

USING AN ADAPTIVE E-LEARNING CURRICULUM TO ENHANCE DIGITAL LITERACY: CHALLENGES AND OPPORTUNITIES

Rhian Morgan*, Sharon Bryan*, Kathryn Meldrum, Bronwyn Mathiesen, Angela Hill.

James Cook University, Australia

Abstract:

Universities have established the need for digital literacies as key graduate outcomes and must support students' development in these areas (Lea, 2013; Littlejohn, Beetham & McGill, 2012). In an era of widening participation, it is erroneous to assume all students will enter the sector with the technological skills required to support their studies. While some may be "skilled technology users", many will lack the digital competencies required for academic success (Jisc, 2014). Students need support for developing digital literacies, but explicit teaching may lead to frustration, as some are forced to "learn" skills they possess, while others are lost in the crowd. Adaptive learning technologies are particularly suited to addressing student diversity, as they automatically adjust to individual student's needs. This paper documents the development of a digital literacies curriculum that uses an adaptive e-Learning platform to prepare students for technology-rich academic environments. The curriculum was co-developed by academics and librarians and consists of lessons on information, data and media literacies, and online identity management. The paper outlines the pedagogical underpinnings of the lessons, alongside the challenges and opportunities observed during development process, and reflects on the impacts of adaptive technologies on teaching in blending learning environments.

Keywords: Digital literacy, adaptive e-Learning, information literacy, smart-sparrow, e-Learning, digital readiness

Introduction

Web 2.0 technologies have become so widespread in modern society that progression through university studies is now increasingly dependent on students developing a range of information and communications technology (ICT) skills alongside the specialist skills associated with their disciplines. Students are expected to have a core level of digital literacy in order to be successful in twenty-first century academic and work environments. However, with widening participation in universities and colleges, it is important to take note of the cautions expressed by the *Educating the Net Generation* report (Kennedy et al., 2009), which warned against an assumption that ‘digital natives’ are entering the higher education sector with extensive existing digital literacies and the capacity to use those literacies to support their academic endeavours. Even students who are highly knowledgeable of ICTs “do not necessarily expect to use these technologies to support some activities, including learning” (Kennedy et al., 2009, p.4). This paper describes the design of a digital literacies curriculum, authored using proprietary adaptive e-Learning software, and outlines the pedagogical, contextual and theoretical background behind the design. The aim of the paper is to discuss the rationale of the project and position it within the context of the relevant literature, before going on to outline an adaptive digital literacies curriculum that was undertaken as a collaborative endeavour between teachers, academic support and library professionals. The project provided the collaborators with several challenges and opportunities for curriculum and pedagogy development, and the lessons learnt will inform future use of adaptive e-Learning.

Digital Literacy and Higher Education

Widening participation in higher education calls for differentiated instruction that responds to the varying levels of technical experience, ability and knowledge our students exhibit – and this is especially relevant to teaching digital literacies. Pedagogical research has ascertained that engagement is a key determinant of success, as well as a means of reducing inequities among diverse cohorts

(Gabb, Milne & Cao, 2006; Kuh, Cruce, Shoup, Kinzie & Gonyea, 2008). Clearly, the provision of equitable digital literacy instruction calls for deliberate curriculum design that acknowledges engagement and differentiated instruction as key elements of academic success.

The US based organisation, EDUCAUSE, offers significant insight into the digital literacies of students in their universities and colleges. In 2015, their annual *Study of Students and IT* surveyed the digital literacy practices of over 50,000 students across 43 states and 11 counties (Dahlstrom, Brooks, Grajek & Reeves, 2015). Key findings of the 2015 student survey included: students' academic use of technology is widespread, but not deep; although omnipresent in students' lives, the leveraging of technology as an engagement tool is still evolving; and students have a complex relationship with technology – they recognise its value but still need guidance in order to use it in meaningful ways (Dahlstrom, et al., 2015).

Universities are increasingly offering multiple modes of education to prospective students. However, to enable students to fully take advantage of flexible learning and distance education, it is important to support the development of digital literacies and online learning skills (Yang, Catterall & Davis, 2013). Benchmarks set by the New Media Consortium and EDUCAUSE Horizon reports (Johnson, Becker & Hall, 2015) acknowledge the importance of training and institutional support for students regarding the effective use of learning technologies. The notion that students require a core level of digital literacy in order to succeed in university is becoming widely accepted, but a definition of what actually constitutes digital literacy – or, rather, digital *literacies* – continues to develop (Kiili, Mäkinen & Coiro, 2013).

