



Do 21st Century Students Dream of Electric Sheep? A mobile social media framework for creative pedagogies

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Students sometimes appear to be 'asleep' and are often updating their Facebook status during seminars and lectures. We argue this is the equivalent of counting electric sheep. Student brainwave activity measured during traditional lectures has been shown to be similar to that while watching television and significantly lower than that exhibited during any form of activity including sleep (Mazur, 2012). Mazur found that introducing interactive activities in lectures significantly increases brain activity. In this paper we explore the potential for mlearning to enhance student interactivity and collaboration both in the classroom and in authentic situated learning contexts. We partnered with Vodafone New Zealand and Auckland Transport to provide our students with an iPad Mini, and 4G connectivity, to enable student-generated research projects. The students' brief was to design an enhanced experience of commuting via public transport in Auckland City. Thus the research investigates how mobile devices can be used enable interactive learning environments.

Keywords: Pedagogy, Heutagogy, Mobile Social Media.

Introduction

Mazur (2012) argues that the brainwave activity (or lack of) during traditional learning environments would indicate that students are stimulated less than while sleeping by passive learning environments. Infamously Philip K Dick (1968) wrote a novel titled "Do androids dream of electric sheep?" to explore the notion of self-awareness of artificial intelligence in robots. We suggest that traditional teacher-centric content delivery pedagogies are a passive experience for 21 century students that drive them to seek more stimulating engagement via Facebook, email or other socially connected activities during class time, effectively driving our students to dream of electric sheep (via connected, social networks) during teacher-delivered monologues. Mazur's research demonstrates that introducing interaction, collaboration and student-generated content into learning experiences significantly increases brainwave activity and learning outcomes. In today's world where the most ubiquitous technology is mobile (ITU, 2011) and mobile internet connectivity exceeds fixed connections, education must include a critical engagement with new technologies including mobile social media. As Yagou (2007, np) argues: "Having started as craft-based training with rather narrow vocational aims, design education is developing into an interdisciplinary academic field emphasizing research and preparing designers for a knowledge economy".

The recently developed Product Design programme at Auckland University of Technology is underpinned by physical studio experience for students that supports and facilitates a Design Thinking approach (Bauer & Eagen, 2008). While great physical studio spaces provide an excellent environment to support the learning and teaching of key aspects of Design Thinking including group collaboration, brainstorming, drawing/ideation and

3D prototyping, these studios have a danger of ‘insulating’ students from real-world design contexts. The situation is similar to Architectural education, based on what once was considered a radical studio model, “Architectural pedagogy has become stale... curricular structures have hardly changed in recent decades, despite the major transformations that have taken place with the growth of globalisation, new technologies, and information culture” (Colomina et al., 2012). In contrast, Design Thinking methodologies also require human-centred observation, interviews and the testing of ideas and concepts in real-world situations. Design Thinking also requires students to collaborate, share and to reflect about their works ‘on-the-fly’, while mobile, and in less formal learning situations.

Drawing upon disciplines outside of design, including media studies, communication and education, the integration of mobile social media, mobile phones and tablets, blogs, twitter and other social media tools has the potential to enhance the Design Thinking process, acting as a catalyst for new pedagogies (Kukulka-Hulme, 2010). It also has the potential to complement, augment and enhance great physical learning environments by providing the tools and mechanisms that encourage students to take their learning outside into the ‘real world’, and to work more collaboratively in new and effective ways. As Balsamo (2011) argues, higher education needs an epistemological reboot. We argue that in essence such a reboot will provide a bridge between the formal and informal learning contexts for Design Thinking utilizing mobile social media.

