Engaging students in the use of technologies for assessment within Personal Learning Environments (PLEs): The development of a framework

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Higher education students use a wide range of information and communication technologies for personal and study purposes, collectively known as a Personal Learning Environment (PLE). The ways in which students use technologies to prepare and complete assessment tasks, however, has not been researched as much as their general use of technology. This paper reports on the process adopted to develop a research-informed framework to engage higher education students in the use and evaluation of technologies for assessment purposes within their PLEs. The method used to construct the framework is presented alongside recommendations for how the framework may be used by lecturers and students.

Keywords: framework, assessment, self-assessment, Personal Learning Environments (PLEs)

Introduction

Unlike students in previous generations, millennials rely upon an ever-expanding collection of technologies to learn. The technologies used by these students have been identified (Conradie, 2014; Gosper, Malfroy, & McKenzie, 2013; Gosper, McKenzie, Pizzica, Malfroy, & Ashford-Rowe, 2014; Johnson & Sherlock, 2014). As technological advances continue to infiltrate teaching and learning practices in the higher education sector, the speed with which this happens does not always allow for considered reflection on how these technologies impact students' learning experiences. Because of the impact of assessment upon the learning process, it is important to understand how students use technology to complete assessment tasks. Although some research has recently been conducted into the specific technologies used by students to prepare and submit assessment tasks which constitute the required components of undergraduate and postgraduate courses (Lounsbury, Mildenhall, Bolton, Northcote, & Anderson, 2015), more research is needed. This paper continues the previous research, outlining the development of a framework to engage higher education lecturers and students in the use of *and* evaluation of technologies for assessment purposes within students' Personal Learning Environments (PLEs).

Background

Personal learning environments

Higher education students' use of technologies, within their personal learning environments (PLEs) impacts their learning and study practices which, in turn, influences how they use technology to prepare, complete and submit assessment tasks. Personal learning environments (PLEs) are defined as "all the different tools we use in our everyday life for learning" (Attwell, 2007, p. 4), These tools can include "feeds for collecting resources and other data; conduits for sharing and publishing; services for interacting with organisations; personal information management; and ambiguity of teacher-learner role" (Milligan et al., 2006, p. 509). Although PLEs may consist of a variety of electronic or even non-electronic tools, social media plays a central role in most discussions about PLEs (Attwell, 2007). Social media are capable of bringing learners into educational relationships with others by helping them identify networks of people, content and services which may be used to enhance their learning (Attwell, 2007; Cochrane & Withell, 2013; Wang, Niiya, Mark, Reich, & Warschauer, 2015). These networks have the potential to address the learner's changing needs and learning goals, rather than requiring the learner to adapt to a learning system (Attwell, 2007).

As well as showing how learners use technology in individual and social settings, Dabbagh and Kitsantas (2012) highlight how PLEs support learners' abilities to "aggregate and share the results of learning achievement, participate in collective knowledge generation, and manage their own meaning making" (p. 1). As students develop their capacity to learn with technology in formal educational settings, they refine their skills both in the selection and use of the technologies that can be applied as lifelong learning skills in professional settings.

Formal and Informal Learning

Personal learning environments are a "potentially promising pedagogical approach for both integrating formal and informal learning" (Dabbagh & Kitsantas, 2012, p. 2). Formal learning often occurs in artificial, non-authentic settings (e.g., classrooms), and is tied to educational goals which are defined by someone other than the learner. Informal learning, on the other hand, often occurs spontaneously outside formal settings, and is typically learner driven (Le Clus, 2011; Marsick, Volpe, & Watkins, 1999). Lounsbury et al. (2015) report that when different technologies are used side-by-side in students' PLEs, the distinction between formal and informal learning become less noticeable. The use of PLEs has the potential to bring these two types of learning together (Dabbagh & Kitsantas, 2012; Melo Filho, Carvalho, Tavares, & Gomes, 2014) and to reduce the need for the instructional walls of the learning management system (LMS) (Hustad & Arntzen, 2013; Sclater, 2008; Stantchev, Colomo-Palacios, Soto-Acosta, & Misra, 2014; Weaver, Spratt, & Sid Nair, 2008).

