising cost and wastage of material. Autocad was used to draft a plan for the stand in such a way that the stand could be assembled using a minimum of screws and bolts, utilizing a slot joint system.

Prototype

The MOA stand went through three design iterations before settling upon a design for production. The Product Design lecturers and the researcher as the key stake holders gave feedback on the stand design iterations. The first prototype used conservatively too much plywood and was consequently overly heavy. The first iteration of wheels used were found to provide limited mobility, particularly over rough surfaces when the MOA was moved between buildings or not on a flat carpeted surface. Thus the design was altered to halve the structural joints, and larger and higher quality wheels were specified. The second iteration of the MOA stand integrated the cable management between the devices mounted on the stand. While lighter and more manoeuvrable, the second iteration of the MOA stand was found to flex too much when moved. The third iteration of the MOA stand repositioned the main braces of the structure to provide overall stiffening and strength without adding more material. WiFi connectivity for the MOA required working with the institution's IT department to create a test network that enabled iTunes, Airplay, and DLNA media streaming. A separate network name (SSID) was created and activated on wireless Access Points (APs) in any area that the MOAs would be used.

Test

The build and test stages have underwent iterative cycles as the project progressed through the stages of prototype, pilot implementation, and several full production iterations. The collaborative design of learning activities and assessments using mobile social media and the impact of the MOAs were tested in several different higher education contexts as briefly described in the following section. Each implementation case study involved the formation of a community of practice of lecturers in a department and the researcher. The researcher demoed the use of the MOA and brainstormed the integration into the curriculum of mobile social media with the lecturers, who met weekly over a semester to explore the potential of new pedagogies enabled by mobile social media.

EDR Implementation Case Studies

We have implemented this EDR methodology to explore creative pedagogies in a range of contexts. The EDR methodology provided a structure for collaborative curriculum redesign supported by the partnership of educational researchers and discipline lecturers, forming communities of practice to explore the application of mobile learning to their own contexts. In this section we explore three examples of implementing this EDR methodology in a range of curriculum contexts across the university enabled by the design and use of MOAs.

Game Design

This project began with the aim of supporting the development of a new Game Design degree. The goal of this new degree is to transform students into creative professionals, by focusing upon ontological pedagogies (Danvers, 2003) that deal with the process of becoming, rather than pedagogies that focus upon knowledge transfer. Thus the new degree focuses upon extending students' experience and expertise beyond the formal requirements of the degree to give them a real world collaborative experience of becoming part of the professional community of game developers modeled within a collaborative design studio experience. For example, students could use their own mobile devices to present in class reports and participate in live critiques via the MOAs. Active student participation within a national game developer community was achieved through a monthly game developers meetup, where the MOAs have enabled interactive game development demonstrations as part of and an open interactive studio space environment that models best practice. Through the use of MOAs and screen mirroring students were encouraged to work collaboratively in the studio spaces whereby game design processes were demystified by third year students modeling their project workflows via screen-mirroring their devices to the MOAs for first and second year students to observe within the studio. Reflections on the game design project are regularly updated and archived on a Google Plus Community: <http://bit.ly/1BexeAT>. Critical reflection on the project via SOTEL outputs from this project include conference presentations and an ebook chapter (Cochrane et al., 2014; Kenobi & Cochrane, 2015).