This paper presents the background, the implementation, and the impact of a project, which aims to use mobile social media to augment and enhance a Design programme underpinned by Design Thinking. The goal of the project is to enhance student-learning experiences, positively impact their Design Thinking expertise development, and to explore the future of Design Thinking education enhanced by mobile social media. In addition it provides an opportunity for a small university department to engage with implementing and sustaining pedagogical change enabled by technology through the establishment of communities of practice (Cochrane, 2010). Building upon our work of establishing a framework for mobile social media integration in higher education (Cochrane and Bateman, 2013) we explored how to harness the affordances of mobile social media to stimulate student-generated learning in and beyond the classroom (Cochrane and Withell, in press). We use the concept of the pedagogy-andragogy-heutagogy (PAH) continuum (Luckin et al., 2010) as a measure of pedagogical change enabled by the introduction of mobile social media within the curriculum. Luckin et al., (2010) argue that heutagogy, or student-directed learning (Blaschke, 2012), need not be the sole domain of post-graduate education, rather pedagogical strategies can be seen as a continuum encompassing teacher-directed pedagogy, student-centred andragogy, and student-directed heutagogy. While this paper focuses upon one specific mlearning project during 2013, the research was part of a wider community of practice involving all of the lecturers in the Product Design department begun in 2012, with the aim of enhancing the curriculum across all three years of the bachelors degree, involving a four fold approach including: integrating the use of mobile social media into the curriculum, establishing student eportfolios as a core aspect of the design curriculum, critically underpinned by a Design Thinking Toolkit (DTT), and new ‘smart’ assessment strategies.

The outcomes of the mobile social media project during 2012 resulted in a radical conceptual shift within the thinking of the lecturers, where “mobile social media was reassigned from the category of a purely social tool for informal use into a powerful tool for student-generated content and collaboration within student-generated learning contexts” (Withell et al., 2012). This conceptual shift then led to the reimagining of core tools for supporting social constructivist pedagogy throughout the programme, leading to the implementation of a mobile social media framework across the entire Bachelor of Product Design programme. Implementing this framework involved three key aspects, including: creating a new culture around building learning communities, integrating the pedagogical use of mobile social media into the curriculum, and providing the technology infrastructure required to support the use of mobile social media. Our review of the mlearning literature revealed that there are few mlearning projects that design for these three key aspects (Cochrane, 2013). A notable exception was the MoleNET project (Attewell et al., 2010), which focused upon developing a rigorous teacher professional development strategy, embedding the use of technology in the curriculum, and making informed decisions about the choice of technologies. From our previous experience, failing to provide technological infrastructure to support pedagogical innovation and curriculum redesign leads to project failure (Cochrane, 2012b). The integration of the social media framework into the Product Design curriculum involved three stages, with each stage aligned with each year of the Bachelor of Product Design programme, as shown in Table 1.

Table 1: Staging and scaffolding the PAH continuum

Stage	Learning context	Mobile social media project	Course timeframe	Infrastructure	PAH alignment
Level 1	Social collaboration with peers and lecturer Student generated content	Establishment of student-generated e-portfolios using student-owned mobile devices, Wordpress blogs, and critically founded on the mobilized Design Thinking Toolbox.	First year of Product Design course	WiFi Lecturer iPads R2D2 presentation systems	Pedagogy (lecturer directed)
Level 2	Social collaboration with peers and 'authentic environments' Context aware	Student project collaboration using Dropbox, Google Drive, and student-owned mobile devices.	Second year of Product Design course	WiFi Lecturer iPads R2D2 presentation systems	From pedagogy to andragogy (students become the content creators)
Level 3	Context independent, bridging formal and informal learning Student generated contexts	Student-negotiated team projects exploring the unique affordances of mobile devices in partnership with Vodafone New Zealand and Auckland Transport	Third year of Product Design course	Student iPads with 4G MOAs	From andragogy to heutagogy (students become independent learners)

Methodology

The context of this research project was the third year of a Bachelor of Product Design. Participants included 24 students, two lecturers, and two researchers. As we are interested in pedagogical change and better graduate outcomes, a participatory action research methodology was used (Swantz, 2008). A survey of the 2012 third year Product Design students indicated that less than 40% of the students owned smartphones and none owned tablet devices. Therefore to implement this project we required appropriate mobile devices for the participants. The authors secured a contestable grant from Vodafone New Zealand to supply all third year Product Design students with an iPad mini and 2GB per month mobile broadband data to utilize during a project to investigate and design an enhanced commuting experience for public transportation on Auckland buses. An acceptable use policy was created and signed by all participating students that outlined the project expectations and use of the iPad Mini. Students also signed ethics consent forms consenting to anonymous use of data associated with the project for research publication. Students were expected to use their mobile device on a number of social media platforms including: Wordpress, Google Plus, YouTube and Twitter. The project was introduced and supported by several mobile social media tutorials curated via Evernote (<http://tinyurl.com/b5d97vr>).