The importance of assessment

Biggs (2003) and Cohen (1987) demonstrate the importance of alignment between instruction and assessment in increasing achievement. Performance on assessment is related to how students approach studying (Marton & Säljö, 1976; Rossum & Schenk, 1984; Van Rossum, Deijkers, & Hamer, 1985). The study of technology-laden PLEs has the potential to further this research into the relationship between assessment and study practices. As this paper is focusing on assessment within the higher education context is important to note that James, McInnis and Devlin (2002) assert that assessment is central to higher education learning. It is therefore logical that assessment will be central to the creation of the PLE in the tertiary context. The authors have noted a lack of research on the role of assessment in tertiary students PLES (2015) and therefore it is important and timely that there is a research focus on this area. Through undertaking this research there is the potential to gain a cohesive understanding into the relationship between assessment and study practices in higher education.

Need for a flexible, dynamic learning environment

Wilson, Liber, Johnson, Beauvoir and Sharples (2007) emphasise that an educational system should focus on "coordinating connections between the user and a wide range of services offered by organisations and other individuals" (p. 32). Academic teaching staff must now focus on teaching within this environment rather than over-relying on the typical LMS environment which, as mentioned above, tends to foster a static learning environment. However, promoting and supporting students to operate within their own PLE may bring new pedagogical challenges. For example, students frequently wish to incorporate Web 2.0 technologies into their higher education learning, including web-based tools, environments and services (Margaryan, Littlejohn, & Vojt, 2011). Students need technological and pedagogical support if they are required to access this broad range of technologies and use them with skillful application in their university studies.

A Personal Learning Environment framework

When supporting students in selecting technologies, which form the students' PLE, academic staff require support to instruct students on how to use these technologies in individual and collaborative learning spaces. The purpose of a framework, such as the framework outlined in this paper is to "support teachers in the delivery of high quality teaching and learning that will improve the students' ability to learn and understand the material that they are being taught", provide "a structure around the philosophy of teaching and learning" (McGuire College, 2014, p. 2), and give guidance to faculty staff regarding research-based, best practices in providing the most effective educational experience (McGuire College, 2014). Heibert (2006) created such a framework for describing students' PLEs. In the framework he outlined how students operate and participate within a social network. He identified how self-directing learning tools can serve as the connection between the learning process (i.e., reflecting or collecting) and the participation in learning (i.e., "what you are learning or what are you doing" (2006, para.1).

Dabbagh and Kitsantas (2012) explored how to engage teaching staff in the support of students' use of technologies for learning purposes in their PLEs. The framework consisted of three levels of interaction with social media: (1) personal information management, (2) social interaction and collaboration, and (3) information and management (p. 5). Their framework is useful for considering how the teachers' pedagogy may change so they can support student learning within a PLE. The framework drew on Zimmerman's (2002) work on self-regulation which sees the student become increasingly able to monitor their own learning progress while selecting appropriate technologies to complete their learning tasks. Thus, by helping academic teaching staff understand how students use technology, pedagogical frameworks can guide the design of effective instruction. By encouraging students to create their own PLEs, rather than relying on passively receiving information within teacher-designed educational systems (Wilson et al., 2007), learners can be supported to be more actively involved and metacognitively aware about their own learning processes (Melo Filho et al., 2014). Recent research has confirmed the benefits of engaging in metacognitive activities (Chick, Karis, & Kernahan, 2009; Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014).

Level 3 of Dabbagh and Kitsantas' framework (2012), involves the use of technology to enhance metacognitive skills. Students can metaphorically 'stand back' and understand how the different technologies have contributed to their learning as an effective learner. In this dynamic process, sophisticated users of PLEs are aware of what technologies they are using and how effective they are for their learning. This cyclical process incorporates increasing levels of interactivity enabled through social media.

Phase 1 of the research study

Phase 1 of the current research study was conducted in 2015 and focused on approximately 100 university students' use of specific technologies within their Personal Learning Environments (PLEs) (Lounsbury et al., 2015). The first phase of the study was designed to discover the technologies and devices being used by students for university assessment tasks. Two Australian higher education institutions were involved in Phase 1 of the study: Edith Cowan University (ECU) in Western Australia and Avondale College of Higher Education in New South Wales. The ECU students who responded to the survey and participated in the focus groups were drawn from two urban campuses. The majority of these students were in the second or third year of their degrees. All of the students in the study were enrolled as on-campus students.