The UK based Joint Information Systems Committee ([Jisc], 2011) have adopted a definition of digital literacies as capabilities that support individuals to live, work and learn in a digital society. This definition recognises that digital literacies are multidimensional – incorporating multiple literacies and multiple aspects of literacy. Belshaw (2014), for example, put forward eight elements of

digital literacies: cultural, civic, cognitive, constructive, critical, communicative, confident, and creative. Lankshear and Knobel (2003) had previously identified three dimensions of literacy: operational, cultural and critical. Operational literacies included competency with tools and procedures, while the cultural dimension concerned an individual's ability to understand a text within its cultural context. The critical dimension of this model regarded an individual's awareness that literacies are socially constructed; they include some values while excluding others. It has also been remarked that digital literacies encompass a "plurality of understanding and skills" (Brown, 2014, p. 284), such as information, visual, technological and media literacies (Martin, 2006), hypermedia and photovisual literacies (Aviran & Eshet-Alkalai, 2006) and games literacy (Schott & Selwyn, 2011). Different frameworks and models for supporting students have emerged as investigations into the nature of digital literacies have advanced (Buckingham, 2006; Eshet, 2012; Jisc, 2014; Jisc, 2015a; The Open University, 2015).

The DigEuLit project (Martin, 2006) described a three stage model of digital literacies that include digital competence, digital usage, and digital transformation. These stages describe how students might use their competence, and then transform their use into creating and innovating using digital tools. Belshaw (2014), however, warns that the development of digital literacies is not a linear 'process', but rather subject to contextual variation. Within the UK's higher education context, Jisc have been instrumental in developing a conceptual framework (Jisc, 2015a) that describes the digital literacies necessary for student success. Jisc's six capabilities model of digital literacies (illustrated in figure one) identifies the range of digital literacies that university and college students need to master. These include: ICT literacy; information literacy; data literacy; media literacy; digital learning and self-development; and identity and well-being. These models – particularly the Jisc six capabilities model – were used to form a guiding framework for the development of a suite of adaptive e Learning lessons, which were designed to facilitate the embedding of digital literacies instruction into existing curricula at a university, as outlined below.

Adaptive e-Learning Platforms (AeLPs)

Adaptive e-Learning Platforms (AeLPs) use interactive activities with multiple pathways in order to redirect students to lesson material based on their demonstrated understanding of the content. This enables instructors to provide appropriate remediation as and where necessary, rather than making all of the students progress through lesson content at the same rate. The multiple pathways should also allow for students who have a good grasp of the content to move through the lessons at a more agreeable pace, lessening the potential for frustration at both ends of the spectrum. The interactivity of AeLPs enables a shift away from static (or linear) presentations of information by adapting instruction, learning activities and feedback to the individual needs of the learners. This, ideally, facilitates a holistic learning experience in which active learning, explicit instruction and evaluation combine to enable success among diverse learners (Mampadi, Chen, Ghinea & Chen, 2011; Murray & Pérez, 2015; Wauters, Desmet & Van den Noortgate, 2010). Research indicates that personalised content in online education can improve student performance (Gangadhara Prusty, Vrcelj, McCarthy, Ojeda & Gardener, 2013). With widening participation, institutions need to cater not only to students who are comfortable with using technology in a variety of contexts, but also to younger students who are not necessarily “digital natives”, students from rural/remote areas who might not have had access to a wide range of technologies, or mature age students who may be uncertain about the technologies used for learning (Dawson et. al., 2013). AeLPs enable us to cater to this diverse range of students.

The capacity of AeLPs to respond to the individual needs of students means that such technologies are well-suited to areas such as digital literacies, where students exhibit varying levels of pre-existing ability, and online or blended learning environments where personal engagement with learners is not always possible. This suitability derives from the platforms’ provision of formative feedback in response to individual mistakes and personalised remediation during the learning process, rather than after summative assessment (Edathil, Chin, Zank, Ranmuthugala & Salter, 2014). Three levels of adaptivity were built into the platform used for our digital literacy curriculum:

1. Adaptive feedback, which allows instructors to provide help and address specific misconceptions,

2. Adaptive learning pathways, which provide varying sequences of content to facilitate fast movement through the package where information is known, or remediation where necessary, and
3. Adaptive content authoring, which enable instructors to use analytics to track lessons' outcomes, assess their efficacy, and adjust content and learning pathways accordingly (Smart Sparrow, 2014).

These elements introduce students to processes of independent learning in a structured, but personalised manner, therefore, “helping learners to become self-reliant, confident and able to make judgements about the quality of their own learning” (Nicol, as cited in Jisc, 2010, p.10). As a result, AeLPs are particularly well suited to the provision of instruction for diverse cohorts like the one used in this study.

Institutional and Pedagogical Context

James Cook University (JCU) is a regional university located in Townsville and Cairns in North Queensland, with a third campus located in Singapore. It is a significant provider of higher education in the north east of Australia. A relatively small institution, JCU takes pride in responding actively to the contextual factors associated with its regional location. Regional universities need to be responsive to the access, engagement and outcome needs of their populations – this has been identified as critical to regional development and prosperity (Universities Australia, 2013).

The digital literacies curriculum project documented below was intended to use the capacity of current technologies to enable new types of learning experiences (Laurillard, Oliver, Wasson & Hoppe, 2009), while also effectively responding to the incoming digital literacies of students and developing their preparedness for academic and professional environments. The curriculum is currently being trialled in JCU's Diploma of Higher Education (DHE). The DHE is an open access

course that has attracted a diverse array of students. Students are encouraged to see the course as a 'stepping stone' to Bachelor qualifications. Within the 2016 cohort:

- 12% of students identify as Australian Aboriginal or Torres Strait Islander peoples;
- 63% are the first in their families to attend university;
- 32% are working with English as an additional language;
- 18% are from low socio-economic backgrounds;
- 10% are from regional or remote areas.