Journalism

The integration of mobile social media within the journalism curriculum was initially triggered by a discussion between the course lecturers and the researcher as an academic advisor around how to stop students disengaging in class by constantly updating their Facebook status. This led to the establishment of a community of practice of lecturers and the academic advisor exploring ways to authentically integrate the use of mobile social media (for example Twitter and Instagram) within the journalism curriculum. This project involved the collaborative redesign of a New Media Journalism paper from a previous focus upon teaching students rudimentary web 1.0 development skills and the PowerPoint presentation of social media case studies from the lecturers, to providing students with an authentic experience of using and critiquing mobile social media as it has transformed contemporary journalism practice. This redesigned level 7 paper offers students authentic team-based projects in which they are included as active negotiators of the project outcomes (heutagogy). Students build a professional mobile social media identity throughout the course, and engage with mobile social media both during their class time and beyond class. Thus graduates are better prepared to become active members of collaborative mobile social media journalism teams, both nationally and internationally. In this context the MOAs were used to display: either Twitter streams during class or a Todaysmeet.com backchannel creating an interactive crowd-sourced mobile discussion forum, student presentations from their mobile devices (for example: <http://youtu.be/a5813L5O18E>), and guest lecturers via Skype and other mobile live streaming Apps. The use of the MOAs made the backchannel conversations around class discussions and topics explicit and interactive. These live discussion forums were also able to be recorded and any questions followed up after class. Reflections on the Journalism project are updated on a Wordpress blog <http://ejeteam.wordpress.com>, and archived on a Google Plus Community <http://bit.ly/mojomlaw>. SOTEL outputs from this project include conference presentations, Journal papers, and book chapters (Cochrane et al., 2013; Cochrane, Mulrennan, Sissons, Pamatatau, & Barnes, 2013; Cochrane, Sissons, Mulrennan, & Pamatatau, 2013).

Performance for Screen Studies

In 2013 the performance for screen course was relocated into a new building space that incorporated state of the art performance facilities for drama, dance, and live theatre. However, no thought had been given to providing a

wireless infrastructure to enable presentation and collaboration technologies within this space. Hence the use of three MOAs and iPad minis for the course lecturers enabled this space to be used for a range of activities: for lecturers to wirelessly present, for students to record their performances, play them back on the MOAs, critique their performance, and view and discuss supporting material in the performance space rather than in a separate classroom space. This project also resulted in the development of a guide to the use of the MOAs by one group of the project participants that was shared between all of the project participants. Example lecturer initial reflections on the use of the MOAs in 2013 are transcribed below.

We've been using the MOA and the iPad minis in our teaching. Initially we were using it as a presentation device, which has limitations and it is difficult to transfer files to the iPad. For example PowerPoint on the iPad messes up fonts and layouts and embedded videos do not play. However there are other applications of the devices that are quite useful, for example showing videos using GoodReader, and being able to immediately show student videos straight after they are recorded is great. So part of the relevance for our context of performance for screen is that students can use the technology to film themselves doing things and then immediately show the rest of the class and form the basis for a discussion. We are also looking at ways of creating online communities where students can discuss things amongst themselves and present assessments less as written activities than as video blogs of their performance - we're teaching them performance, so rather than writing it down as a journal entry they can express their performance as a combination of written and video reflections. (Lecturer reflection, 2013)

A survey of students conducted in 2014 revealed that all of the students enrolled in the course owned smartphones (either iPhones (90%) or Android (10%) smartphones), thus we were able to focus the second iteration of this project upon redesigning the course activities and assessments around the use of student BYOD devices and Wordpress.com student ePortfolios. Students also explored mobile augmented reality applications displayed in teams via the MOAs. Reflections on the performance for screen project are archived on a Google Plus Community <http://bit.ly/GA4kQW> and a Vimeo channel (<https://vimeo.com/channels/1001895>). SOTEL outputs from this project include conference presentations, Journal papers, and book chapters (Cochrane, Guinibert, Simeti, Brannigan, & Kala, 2014; Cochrane, Narayan, et al., 2014).