During the first phase of the study, students were invited to complete an online survey in which they were asked demographic questions as well as questions which asked them to identify the most common types of hard and soft technologies they used to prepare for their college and university assessment tasks. In all, 39 students completed the survey, 24 from Edith Cowan University and 15 From Avondale. They were required to list the online sites or technologies they used. Students were also presented with a selection of technologies (e.g., websites, online communication methods, search tools) and were asked to rate the frequency with which they used these technologies for the purposes of completing assessment tasks.

After the completion of the surveys, small focus groups of students in each institution were questioned more deeply about how they used technologies for assessment preparation and completion. Of the nine students who participated in the focus groups, 5 were from Edith Cowan University and four were from Avondale. The focus group participants were asked to comment on the importance of mobility in technology as well as to draw a graphical representation of their own PLE. Students then labelled these drawings and identified relationships between the technologies they drew as part of their PLE.

The data from the surveys were analysed by calculating frequencies and descriptive statistics. This analysis provided the study with demographic details as well as specific responses to the questions posed to students about PLEs. Frequencies were obtained for the questioned categories and specific responses grouped together. Once this was completed, conclusions could be drawn about the technologies or sites that the students used or did not use. The overall response data were summarised and the frequencies were tabulated and means calculated to provide specific information about each category. Data from the focus groups were analysed slightly differently. Transcripts were made of the discussions and were then reviewed to determine trends in the use of technologies and devices by the students as well as their perceptions about how their peers used technologies and devices. The transcripts were analysed using NVivo and the frequency of devices and technologies used was calculated. The information was broken down into categories to enable commonalities among the data to be easily determined. Likewise, the mapping exercises completed by the students in the focus groups were analysed to identify the technologies being used, and not being used, by the students when completing assessment tasks, as well as the connections between the technologies.

The results of the survey were compared with those of the focus group analyses to determine credibility and establish whether or not the findings between the two data sets were consistent. This comparison made it possible to establish links between the data sets and gave an overall picture of the technologies used for assessment purposes within the students' PLEs. The results showed that students definitely preferred technologies that were portable and available across variable hard technologies and their primary concerns were for freely available connectivity, particularly in the form of power-outlets and Wi-Fi. When it came to soft technologies, students were most likely to use online library databases and search engines, and they appreciated technologies that allowed them to share ideas in the process of preparing assessment tasks. Interactivity was important to the students, along with flexibility, though innovation was not, and students were less likely to use new technologies that came with a "steep learning curve", particularly when they were planning and executing assessment tasks.

Overall, the findings from the first phase of the research project suggested that the students who participated in Phase 1 of the study were conservative in their technological choices when it comes to the preparation and completion of assessment tasks. They appeared to be less reliant on the institution's hardware (e.g., printers and desktops) and software (such as the institution's LMS). Furthermore, the students appeared to be more independent and device-wise than in the past. They appeared to be less likely to try new technologies when working on an assessment task and were primarily concerned with Wi-Fi connectivity and freedom to study in any location. The findings from Phase 1 of the study allowed the researchers to develop a deep understanding of students' PLEs and how educators may be able to interact with and guide students' choices to create a broader PLE for assessment purposes.

Phase 2 of the research study

Phase 2 of the research study began in 2016, immediately after Phase 1 of the study. In Phase 2, the researchers focused on creating and producing a pedagogical framework that was beneficial for both teachers and students by providing guidance about the use of technology for assessment purposes. The PLE Framework for Assessment, was developed as an instructional tool for use by university lecturers who are interested in integrating technology in a meaningful way into their courses, through their students' use of technologies for assessment purposes. The content, intentions and structure of the Framework was informed by the findings of Phase 1 of the study (Lounsbury et al., 2015). The Framework that was developed in Phase 2 is intended to provide guidance on how to engage students in the use of self-regulating and self-evaluating practices in their selection of appropriate online and offline technologies to use within their PLEs. As such, it is anticipated that the Framework could be used to guide teachers in the design and teaching of courses, as well guiding teachers in how to give advice to students about using technology to complete assessment tasks. The Framework may also guide students in the use of technologies in self-regulated ways in order to produce assessments more efficiently. The development of the Framework was guided by the following foundational understandings:

> **Use and application of a PLE.** A PLE is a self-constructed collection of technologies which a learner selects and uses for a particular purpose, usually related to activities associated with learning or studying. Furthermore, for assessment purposes, university students typically use a range of formal (e.g., technologies made available by the institution) and informal technologies (e.g., social media). Modelling the use of technologies within PLEs by the lecturer may facilitate students' use of appropriate technologies in their learning, studying and/or assessment practices.