At the beginning of semester, students enrolled in the DHE were required to undertake a survey regarding their readiness for using technologies in a university context. Responses to this readiness assessment indicated that 38% of these students were highly anxious regarding online learning and that approximately 42% had no Internet access at home. Anecdotal evidence gleaned from conversations with students, tutors, academic support staff and lecturers suggests that there is also a wide range of engagement and capacity in the digital readiness of students entering other undergraduate degrees offered by JCU.

The DHE is designed to assist students with transitioning into university, and currently uses transition pedagogy to carefully scaffold, mediate and support the student experience (Kift, Nelson & Clark, 2010). Transition pedagogy entails a whole of student/whole of course approach, with curriculum serving as an organising device (Kift, 2009). This approach negotiates the gaps caused by diverse levels of preparedness and cultural capital among incoming students (Kift, 2009). However, its success is dependent on the "intentional design of learning, teaching and assessment approaches that acknowledge the reality of the contemporary student context" (Sheppard & Hill, 2015, p.6). With regard to digital literacy instruction, this acknowledgement involves recognising the potential impacts of socio-economic, cultural, and demographic factors on students' dispositions towards and experiences of information technologies.

Online engagement data from DHE cohorts suggests a preference for content that utilises user-centred design to respond to varying learning styles. Furthermore, student feedback from a core IT subject indicates that low engagement rates could be the result of students ignoring content that seems overly simplistic or, conversely, feeling overwhelmed by content that was overly challenging. While many supporting resources (such as videos and text-based guides) are available to students to assist them with building their digital literacies, these resources are linear in nature. Regarding interactivity, these resources may sometimes test a student's knowledge about a concept, but do not have the capacity to remediate misconceptions. In 2016, the roll-out of the adaptive digital literacies curriculum extended the DHE's model of personalised support by using an adaptive e-Learning platform (AeLP) to provide opportunities for skills development within an online environment that responds to students' diverse levels of preparedness.

An initial roll-out of the adaptive curriculum within the DHE has been trialled over two semesters, so far. The first semester was used as a shakedown for the AeLP, and the lessons learnt from that roll-out of the e-Learning modules were used to refine the product for the second semester. At the time of writing, this semester is still in progress. It is anticipated that what is learnt from this project will provide a contextually specific evidence base for the further development of a whole of institution approach to digital literacy instruction for diverse learners – not only in this university, but in a regional Australian context.

The Australian context is largely missing from the literature regarding digital literacies and curriculum design at present. Projects undertaken in the United Kingdom with Jisc funding have produced a strong evidence-base for the use of online learning platforms for implementing whole of institution approaches to supporting digital literacies. Such approaches offer considerable support to international institutions – especially with regard to their sustainability. The rationale for our project draws heavily from the work undertaken in other countries, acknowledging that the context of Australasian institutions may not be completely analogous to the United Kingdom and Europe.

Throughout the project, the *Educating the Net Generation* report and toolkit (Kennedy et al., 2009) has contributed significantly to our understanding of the digital literacies of students and staff in the Australian context. Kennedy et al. (2009) administered an “experiences with technology” questionnaire to explore student and academic experiences with technology, followed by qualitative data collection. Key findings from the questionnaire indicate that:

- little empirical support exists for the popular conception that university students are digital natives and university staff are digital immigrants;
- student and staff experiences with technology (and their preferences for the use of technology in higher education) varies greatly; and
- the data paints a complex picture of the technological experiences first-year university students bring to higher education (Kennedy et al., 2009, p. 3).

These findings, in conjunction with the institutional context described above, indicate a need for differentiated and personalised digital literacies instruction. This need informed the selection of an AeLP for the digital literacies curriculum described below. The design of the lessons was also informed by principles of authentic and transformative learning.

Authentic learning occurs when task design and the context in which learning occurs reflect the way knowledge is used in the ‘real-world’ (Herrington, Reeves & Oliver, 2010). Didactic (or linear) online instruction can detach information from the context in which it is applied. Here, “knowledge itself is seen by learners as the final product of education rather than a tool to be used dynamically to solve problems” (Herrington & Oliver, 2000, p. 23). In contrast, authentic design integrates context and learning by allowing for practice in knowledge application. Herrington, Reeves and Oliver (2010) identify several characteristics of authentic e-Learning design, including real-world relevance, ill-defined tasks that require problem-solving, and opportunities for engagement from a range of theoretical and practical perspectives. When considering digital literacies, educational designers must attend to the manner in which authentic learning and transformative processes can be incorporated

into procedural instruction. Such integration works best when learning includes reflection on the “procedural assumptions guiding the problem-solving process ... [to] reassess the efficacy of the strategies and tactics used” (Mezirow, 2003, p. 204). AeLPs can facilitate such reflection through the integration of ‘trap states’ that reflect common misconceptions. ‘Trap states’ are points in the interactive activities in which students are redirected back to remediated content if they reveal that they have not gained sufficient understanding. When students are faced with repeating information and exercises, they are given the opportunity to reflect on their previous understanding and choices. With these considerations in mind, a digital literacies curriculum was developed that could provide personalised instruction on the use of technologies for research, assignment preparation, and online identity management among diverse cohorts – particularly for students in non-computer science based disciplines.