Discussion

Adopting a design thinking process for the development of the MOAs formed part of an overall educational design research methodology informed by our mobile social media project framework. Thus the development of a supporting infrastructure (MOAs) has been key to enabling new pedagogies within a variety of contexts as illustrated by the brief case studies included in this paper. A key goal of the MOA design was to minimise the technical requirements for mirroring a student-owned mobile device to a large screen by utilizing the built-in screen mirroring capability of iOS and Android mobile devices. Therefore the MOAs were designed to require only a simple WiFi login process with a simple password on each MOA and a single cable required for power. This allowed us to focus more upon pedagogical redesign without the technology getting in the way of pedagogical innovation. The problem that we observe is that education is invariably driven by IT decisions that determine teaching and learning opportunities rather than seeing IT as an enabler of new pedagogies and creativity. When the technology gets in the way of creative teachers and learners then the problem is with the technology, not the teachers or learners. Technology must be reconceptualised as creative tools that enable innovative pedagogies. Driving teaching and learning from IT decisions rather than pedagogy propagates the substitution of old pedagogies onto new technologies, leading to the phenomenon of no significant difference (Reeves, 2005). Rather than limiting creative teachers and learners, ICT should empower them, and appropriate technology choices be made to do this. In 2013 the European Commission presented their vision for creative classrooms where the theme was upscaling innovation in teaching and learning (Punie, 2013), this vision places ICT infrastructure as an enabler rather than the driver of creative classrooms: <http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html>. Within our model of educational design research this process is informed by our mobile social media framework for creative pedagogies.

The development of the MOAs has enabled the integration of new pedagogical practice within several departments across the university. However, while the use of MOAs was found to be beneficial in small group tutorials, and flexible learning spaces enabling student team project work using their own mobile devices, their use within computer lab situations was less successful due to the restriction of sightlines created by the large screen

computer monitors. Connecting an AppleTV to a large screen video projector was found to be more effective in computer lab environments. The rapidly evolving nature of mobile and television development has meant that every iterative production run of the MOAs has required tweaking of the MOA design to accommodate new components as prior models become unavailable. In particular this has meant replacing the original 50-inch plasma screens with 50 inch LED screens, and a new wireless audio unit. In general these updates have been beneficial: for example the 50 inch LED screens are 10kg lighter than the original plasma screens, making the MOAs easier to move. The iterative software updates available for the AppleTV since the initiation of the project have also provided solutions to some of the initial security and connectivity issues that were concerns for the institutions IT department. In particular Apple has updated the AppleTV and iOS with Airplay across WiFi subnets and discovery of Airplay devices via bluetooth. This means lecturers and students no longer have to switch WiFi subnets and daily login to the institutions proxy network to gain access to both the Internet and Airplay mirroring to the MOAs. These advances mean that the end user experience is more seamless, encouraging the use of the technology.

Following a design thinking process has led to several practical solutions to the availability and supply of the MOAs. The design of the MOAs stands as a CNC file cut from a single sheet of plywood and press fit assembly has meant that we have been able to simply share the design with other New Zealand institutions either as a pre-cut flat-pack for on site assembly, or via sharing the CNC files to institutions with their own CNC facilities to cut and assemble their own MOAs on site. By embedding the use of MOAs as curriculum redesign enablers within a reflective practice framework (SOTEL) we have also been able to document and share our pedagogical redesign experiences with other institutions globally – both through conference presentations and publications, and journal articles based upon our experiences. This case study illustrates the intersection of educational design research and the unique affordances of mobile learning, and has resulted in the identification of several collaborative curriculum design principles for integrating the use of mobile social media within new pedagogical paradigms:

- Educational design research can be supported and informed by a simple and scalable framework for creative pedagogies using mobile social media.
- Design thinking enables the development of a simple and scalable supporting technological infrastructure.
- Both technological and pedagogical support are essential for innovative curriculum redesign, including the importance of working in partnership with the institutional IT support department (Salmon & Angood, 2013).
- Embedding a reflective practice framework (SOTEL) critically informs the evaluation and impact of the curriculum redesign process and provides a mechanism for dissemination to a broader audience.

Conclusion

Embedded within an educational design research methodology, we have used a design thinking approach to find a creative solution to our goal of enabling student-generated contexts and collaboration via mobile social media. This involved the development of a portable wireless infrastructure for enabling screen mirroring from student owned mobile devices. This low cost technological solution (MOAs) has been successfully shared and implemented with other New Zealand institutions. Partnering with various lecturers we were able to collaboratively explore the intersection of mobile learning and curriculum redesign to enable new pedagogies that focus upon student-generated contexts and collaboration via mobile social media. The design process was informed by a mobile social media framework for creative pedagogies and the project outcomes have been critically evaluated and disseminated by the scholarship of teaching and learning (SOTEL) providing a potentially transferable solution to enabling new pedagogies within a variety of educational contexts.