Enabling mobile collaboration was a key goal of the project, thus we explored designing infrastructure options for facilitating this. Two approaches were taken, exploring wireless mobile presentation systems for video projectors in large group settings, and wireless small group collaborative workstations using large screen mounted displays. Wireless mirroring of mobile device screens is a relatively new affordance that was introduced in the 2011 Airplay update of the AppleTV software and built in to the iPhone 4S and iPad2. This was quickly followed by similar wireless screen mirroring protocols for Windows (WiDi) and Android (Chromecast) based mobile devices. Based upon the work on Mobile Collaborative Workstations (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.) and Allshare (Samsung Electronics) students can present the screen of their mobile device onto a large-screen mobile display turning their mobile device into a group presentation and collaboration tool. The MOA acronym plays on the name of the large flightless bird once native to New Zealand, similar to the Emu, but now extinct. These MOAs can be wheeled into different spaces for students to breakout into teamwork during or in-between classes. Thus we expand 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-directed heutagogy. Students were assessed on their application of the Design Thinking processes throughout the project. Project criteria included: planning and management, analysis, research, synthesis, communication, and appropriate use of mobile social media.

Research questions

There are two research questions informing this project:

1. How can mobile social media be used as a catalyst to enable student-directed collaboration in and beyond the classroom?
2. How can we design presentation systems that turn a personal mobile device into a collaborative tool?

Data collection methods included: the collation of participating lecturers and students web 2.0 eportfolios via RSS feeds within Google Reader, student pre-project surveys, and informal focus group discussions. Student feedback throughout the project was used to inform tweaks to the research project implementation.

Data and analysis

All participants had established Wordpress blogs during 2012. This was extended in 2013 by the use of the Wordpress App for blogging from their iPads anywhere, anytime. Students used their Wordpress blogs as the hub of their eportfolios for the project, embedding YouTube videos and a variety of social media into their blogs. These were aggregated via RSS feeds by Google Reader, and curated by the students via the Flipboard App on their iPads. Analysis tools included the use of SurveyMonkey for student feedback, discourse analysis of participant blog posts using collated word clouds, and transcription of participant reflective videos that had been uploaded to YouTube and embedded in their blogs. This enabled identification of emerging themes, and this was triangulated against the observation and identification of critical incidents from focus group discussions with selected students. Another rich source was the use of Google Docs for collaborative comparison of previous course assessments with those developed as outcomes of the project.

Results

The initial rollout of iPad minis for the students was met with unsurprising enthusiasm, with the most immediate impact being most noticeable in a significant higher level of engagement with blogging as student design journals.

Today was a big day for AUT Product Design 3rd Year Students. Surprisingly to us, Apple [Vodafone] has kindly given us iPad minis to use for the year to make blogging and research for our designing easier and quicker. Having the apps on display for all our needs makes the blogging experience a lot more fun! (Student blog post, March 2013)

A survey of the participating students at the end of the first semester of the project asked the students to indicate what activities they had used the iPad for (Figure 1), and to rate the most useful affordances of the iPad (Figure 2). Figure 1 indicates that students used the iPad mini to document their design processes and record the design activity associated with their projects. Less used were the communication affordances of the iPad, with Twitter being used by only 26% of the students for collaborating on their projects, and none utilizing Google Plus. 80% of students did however make use of Facebook on their iPad. Facetime (video calling) and audio recording were used by a significant number of students, mostly for free video calling between team members, and recording of interviews with industry experts and public transport patrons used to gather feedback on the Auckland Bus transportation system. Figure 2 indicates that the experience was a positive enhancement across a range of activities for students, with no direct negatives identified. Most valued by the students was the mobility and ubiquitous connectivity of the iPad, particularly allowing them to reflect and critique in situ experiences that previously required separate documentation and subsequent recording and evaluation. They were able to record and critique the implementation of their bus trip enhancement designs while on location and coordinate intricate real-time experiments.