An Adaptive Digital literacies Curriculum

The curriculum designed for this project builds on findings from the 2007-2012 Adaptive Mechanics project, which demonstrated that adaptive tutorials (ATs) had the capacity to improve student learning outcomes and comprehension of threshold concepts (Gangadhara Prusty, et. al., 2013). The Adaptive Mechanics project found a positive correlation between the use of ATs, student outcomes and course satisfaction, and also showed reductions in failure rates and significant improvements among low performing students (Gangadhara Prusty, et. al., 2013). Our curriculum builds on these findings and responds to Jisc (2015b) recommendations that institutions provide a “progressive induction process with targeted support for students’ digital needs [in conjunction with] ... diagnostic tests on their digital practices” (Jisc, 2015b, p.2). As the AeLP generates usage analytics, it can also be used “to assess patterns of engagement and likely needs” (Jisc, 2015b, p.3) in an iterative processes of development, roll-out, and refinement.

The curriculum designed for this project consists of three adaptive eLessons, two created in JCU by a team consisting of a lecturer and two librarians, with the third developed by a team based in La Trobe

University, in Melbourne. These lessons were developed in keeping with the Jisc (2015a) six capabilities model of digital literacy (see Figure 1 below). The two lessons developed by JCU follow the narrative of a simulated group project. Creating a ‘story’ for the lessons was intended to provide more interest and coherency and give the students a reason for completing the exercises, much the way the narrative of games gives players a reason for progressing through the game’s challenges. Over the course of the first two lessons, the student user is given the task of directing virtual group members (henceforth referred to non-player characters, or NPCs) through a simulated group assignment. Within the narrative, the student and NPCs are supposedly creating a poster, and must go through a number of activities to prepare for this assignment. Throughout the lessons, two supporting NPCs – a librarian and a lecturer – guide the user through the lesson activities as well as providing feedback and remediation where necessary. Each of the student NPCs within the narrative embodies specific strengths and common misconceptions, offering an opportunity to reflect on different approaches to information and digital literacies. To complete the simulation, the student must negotiate with the NPCs to solve a series of challenges orientated around core digital literacies, such as information, data, and media literacies.

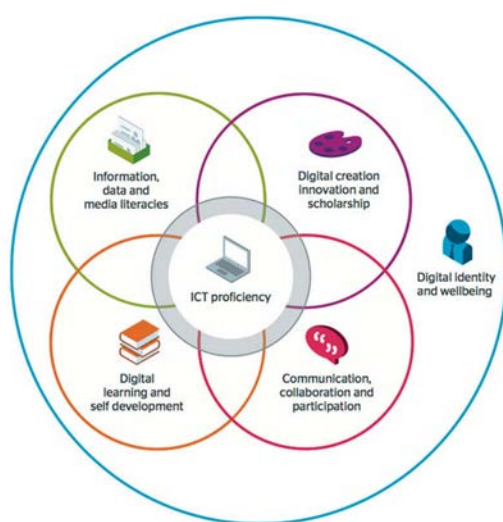


Figure 1: Six capabilities model of digital literacies (Jisc, 2015a).

These activities allowed the curriculum to offer opportunities to integrate transformative process into procedural instruction. For example, the information literacy lesson draws attention to the tendency of

new students to only use Google, as opposed to specialist databases and library collections, to conducting academic research. By allowing students to play out this misconception and experience its consequences in a simulated environment, the lesson directs attention to, and corrects, a habitual information seeking practice of novice researchers. In doing so, the lessons provide students with an opportunity to reflect on and adjust their research practices before engaging with actual assignments. By presenting students with scenarios they will be subsequently confronted with throughout the duration of their studies, the transformative processes prompted by the e-Lessons should help them apply their knowledge in new academic contexts.

The learning environment, tasks and interactions with fellow “students”, may have been simulated, but they nevertheless provided an opportunity to present the learning material in a way that was far more authentic than static and linear training material would have been. In the context of this adaptive digital literacies curriculum, authenticity is engaged by using a narrative that reflects the actual assessment processes that students are confronted with during studies at university. During these lessons students are presented with multiple potential solutions to tasks through interactions with the NPCs. Selecting from a range of solutions requires problem solving and engagement from a variety of perspectives, while adaptive pathways provide opportunities for reflection and diverse outcomes. The faux poster assignment also enables students to gain experience of group work and assignment completion in advance of encountering those situations in reality, and there may be a flow on effect of helping the students think about strategies for dealing with group assignments in the future.