Assessment. In the context of this study, an assessment task is defined as an assigned activity, project, examination or task that students are required to complete for the purpose of demonstrating their learning within a university course. Assessment tasks are typically allocated grades, marks or scores which form the basis of the student's university qualifications. Examples of assessment tasks include essays, tutorial presentations, end-of-semester examinations and digital portfolios.

Learning contexts and PLEs. Learning can take place within a community of practice by a group of learners or at an individual level. Some technologies enhance collaboration and communication, while others facilitate independent activities and promote reflection by individuals. PLEs provide opportunities for collaborative knowledge generation and self-management of information for meaning-making purposes. The self-constructed nature of PLEs encourage students to engage in self-regulated learning practices, involving the self-selection of technologies that facilitate collaborative *and* individual learning strategies, to manage and aggregate information. Students ideally aggregate information about the process of completing assessment tasks and the content or topics associated with an assessment task. The purpose of information aggregation and management is synthesis. By encouraging students to develop their own PLEs, the learning context can assist students to self-evaluate their use of technologies for learning, studying and assessment purposes. The completed assessment task can be viewed as a product of a student's use of technologies within their PLE. Use of various and appropriate self-selected technologies may provide students with opportunities to develop and practise their learning independence as well as their ability to learn collaboratively.

The structure of the Framework outlined in this paper (see Figure 1: PLE Framework for Assessment) has built upon the work by Dabbagh and Kitsantas (2012) who devised three levels of social media use to support self-regulated learning in PLEs: 1) Personal information management; 2) social interaction and collaboration; and 3) Information aggregation and management. We have added a fourth dimension to their framework (i.e., Stage 4, Assessment output) and have reworded the explanations for the previous three dimensions in terms of assessment. The examples of the technologies in our PLE Framework for Assessment were provided by the student-participants from whom we gathered data throughout the previous phases of the project.

The future: Phase 3 of the study

The next phase of the study will involve capturing students' real time use of technologies in their completion of assessment tasks through the use of a program called *ManicTime*. *ManicTime* is known as "personal time management software" for logging and tracking work hours (Mininday, 2009). Student-participants across three higher education institutions will be given a free copy of the software, along with instructions that explain how the software would record the date, time, duration, and type of computer programs used as well as the date, time, and duration of the websites they visited over the semester period of the data collection phase of the study. To broaden the reach of the study, the student cohorts that are targeted for Phase 3 of the study will be different from and larger than the cohorts accessed during earlier phases of the study. *ManicTime* has the ability to incorporate data from cloud storage into analytics for data analysis processes and resides in the background of the computer reducing its intrusion on users' normal computer use. It does not record the content of programs or websites. The data collection is thus not reliant on students keeping records, and consequently, has the potential to yield more accurate information than could be gained from data gathering techniques that rely on self-reported data such as asking students about their computer usage. In these ways, the computer activity data captured from the software will provide an accurate reflection of the participants' *actual* practices in comparison to their *reported* practices as presented previously. By capturing data about students' actual practices in using technologies for assessment purposes, the findings of this ongoing study have the potential to contribute further to our existing framework. Furthermore, during Phase 3 and other future stages of the study, the researchers will investigate how academic teaching staff make use of the PLE Framework for Assessment and how their use subsequently impacts on the students' use of technologies. It is anticipated that this next phase of the study will take place in 2017 and will continue across two semesters.