References

- Bannan, B., Cook, J., & Pachler, N. (2015). Reconceptualizing design research in the age of mobile learning. *Interactive Learning Environments*, 1-16.
- Boyer, E. (1990). *Scholarship reconsidered: priorities of the professoriate*. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.
- Cochrane, T. (2014). Critical success factors for transforming pedagogy with mobile Web 2.0. *British Journal of Educational Technology*, 45(1), 65-82.

- Cochrane, T., Antonczak, L., Guinibert, M., Withell, A., Mulrennan, D., Mountfort, P., et al. (2013, 1-4 December). *Collaboration unplugged: Herding a flock of MOAs*. Paper presented at the Electric Dreams: 30th ascilite Conference, Macquarie University, Sydney, Australia.
- Cochrane, T., Guinibert, M., Simeci, C., Brannigan, R., & Kala, A. (2014). Mobile Social Media as a Catalyst for Collaborative Curriculum Redesign. In J. Keengwe & M. Maxfield (Eds.), *Advancing Higher Education with Mobile Learning Technologies: Cases, Trends, and Inquiry-Based Methods* (pp. 1-21). Hershey, PA: IGI Global.
- Cochrane, T., Mulrennan, D., Sissons, H., Pamatatau, R., & Barnes, L. (2013, 4-6 July). *Mobilizing Journalism Education*. Paper presented at the International Conference on Information Communication Technologies in Education (ICICTE 2013), Crete, Greece.
- Cochrane, T., Narayan, V., Brannigan, R., Frenchman, K., Nicholson, E., Rutherford, S., et al. (2014). #NPF14LMD *AUT University Case Studies*. Paper presented at the Rhetoric and Reality, proceedings of the 31st Ascilite Conference. Retrieved from <http://ascilite2014.otago.ac.nz/posters/-291>
- Cochrane, T., Sissons, H., Mulrennan, D., & Pamatatau, R. (2013). Journalism 2.0: Exploring the impact of Mobile and Social Media on Journalism Education. [Journal]. *International Journal of Mobile and Blended Learning*, 5(2), 22-38.
- Cochrane, T., & Withell, A. (2013). Augmenting design education with mobile social media: A transferable framework. *Journal of the NUS teaching academy (JNUSTA)*, 3(4), 150-168.
- Cook, J. (2009). Phases of mobile learning. *Joint European summer school on technology enhanced learning*, (May 30 - June 6). Retrieved from <http://www.slideshare.net/johnnigelcook/cook-phases-of-mobile-learning>
- Cormier, D. (2008). Rhizomatic education: Community as curriculum. *Innovate*, 4(5), np. available <http://davecormier.com/edblog/2008/2006/2003/rhizomatic-education-community-as-curriculum/>.
- Danvers, J. (2003). Towards a radical pedagogy: Provisional notes on learning and teaching in art & design. *International Journal of Art & Design Education*, 22(1), 47-57.
- Educause Learning Initiative. (2012). 7 Things You Should Know About Educational Design Research. *7 Things You Should Know About... 2012*(6 August). Retrieved from <http://www.educause.edu/library/resources/7-things-you-should-know-about-educational-design-research>
- Educause Learning Initiative. (2014). 7 Things You Should Know About Design Thinking. *7 Things You Should Know About... 2014*(3 June). Retrieved from <http://www.educause.edu/library/resources/7-things-you-should-know-about-design-thinking>
- Frohberg, D., Goth, C., & Schwabe, G. (2009). Mobile learning projects - a critical analysis of the state of the art. [Research article]. *Journal of Computer Assisted Learning*, 25(4), 307-331.
- Haigh, N. (2010). *The Scholarship of Teaching & Learning: a practical introduction and critique*. Ako Aotearoa, National Office, Wellington, New Zealand: Ako Aotearoa.
- Hase, S., & Kenyon, C. (2001). From Andragogy to Heutagogy. *ultiBASE Articles*, (December), 1-10. Retrieved from <http://www.psy.gla.ac.uk/~steve/pr/Heutagogy.html>
- Hase, S., & Kenyon, C. (2007). Heutagogy: a child of complexity theory. *Complicity: an International Journal of Complexity and Education*, 4(1), 111-118.
- Kenobi, B., & Cochrane, T. (2015). Innovative Pedagogy in Game Design. In S. Frielick (Ed.), *LTDF 2014 ebook* (pp. 79-81). Auckland University of Technology: Centre for Learning And Teaching.