The use of a narrative and adaptive activities with the eLessons was intended to combine authentic learning theory and principles of game design in order to create an immersive (yet pedagogically sound) learning experience. The narrative is presented by the means of branching, context-dependent dialogue; the dialogue, interactions and activities that the student encounters in the course of the lesson are dependent on the activities they have previously completed and the outcomes of those activities. Interactions with NPCs trigger a selection of responses and choices. The students’ choices

then lead to particular branches of the lesson, which guide them through remediation pathways or advanced content, as required. Possible choices are delimited (and limited) by the lesson design, but the range of possible actions is broad enough to allow students to be held accountable for their choices in terms of future actions and feedback. This design consequently reflects Olli Leino's (2012) articulation of Don Idhe's idea that "the computer game [is] a technological artefact which makes players responsible ... for the freedom it endows them with" (p. 59). Fittingly, the learning experience "is not a feature designed into the game alone" (Jørgensen, 2008), but rather emerges from the process of interaction and negotiation between the student and the AeLP, just as it might in gameplay. The way the narrative provides context for the pathways enables the seamless integration of targeted scaffolding and formative feedback within authentic activities that reflect the genuine day-to-day digital literacy requirements of tertiary study.

Each lesson in the suite focusses on a different element of digital literacy. The first lesson introduces the fundamentals of information literacy, which is defined in the Jisc (2015c) model as the ability to find, evaluate, manage, and reference academic content in conjunction with a critical awareness of credibility and provenance. The student is introduced to the NPCs and the faux poster assignment in this lesson, and given the role of project manager. During the course of this lesson, the user guides NPCs through the process of searching for, evaluating, and referencing a range of sources including books, websites and journal articles. This process involves a series of simulations and activities that introduce the student to digital research practices, such as identifying search terms, selecting appropriate search tools and databases, using Boolean operators, and evaluating online resources. In the second lesson, the group members begin to construct their poster. This lesson explores visual, data, and media literacies through activities focussed on interpreting and presenting data, understanding copyright law, recognising file formats, critically evaluating visual media, and creating visual representations of academic content. The third lesson (developed by La Trobe University) sits outside of this narrative, and provides an introduction to online identity management - including the

processes of creating and maintaining digital profiles for career development. This last lesson addresses the aspect of digital literacy Jisc (2015c) defines as digital identity and well-being.

The activities in the lessons use common, simple input mechanisms such as multiple choice questions, drag and drop interfaces, text input tools, hotspot activities, and dropdown menus – primarily because the proprietary software used for this project tended to utilise these types of activities. It should be noted that the software chosen for the design of these lessons influenced the design both by virtue of its capabilities and because of the advice and support given by the educational designers working for that company. Had we used different software, the activities may have taken a different form. From a user perspective, the narrative should have made the activities seem less like a series of disjointed tasks, but rather meaningful activities within a context. On one level, the student was asked to simply select from a range of answers presented in a quiz format, but the narrative elevated the activity to one where the student responded to scenarios that reflected the realities of tertiary study in digital environments. Multiple choice activities are camouflaged within branching dialogue, and the adaptive platform means that users are able to experience the consequences of choices – for example, selecting to use Google rather than a university database for conducting research. This offers a process of learning by (simulated) doing, and draws on a multimedia design philosophy that engages:

- Simulated interactions, in which the learner is integrated into the narrative;
- Construct interactions, in which the learner produces content through on screen actions;
- Immediacy, so that the learner experiences the events triggered by their own actions/interactions;
- Feedback, in which the learner sees instantaneous responses from the platform;
- Goals, so that the learner is provided with a clear understanding of lesson objectives.

(Tan, Ling & Ting, 2007)

This learning by doing model has been shown to boost engagement and motivation by facilitating practice in problem solving and self-evaluation (Tan, Ling & Ting, 2007). However, when regarding

the context of role-playing lessons, designers also need to attend to the believability the narrative in order to promote immersion. In the context of our AeLP, narrative believability is closely related to principles of authentic design and processes of transformative learning. However, we are under no illusions that our delivery of that narrative enabled complete immersion by students. We were constrained by the technology available to us, as well as our own skills in the design and development of AeLPs and game-like environments.

Challenges, Opportunities and Reflections

This project, in its entirety, involved collaboration between academics, librarians and educational designers across two universities and an external company. This provided us with the opportunity to share knowledge and skills that enriched not only the final product, but also our working relationships. Each of the three lessons was designed by the group of professionals with the most teaching experience in that area. This resulted in a product that was significantly better than anything that would have been produced by any one group working alone. In working collaboratively, we also had the opportunity to learn from each other's expertise and gain different perspectives on the content of the lessons we were creating. The process of co-development enabled lecturers and librarians to pool our collective experiences with regards to the misconceptions and digital learning challenges that students face when working with learning and information technologies. The development of authentic trap states and remediation pathways also required conscious reflection on the implicit expectations that are placed on incoming students in technology-rich university environments. The array of experiences that people brought to the project also meant that team members were not only co-writers, but also a ready-made audience for testing activities and lesson content.