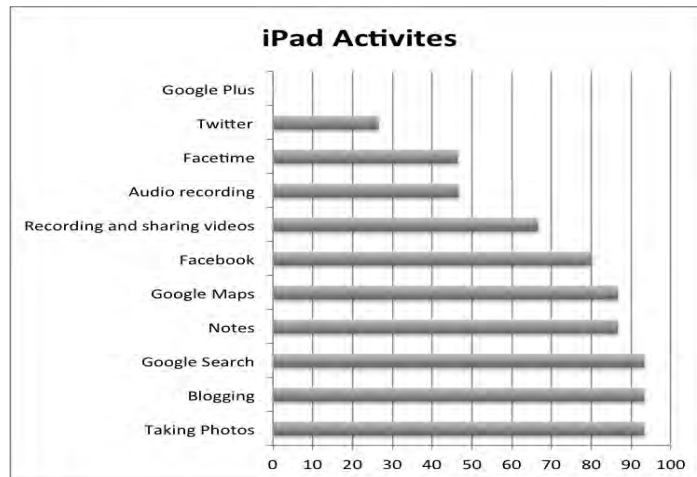


Figure 1: Types of iPad activities

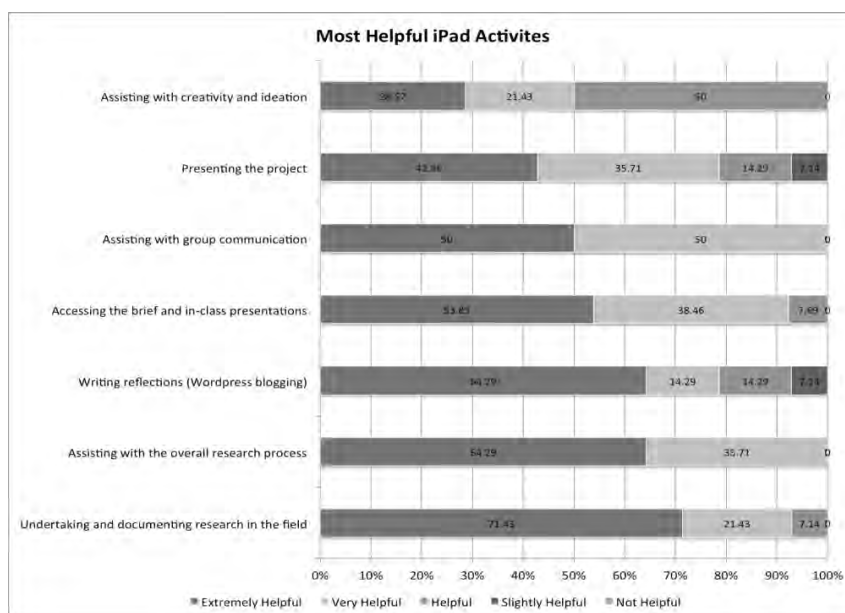


Figure 2: Most helpful iPad activities

A visual summary of student feedback is shown in Figure 3, represented by a word cloud of collated student reflections on their iPad experience posted to their course blogs. The creative, serendipitous and empowering nature of mobile blogging featured strongly in student feedback, as well as the temptation to procrastinate. As Figures 1 to 3 indicate one of the highest uses the iPad was for blogging including blogging in situ while reflecting on their experiences. On average student blog posts increased 500% after the introduction of the iPad in 2013 in comparison to the average number of blog posts per student during 2012. Students also began embedding YouTube video reflections on their blogs for the first time after the introduction of the iPad.



Figure 3: Wordle of collated student feedback

An example of the development and progression in the way students integrated the use of the iPad into their work flows, collaboration and off campus research is captured nicely in a series of video reflections posted to a student's blog. These video reflections are transcribed below.

We've been using the iPad for. Multitude of different reasons, including blogging, and its a really good tool for reflecting immediately upon things that we have done in lectures, and doing stuff on the go - we can take it where ever we want, use our 3G to do work on the Ferry on the way home. And it's so good that it's so light, I can just pop it in my bag and cycle to Uni without having to lug around a massive laptop anymore - it's awesome. (Student video post, March 2013)

We used our iPads for our presentations in a really cool way - we linked our iPads to our presentations via an Appletv and then we could see where we were up to without having to look at the screen behind us. It looked really funny because everyone had their iPads out during their presentations so we could take notes and video each other, which could be a really useful tool for viewing and analysing our presentation skills. I've also been using it for doing stuff on the spot - I'll be away somewhere and I can quickly note ideas and capture raw data. Some of the negatives: it's a bit of an addictive technology, that once you've got it you feel like you need it all the time, every few seconds you can check it - you get notifications, and you need to sort out what is important - you have to get a good balance going. Other than that I'm finding it a really good tool, for blogging especially, and reading and annotating notes. So far I'm very pleased with the iPad. (Student video post, April 2013)