- Leinonen, T., & Durall, E. (2014). Design Thinking and Collaborative Learning. *Comunicar*, 42(1), 107-115.
- Luckin, R., Clark, W., Garnett, F., Whitworth, A., Akass, J., Cook, J., et al. (2010). Learner-Generated Contexts: A Framework to Support the Effective Use of Technology for Learning. In M. Lee & C. McLoughlin (Eds.), *Web 2.0-Based E-Learning: Applying Social Informatics for Tertiary Teaching* (pp. 70-84). Hershey, PA: IGI Global.
- McKenney, S., & Reeves, T. (2012). *Conducting educational design research*. London: Routledge.
- McKenny, S., & Visscher-Voerman, I. (2013). Formal education of curriculum and instructional designers. *Educational Designer*, 2(6).
- Mitchell, G., Matthews, G., Pospisil, R., & White, B. (2009, 6th-9th July). *Space Matters - Particularly when you don't have a lot*. Paper presented at the HERDSA, Charles Darwin University, Darwin, Australia.
- Puentedura, R. (2006). Transformation, Technology, and Education. Retrieved 18 February, 2013, from http://hippasus.com/resources/tte/puentedura_tte.pdf
- Punie, Y. (2013). Up-Scaling Creative Classrooms in Europe (SCALE CCR). from <http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html>
- Reeves, T. (2005). No significant differences revisited: A historical perspective on the research informing contemporary online learning. In G. Kearsley (Ed.), *Online learning: Personal reflections on the transformation of education* (pp. 299-308). Englewood Cliffs, NJ: Educational Technology Publications.
- Rushby, N. (2012). Editorial: An agenda for mobile learning. *British Journal of Educational Technology*, 43(3), 355-356.
- Salmon, G., & Angood, R. (2013). Sleeping with the enemy. *British Journal of Educational Technology*, 44(6), 916-925.
- Scott-Webber, L., & Corcoran, S. (2013, July 25). Design Thinking: Theory and practice. *EDUCAUSE Live! Webinars*, from <http://www.educause.edu/library/resources/design-thinking-theory-and-practice>
- Sharples, M. (2009, October 26-30). *Learning at large*. Paper presented at the MLearn 2009: The 8th World Conference on Mobile and Contextual Learning, University of Central Florida, Institute for Simulation and Training, Orlando, Florida.
- Siemens, G. (2004). Connectivism: A Learning Theory for the Digital Age. *eLearnSpace*, (12 December). Retrieved from <http://www.elearnspace.org/Articles/connectivism.htm>
- Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. (2002). *The creativity conundrum: A propulsion model of kinds of creative contributions*. Philadelphia: Psychology Press.
- Vygotsky, L. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.
- Weaver, D., Robbie, D., Kokonis, S., & Miceli, L. (2012). Collaborative scholarship as a means of improving both university teaching practice and research capability. *International Journal for Academic Development*, 18(3), 237-250.
- Wickens, R. (2006). SoTEL: Toward a Scholarship of Technology Enhanced Learning. *Canadian Journal of University Continuing Education* 32(2), 21-41.
- Wingkvist, A., & Ericsson, M. (2011). A survey of research method and purposes in mobile learning. *International Journal of Mobile and Blended Learning*, 3(1), 1-17.