This method of collaboration was not, however, without its share of challenges. Possibly the greatest challenge we faced involved our collaboration with the educational designers working for the third party software providers. Working at a distance, and with large periods of time between meetings, we found it difficult to fully convey what we wanted from the product and we frequently felt that we

were not getting as much support, direction and understanding from the software providers as we would have liked. This was compounded by the fact that most of what we wanted to do with the software was not within our control; we had to ask the designers to create something for us, which, under different circumstances and using a different product, we might have been able to create for ourselves. On reflection, and in terms of creative freedom and self-direction, it may have been better to have used a more open source product and have been given training in how to create reusable learning objects using that platform. However, with regards the scalability of the project and expansion of the use of AeLPs within the university, an open source product would potentially shift the onus of providing technical and design support back towards institutional IT staff.

Tensions between the technical/design constraints imposed by proprietary platforms and concerns regarding resourcing for technical support and training in relation open source solutions are well documented (van Rooij, 2007). In relation to AeLPs, the simplified user interface provided by proprietary software lowers entry barriers for academics, but only when instructors are provided with sufficient training in independent lesson development. The incorporation of technical support into vendor licences also enables universities to outsource some of the risks associated with the early adoption of new technologies. However, costs and the inflexibility of commercial software licences impose usage constraints and raises concerns regarding the sustainability of third-party licencing agreements. With regard to open source educational software, the presence of established communities of users and specialised in-house IT support have been shown to mitigate institutional concerns regarding the viability of open sources educational platforms (van Rooij, 2007). However, the development of custom designed open source adaptive learning environments and the establishment of specialised user communities is still in its infancy. As such, and with regard to the use of open source adaptive learning solutions at an institutional level, “[t]he threshold that enables perceived benefits to outweigh perceived risks” (van Rooij, 2007, p.442) has not yet been reached.

In terms of curriculum evaluation the analytics built into the AeLP have enabled us to monitor student engagement, while initial anecdotal feedback from students and results monitoring has informed preliminary appraisals of the curriculum. The lessons were integrated into an existing subject, replacing a series of multiple choice quizzes that had previously been used for assessment purposes. Completion of the adaptive curriculum constituted 15% of students' overall subject grade and the lessons were integrated into the subject's learning management system. The lesson completion rate (90 - 95%) was on par with – and, in some instances, marginally higher than – the completion rates for the previous quizzes (90%). Following the initial roll-out, the lessons appear to have contributed to improved results and submission rates on later student assignments. For example, the number of distinctions (grades of 75% or higher) awarded for the research component of a later presentation assignment increased by 13.7%, among students from the participating cohort located on the Townsville campus. Submission rates for the same assignment rose by 6.8% within the same cohort. However, these improvements in assignment results and engagement were not consistent across the four campuses on which the lessons were trialed, and it is not yet possible to establish a direct causal link between assessment results and lesson completion. Further analyses of cross-campus subject results and lesson engagement data from the second semester roll-out (currently underway), in conjunction with follow-up surveys among participating students, will inform fuller assessments of the efficacy of AeLPs in relation to digital literacy instruction.

Overall, the project provided team members with the opportunity to explore and document the process of moving from pedagogical theory and a conceptual framework to a workable curriculum design. The adaptive nature of the platform and authentic design considerations required team members to map out possible misconceptions and the implicit technological requirements of tertiary study. The collaborative design processes provided team members with valuable insight into each other's working environments, enabling us to pool expertise from the fields of both library and information science and game design. In addition, the project illuminated tensions associated with the selection and development of sustainable e-Learning solutions that will support student engagement and

instructional design needs, while concurrently meeting institutional costing and IT support requirements.

Conclusions

The move towards blended and online learning environments necessitates a base level of digital literacy among students. Yet, within the widening participation agenda, we must remain mindful of the different needs of diverse learners and the pressures these needs place on educators to provide differentiated instruction to students with varying levels of expertise. Adaptive learning technologies enable educators to respond to these challenges and provide personalised instruction to large cohorts of diverse learners, particularly in areas such as digital literacy where students may have vastly different pre-existing skillsets. In terms of teaching and learning, AeLPs enable a shift away from didactic or linear online instruction. However, in doing so, the development of adaptive lessons necessitates a design process that moves past the development of learning objectives and presentation of content, and towards a consideration of potential misconceptions and implicit assumptions, in conjunction with the development of variety of lesson pathways that enable fast movement through known content and remediation where necessary. The simulated environments that AeLPs provide also enable the development of authentic learning opportunities – but only when lesson design is informed by considerations of the contexts in which knowledge is to be applied. The digital literacies curriculum described above demonstrates how educational theories such as transition pedagogy, authentic design, and transformative learning can work in conjunction with aspects of game design (such as branching dialogue and multimedia design) to produce immersive personalised learning experiences.