So here I am, on location in Ngaruawahia, fitting in some thinking, reflecting and a bit of work during a long weekend. The iPad is pretty supreme for this - it's pretty much the one thing that the iPad is the most useful for - taking it on location with you and being able to do work on the go. One of the most useful Apps I've found so far is this new YouTube App - you can take video and upload it straight away without the hassle of trying to convert it from one format to another. Another fave App of mine at the moment is the Mail App and the calendar - being able to organise your life on the go including your Uni life and social life and how everything can fit together, especially when things get chaotic at the end of semester. The iPad has been really good for my learning so far - you can do everything quickly and efficiently. (Student video post, May 2013)

Students tended to evidence a progression from using the iPad as a convenient replacement for activities they would previously have achieved on a laptop or desktop computer, to exploring activities that were previously difficult or impossible to achieve with a laptop or other computing technology. There were many location photos, recording paper brainstorms, and interview notes posted to student Blogs from the iPad. While there was plenty of evidence of the use of the iPad for enhancing productivity and for recording ideas and activities, there

were also examples of students using the iPad and its 4G connectivity to achieve creative collaborative activities that were previously difficult or impossible. An example of how students utilized the affordances of the iPad to enhance a team research project was recorded as a student blog post reflecting upon their bus journey project.

During our experiment at the bus stops we used our iPads messaging capabilities to our advantage as show in the diagram [Figure 4] one of us stood down the road and as we saw the bus approaching we messaged the other to trigger the doorbell. The other person filmed the reaction. Altogether we were using three iPads and the speed and reliability just made the whole test easy and simple to do. Initially we thought that we would need walky talkies to communicate but that probably would have looked a bit suspicious and blown our cover. During the experiment we could write down our notes immediately and then copy it straight to our blogs. These iPads are proving to be very useful. (Student blog post, April 2013)

Figure 4 is the students' diagram explaining their use of the iPad to facilitate this on site research experiment.

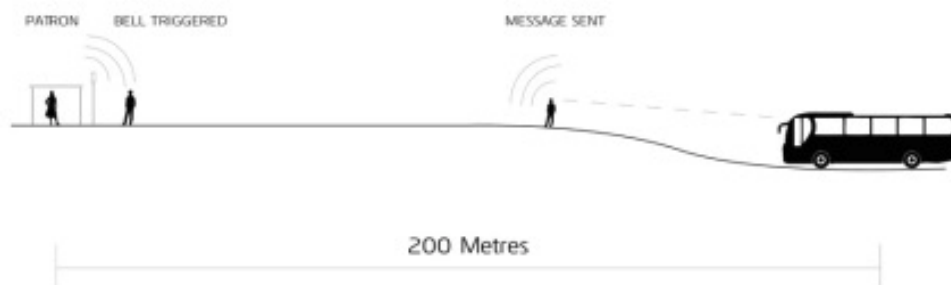


Figure 4: Students using iPads to trigger and test bus arrival alarm system.

Discussion

In this section we discuss some of the identified critical issues around the mobile social media project, and we draw upon our 2013 experience in light of what we have learnt in a variety of mobile social media projects (Cochrane & Withell, 2013; Cochrane & Bateman, 2013; Cochrane, 2012a) to illustrate a social media framework outlined in Table 2.

Critical issues

There were some pragmatic infrastructure issues that needed to be sorted out throughout the implementation of the project, particularly the significant impact of an increased load upon the institution's Wi-Fi infrastructure. The researcher worked with the IT department to enable Airplay protocols on the Wi-Fi network for wireless mirroring during presentations and group work. However there was a significant increase in Wi-Fi devices connecting to the wireless network during semester one 2013, the number of devices doubled across the entire institution in comparison to that recorded at the end of 2012, and the IT department had not anticipated such a heavy increase. This was offset for the project by the allowance of 2GB of 4G data for each of the participating students, which coincided with the rollout of Vodafone New Zealand's 4G network. Where available, 4G connectivity was generally found to be much faster than Wi-Fi, and provided a welcome alternative connectivity option when the institutions server and internet provider crashed early in semester one 2013. The introductory tutorial sessions were voluntary for the participants, and as a consequence only half of the students attended these. It was notable that the students who did attend the tutorials evidenced far more creativity with their iPad use than those who did not attend these sessions. This was documented in reflective blog posts and evidenced in the use of mobile social media for presentations and interaction – whereas the students who attended the tutorials used new presentation tools such as Prezi from their iPads connected wirelessly to the projection system, conversely those students who did not attend the tutorials used PowerPoint from their laptops to present their project proposals and reports. Creating and supporting a new culture around learning and teaching involved a refocus upon ontological pedagogies (Danvers, 2003) that transform students from learning about design principles to becoming active creative designers within an authentic community. This involves moving from simple reproduction of ideas to the reinitiation of design based upon new ideas (Sternberg, Kaufmann & Pretz, 2002). The iPad enabled a shift from the safe walled environment of the design studio into interaction with the environments in which the student design projects were situated.

The iPad project followed a process similar to Puentedura's (2006) SAMR model (Substitution, Augmentation,

Modification, Redefinition) of educational technology transformation. Students initially used the iPad to replicate or replace activities they used their laptop computers for, but then progressively found creative affordances that enabled new ways of working that enabled them to modify and even redefine team activities and collaboration. The iPad tutorial sessions explored various ideas for using the iPads for redefining collaboration, and modelled and encouraged students to explore wireless presentation options. The introduction of the MOAs provided the infrastructure that enabled a redefinition of mobile devices from personal devices to become collaboration and group work tools.

The design of wireless collaborative presentation and collaboration workstations for mobile devices resulted in two distinct designs: a wireless projector presentation system nick named R2D2, and a wireless large screen workstation nick named a MOA. The wireless projector presentation systems have replaced dedicated desktop computer systems connected to fixed mounted video projectors in all of the Product Design classrooms and studios. In contrast the MOAs have been explicitly designed to facilitate student team-work enabled by mirroring their mobile devices to a large portable screen that can be wheeled into any space of students' preference. The MOA design team included a post-graduate Product Design student, the course lecturers, and the researcher, resulting in input from all of the stakeholders. The MOA has been tested in several small group collaborative situations, and it has been found to facilitate more of a flexible work-group collaborative environment rather than the presentation centric R2D2 design. Prototypes of both units are shown in Figure 5 (R2D2) and Figure 6 (MOA).

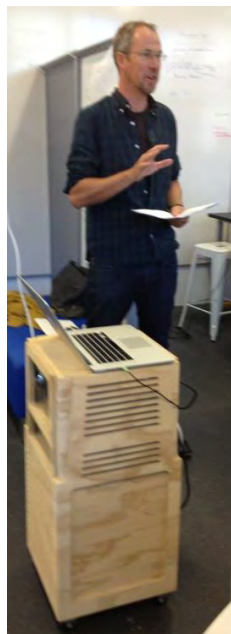


Figure 5: R2D2



Figure 6: MOA

The goal of the Product Design curriculum is to produce creative professionals who employ sustainable and responsible designs, and this requires creative pedagogies (Danvers, 2003, Sternberg et al., 2002). Therefore there is strong affinity with the concept of student-directed learning (heutagogy) within the degree. However introducing student-directed projects requires staging and scaffolding across the three years of the degree (Table 1) as students previous educational experiences are usually heavily teacher-directed. Additionally, student engagement with social media is invariably limited to the use of Facebook, and students require significant modelling of how to utilize mobile social media within a professional framework. The addition of mobile social media into the curriculum has enabled a higher level of student-directed collaboration beyond the studio and classroom that was previously difficult and usually involved a two-step process of documentation followed by reflection and analysis after the event back in the confines of the design studio. While the course has made significant strides in an area that still needs attention is encouraging students to become active participants within a global design community. This is where Google Plus Hangouts and Twitter will become an essential part of their mobile social media toolkit. Currently students are still very focused upon their physical located community based within the Design Studio. One way to model active international participation would be for the lecturers to more explicitly share their international experiences such as involving students in their international conference presentations and inviting virtual community participation via Twitter contacts, inviting and brokering guest international experts to interact via mobile social media with the student projects (Buchem

et al., 2012). This would require further conceptual shifts in collaborative curriculum design.