An effective transition pedagogy requires instructional design that carefully scaffolds, mediates, and supports the student experience (Kift, Nelson & Clark, 2010). The digital literacies curriculum described in this paper exemplifies this pedagogy through the provision of an orientation tool that scaffolds and supports students' entry into the online university environment. Initial evaluations of the

lessons points towards heightened engagement and improved student results, but further research is necessary in order to determine the efficacy of the lessons in regard to enhancing students' digital literacies. Considerations of sustainability, technical training requirements for both IT and teaching staff and a desire for control and flexibility with regards to lesson design will inform future decisions about the use of either proprietary or open source software. However, as communities of practice develop around open source adaptive learning solutions it is expected that perceived barriers to entry at an institutional level may be reduced. The curriculum development process described in this paper demonstrates not only the suitability of adaptive learning technologies for digital literacies instruction, but also the manner in which collaborative design can inform the development of authentic online learning experiences that respond to the needs of diverse learners.

References

- Aviram, A. & Eshet-Alkalai, Y. (2006). Towards a theory of digital literacy: Three scenarios for the next steps. *European Journal of Open, Distance and E-Learning*, 2006(1), 1-11.
- Belshaw, D. (2014). The essential elements of digital literacies. Retrieved from <http://doughbelshaw.com/ebooks/digilit/>
- Brown, S. A. (2014). Conceptualizing digital literacies and digital ethics for sustainability education. *International Journal of Sustainability in Higher Education*, 15(3), 280-290.
doi:10.1108/ijshe-08-2012-0078
- Buckingham, D. (2006). Defining digital literacy. What do young people need to know about digital media? *Nordic Journal of Digital Literacy*, 1(4), 263 - 276.
- Dahlstrom, E., Brooks, D. C., Grajek, S., & Reeves, J. (2015) *ECAR study of students and information technology, 2015*. Louisville, KY: ECAR.
- Dawson, P. Charman, K., & Kilpatrick, S. (2013). The new higher education reality: What is an appropriate model to address the widening participation agenda? *Higher Education Research & Development*, 32(5), 706-721. doi: 10.1080/07294360.2013.776520

- Eshet, Y. (2012). Thinking in the digital era: A revised model for digital literacy. *Issues in Informing Science & Information Technology*, 9(2), 267- 276.
- Edathil, S., Chin, C. K. H., Zank, S., Ranmuthugala, D., & Salter, S. (2014). Development of an application with process feedback to enhance student-centred learning. In B. Hegarty, J. McDonald & S.K. Loke (Eds.), *Rhetoric and reality: Critical perspectives on educational technology* (pp. 394-398). Dunedin, Ireland: Ascilite.
- Gabb, R., Milne, L., & Cao, L. (2006). Understanding attrition and improving transition. Retrieved from <http://learningandteaching.vu.edu.au/>
- Gangadhara Prusty, B., Vrcelj, Z., McCarthy, T., Ojeda, R., & Gardner, A. (2013). *An adaptive e-Learning community of practice for mechanics courses in engineering: Final report*. Retrieved from <http://adaptive-mechanics.eng.unsw.edu.au/wp-content/uploads/2013/08/CG10-1586-final-report-published.pdf>
- Herrington, J. & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, 48(3), 23-48.
doi:10.1007/BF02319856
- Herrington, J. Reeves, T.C., & Oliver, R. (2010). *A guide to authentic e-Learning*. New York, NY: Routledge.
- Jisc. (2010). *Effective assessment in a digital age: A guide to technology-enhanced assessment and feedback*. Retrieved from http://www.webarchive.org.uk/wayback/archive/20140614115719/http://www.jisc.ac.uk/media/documents/programmes/elearning/digiassass_eada.pdf
- Jisc. (2011). ALT: Developing digital literacies. Retrieved from <http://www.webarchive.org.uk/wayback/archive/2014061400244/http://www.jisc.ac.uk/whatwedo/programmes/elearning/developingdigitalliteracies/alt.aspx>
- Jisc. (2014). *Quick guide - developing students; digital literacy*. Retrieved from http://digitalcapability.jiscinvolve.org/wp/files/2014/09/JISC_REPORT_Digital_Literacies_280714_PRINT.pdf