A mobile social media framework

Our mobile social media framework is a mashup of associated frameworks that work together to achieve creative social-cultural pedagogy, mapped onto the pedagogy-andragogy-heutagogy continuum (Luckin et al., 2010). Table 2 provides a summary of the types of changes brought about in the curriculum by the mobile social media framework and provides a potentially transferable mobile social media framework for a variety of contexts.

Table 2: Mobile social media framework and the PAH continuum (modified from Luckin et al., 2010)

	Pedagogy	Andragogy	Heutagogy
Activity Types	<ul style="list-style-type: none"> • DTT delivered • Digital assessment • Teacher delivered content • Teacher defined projects 	<ul style="list-style-type: none"> • DTT as guide • Digital identity • Student-generated content • Student negotiated teams 	<ul style="list-style-type: none"> • DTT inherent • Digital presence • Student-generated contexts • Student negotiated projects
Locus of control	Teacher	Student	Student
Cognition	Cognitive	Meta-cognitive	Epistemic
SAMR	Substitution & Augmentation <ul style="list-style-type: none"> • Portfolio to eportfolio • PowerPoint on iPad • Focus on productivity • Mobile device as personal digital assistant and consumption tool 	Modification <ul style="list-style-type: none"> • Reflection as VODCast • Prezi on iPad • New forms of collaboration • Mobile device as content creation and curation tool 	Redefinition <ul style="list-style-type: none"> • In situ reflections • Presentations as dialogue with source material • Community building • Mobile device as collaborative tool
Knowledge production	Subject understanding	Process negotiation	Context shaping
Creativity	Reproduction	Incrementation	Reinitiation
Self perception	Learning about	Learning to become	Active participation within the professional design community

Revisiting Electric Sheep

Rather than providing a distraction for disengaged students, integrating the use of mobile social media into the curriculum has afforded the development of a culture around enabling design thinking and exploring new forms of collaboration. Lectures no longer focus upon talk and chalk, but involve active student engagement on the fly creating opportunities for in class exploration via mobile connectivity, enabling students to share their ideas and discoveries directly from their mobile device wirelessly for the entire class to discuss and critique. Of course this was not an instant process, but is the result of the development of a cultural shift that the lecturers and students have embarked upon, supported by the researchers as technology stewards. Feedback from the staff members teaching into the year three product design studio has indicated that there has been quite an improvement in student engagement, especially during lectures and seminar presentations. For example they commented that the students were now using their iPads to actively follow lecturer presentations ‘on the fly’ in class as well as presenting their ideas and concepts via Apple TV and the MOBILE Airplay screens (MOAs) to the rest of the group for feedback. This has allowed for a more interactive and stimulating experience for both staff and students. In addition the Wordpress blogs have been useful to drive student personal reflective practices, with mobile devices allowing immediate and in context reflection. Initial analysis has indicated that students have been more inclined to document and reflect deeply on their work via personal blogs rather than the previously established group electronic portfolios that utilised Mahara. Feedback from students has indicated that the iPads have provided a good, and readily successful platform for blogging, ideation, and collaboration.

Conclusion

Rather than dreaming of electric sheep, the students in our mobile social media project have been dreaming up

new ways of collaborating and creative thinking. The impact of the project has been described by the participating lecturers as: “overall quite transformative” and has resulted in significant change within the curriculum with the implementation of new assessment strategies that are no longer physically limited to the design studio, and enabling new forms of student-generated collaboration both in the studio and in authentic contexts. Through designing and deploying a flock of MOAs we have provided a flexible infrastructure to enable student-owned personal devices to be reconceptualised as collaborative team work and presentation tools.

References

- Attewell, J., Savill-Smith, C., Douch, R., & Parker, G. (2010). Modernising education and training: Mobilising technology for learning Available from [http://www.talpalink.co.uk/resources/Modernising+education+and+training\\$2C+mobilising+technology+for+learning.pdf](http://www.talpalink.co.uk/resources/Modernising+education+and+training$2C+mobilising+technology+for+learning.pdf)
- Balsamo, A. (2011). *Designing Culture: The Technological Imagination at Work*. USA: Duke University Press.
- Bauer, R., & Eagen, W. (2008). Design thinking: Epistemic plurality in management and organization. *Aesthesis*, 2(3).
- Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. [Research Article]. *The International Review of Research in Open and Distance Learning*, 13(1), 56-71. <https://doi.org/10.19173/irrodl.v13i1.1076>
- Buchem, I., Cochrane, T., Gordon, A., Keegan, H., & Camacho, M. (2012). Mlearning 2.0: The potential and challenges of collaborative mobile learning in participatory curriculum development in higher education. In I. A. Sánchez & P. Isaias (Eds.), *Proceedings of the IADIS International Conference on Mobile Learning 2012* (pp. 311-314). Berlin, Germany: IADIS International Association for Development of the Information Society.
- Cochrane, T. (2013). A summary and critique of mlearning research and practice. In Z. Berge & L. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 24-34): Routledge.
- Cochrane, T., & Withell, A. (2013). Augmenting design education with mobile social media: A transferable framework. *Journal of the NUS teaching academy (JNUSTA)*, in press.
- Cochrane, T., & Bateman, R. (2013). A mobile web 2.0 framework: Reconceptualizing teaching and learning. In M. Repetto & G. Trentin (Eds.), *Using network and mobile technology to bridge formal and informal learning* (pp. 57-92). Oxford, Cambridge: Chandos Publishing.
- Cochrane, T. (2012a). Critical success factors for transforming pedagogy with mobile Web 2.0. *British Journal of Educational Technology* (in pre-print doi:10.1111/j.1467-8535.2012.01384.x).
- Cochrane, T. (2012b). Secrets of mlearning failures: Confronting reality. In D. Hawkrige, S. Verjans & G. Wilson (Eds.), *Proceedings of ALT-C 2012 - a confrontation with reality: The 19th international conference of the Association for Learning Technology* (pp. 123-134). University of Manchester, UK: ALT Association for Learning Technology.
- Cochrane, T. (2010). Exploring Mobile Learning success factors. *ALT-J, Research in Learning Technology*, 18(2), 133-148. <https://doi.org/10.1080/09687769.2010.494718>
- Colomina, B., Choi, E., Galan, I. G., & Meister, A.-M. (2012, 28 September). Radical pedagogies in architectural education. *The Architecture Review*, 28 September.
- 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. <https://doi.org/10.1111/1468-5949.00338>
- Dick, P. K. (1968). *Do androids dream of electric sheep?* (1996 ed.). New York, USA: Ballantine Books.
- International Telecommunication Union. (2011, 16 November). Key Global Telecom Indicators for the World Telecommunication Service Sector. Retrieved 1 June, 2012, from http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html
- Kukulska-Hulme, A. (2010). Mobile learning as a catalyst for change. *Open Learning: The Journal of Open and Distance Learning*, 25(3), 181 - 185. <https://doi.org/10.1080/02680513.2010.511945>
- 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. <https://doi.org/10.4018/978-1-60566-294-7.ch004>
- Mazur, E. (2012). *The scientific approach to teaching: research as a basis for course design*. Paper presented at the Proceedings of ALT-C 2012 - a confrontation with reality: The 19th international conference of the Association for Learning Technology. Retrieved from <http://mazur.harvard.edu/email/download.php?type=t&r=1815>
- 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
- Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. (2002). *The creativity conundrum: A propulsion model of kinds of creative contributions*. Philadelphia: Psychology Press.
- Swantz, M. L. (2008). Participatory Action Research as Practice. In P. Reason & H. Bradbury (Eds.), *The SAGE Handbook of Action Research: Participative Inquiry and Practice* (Second ed., pp. 31- 48). London: SAGE Publications. <https://doi.org/10.4135/9781848607934.n8>
- Withell, A., Cochrane, T., Reay, S., Gaziulusoy, I., & Inder, S. (2012). Augmenting the Design Thinking Studio. In M. Brown (Ed.), *ascilite 2012: Future challenges, sustainable futures* (pp. 1071-1081). Wellington, New Zealand: ascilite
- Yagou, A. (2007). Design Pedagogy. *Designophy*, 2013, from <http://www.designophy.com/designpedia/design-term-100000000-design-pedagogy.htm>

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