- Jisc. (2015a). Building digital capability: Building capability for new digital leadership, pedagogy and efficiency. Retrieved from <https://www.jisc.ac.uk/rd/projects/building-digital-capability>
- Jisc. (2015b). *JISC-NUS benchmarking tool - the student digital experience*. Retrieved from http://repository.jisc.ac.uk/6140/1/Jisc_NUS_student_experience_benchmarking_tool.pdf
- Jisc. (2015c). *Digital capabilities: The 6 elements defined*. Retrieved from <http://digitalcapability.jiscinvolve.org/wp/files/2015/06/1.-Digital-capabilities-6-elements.pdf>
- Johnson, L., Becker, S. A., & Hall, C. (2015). *2015 NMC technology outlook for Australian tertiary education: A horizon project regional report*. Retrieved from <http://cdn.nmc.org/media/2015-nmc-technology-outlook-australian-tertiary-education.pdf>
- Jørgensen, K. (2008). Audio and gameplay: An analysis of PvP battlegrounds in World of Warcraft. *Game Studies*, 8(2). Retrieved from <http://gamestudies.org/0802/articles/jorgensen>
- Kennedy, G., Krause, K.-I., Gray, K., Judd, T., Bennett, S., Dalgarno, B., ... Churchward, A. (2009). *Educating the Net generation: A handbook of findings for practice and policy*. Retrieved from <http://www.netgen.unimelb.edu.au>
- Kift, S. (2009). Articulating a transition pedagogy to scaffold and to enhance the first year learning experience in Australian higher education. Retrieved from <http://www.olt.gov.au/resource-first-year-learning-experience-kift-2009>
- Kift, S. Nelson, K. J., & Clarke, J. A. (2010). Transition pedagogy: A third generation approach to FYE: a case study of policy and practice for the higher education sector. *The International Journal of the First Year in Higher Education*, 1(1) 1-20.
- Kiili, C., Mäkinen, M., & Coiro, J. (2013). Rethinking academic literacies. *Journal of Adolescent and Adult Literacy*, 57(3), 223-232. doi:10.1002/JAAL.223
- Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., & Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *Journal of Higher Education*, 79(5), 540-563.
- Lankshear, C. & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Buckingham, England: Open University Press.

- Laurillard, D., Oliver, M., Wasson, B., & Hoppe, U. (2009). Implementing technology-enhanced learning. In N. Balacheff, S. Ludvigsen, T. de Jong, A. Lazonder & S. Barnes (Eds.), *Technology-enhanced learning: Principles and products* (pp 289-306). Dordrecht, Germany: Springer.
- Lea, M. R. (2013). Reclaiming literacies: Competing textual practices in a digital higher education. *Teaching in Higher Education*, 18(1), 106-118. doi:10.1080/13562517.2012.756465
- Leino, O. T. (2012). Untangling gameplay: An account of experience, activity and materiality within computer game play. In J. R. Sageng, H. Fossheim & T. M. Larsen (Eds.), *The philosophy of computer games*, (pp 57-76). Dordrecht, Germany: Springer.
- Littlejohn, A., Beetham, H., & McGill, L. (2012). Learning at the digital frontier: A review of digital literacies in theory and practice. *Journal of Computer Assisted Learning*, 28(6), 547-556. doi:10.1111/j.1365-2729.2011.00474.x
- Mampadi, F. Chen, S. Y. Ghinea, G., & Chen, M. P. (2011). Design of adaptive hypermedia learning systems: A cognitive style approach. *Computers & Education*, 56(4), 1003-1011. doi:10.1016/j.compedu.2010.11.018
- Martin, A. (2006). Literacies for the digital age. In A. Martin & D. Madigan (Eds.), *Digital literacies for learning* (pp. 3-25). London, England: Facet.
- Mezirow, J. (2003). How critical reflection triggers transformative learning. In P. Jarvis (Ed.), *Adult and continuing education: Major themes in education* (pp. 199-214). New York, NY: Routledge.
- Murray, M. C., & Pérez, J. (2015). Informing and performing: A study comparing adaptive learning to traditional learning. *Informing Science*, 18(1), 111-125.
- Schott, F., & Selwyn, N. (2011). Game literacy: Assessing its value for both classification and public perceptions of games in a New Zealand context. In P. Felicia (Ed.), *Handbook of research on improving learning and motivation through educational games: Multidisciplinary approaches* (Vol. 1, pp. 176-191). Hershey, PA: Information Science Reference.

- Sheppard, K. & Hill, A. (2015, October). *Pathways to university: Intentional curriculum and student support mechanisms and some tentative tales of success*. Paper presented at Global Access to Post-Secondary Education Conference, Kuala Lumpur, Malaysia.
- Smart Sparrow. (2014). Our learning design platform. Retrieved from <https://www.smartsparrow.com/platform/>
- Tan, P. Ling, S., & Ting, C. (2007, September). *Adaptive digital game-based learning framework*. Paper presented at the 2nd International Conference on Digital Interactive Media in Entertainment and Arts, Perth, Australia.
- The Open University. (2015). Digital and information literacy framework. Retrieved from <http://www.open.ac.uk/libraryservices/pages/dilframework/index>
- Universities Australia, (2013). An agenda for Australian higher education 2013-2016. Retrieved from <http://www.universitiesaustralia.edu.au>
- van Rooij, S. W. (2007). Perceptions of open source versus commercial software: Is higher education still on the fence? *Journal of Research on Technology in Education*, 39(4), 433-453.
doi:10.1080/15391523.2007.10782491
- Wauters, K. Desmet, P., & Van den Noortgate, W. (2010). Adaptive item-based learning environments based on the item response theory: Possibilities and challenges. *Journal of Computer Assisted Learning*, 26(6), 549-562. doi:10.1111/j.1365-2729.2010.00368
- Yang, D. F. Catterall, J., & Davis, J. (2013). Supporting new students from vocational education and training: Finding a reusable solution to address recurring difficulties in eLearning. *Australasian Journal of Educational Technology*, 29(5), 640 - 650.