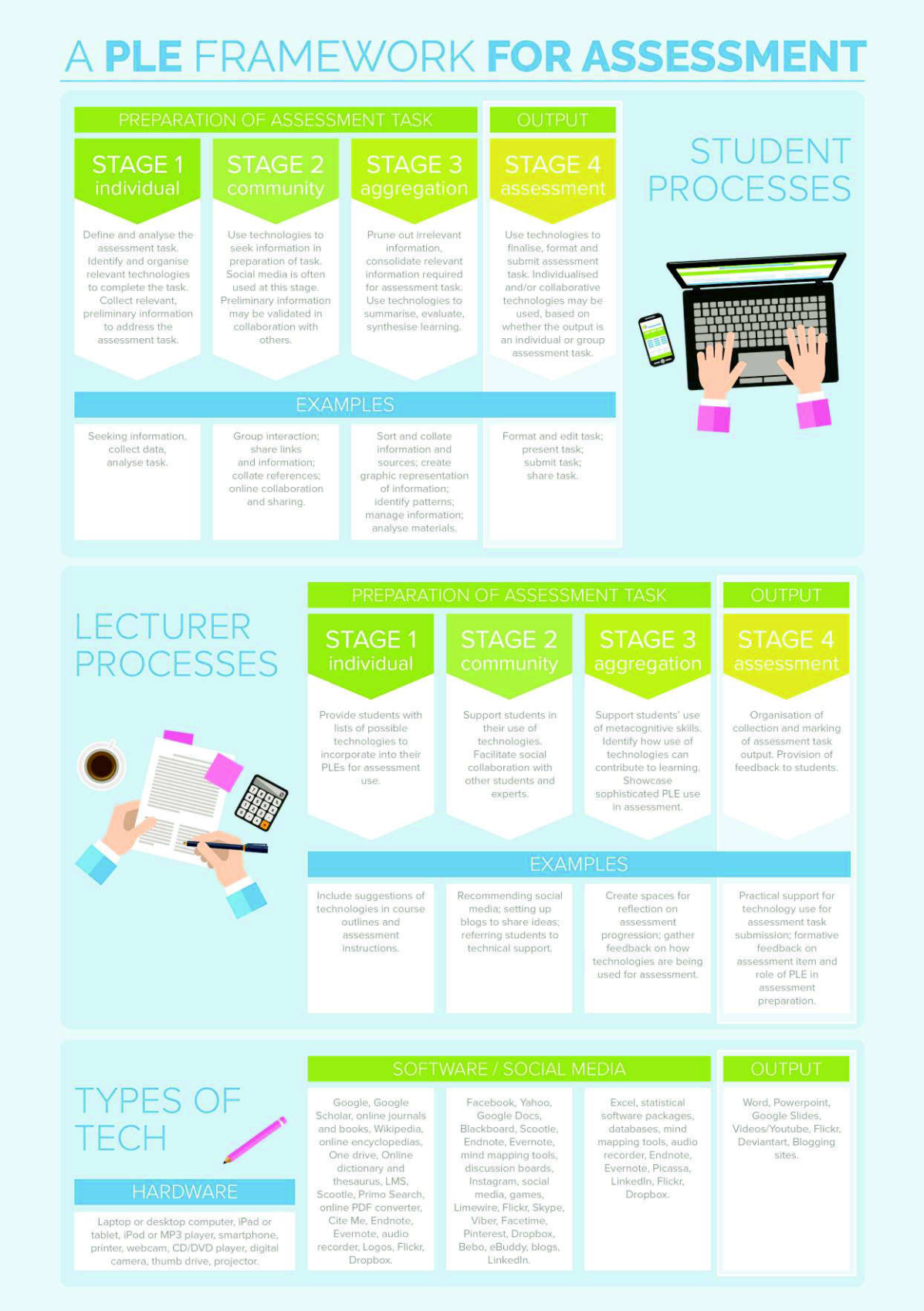


Figure 1: PLE Framework for Assessment[4]

[4] Graphic design work by David A. Page. www.david-page.com

Discussion

The PLE Framework for Assessment is based upon the idea that learning does not just take place in the classroom; it has been developed to extend instruction and foster an interest in the subject matter beyond the traditional on-campus learning contexts: “Activities that students engage in by choice outside the classroom can complement and strengthen classroom-based learning, and can also lead to that learning being extended and updated long after the formal classroom program ends” (Crooks, 1988, p. 463). If assessment is limited to in-class, written tests of surface knowledge, there is little chance that students will develop intrinsic and continuing motivation in the subject matter. The framework is set up to transfer more control over the assessment process to the students, as recently recommended by Boud, Lawson and Thompson (2015). This transition may extend the movement from "sage on the stage" to "guide on the side" style of teaching into the realm of assessment.

While not prescriptive, the PLE Framework for Assessment opens up a range of possibilities for instructors to rethink his or her use of assessment. Rather than focusing upon assessment as an insular activity of an individual student, the framework defines assessment as an authentic experience over which the student is given a significant amount of control and encouraged to self-assess (Yucel, Bird, Young, & Blanksby, 2014). Assessment is not just something which the instructor does to the student in the classroom (Boud & Molloy, 2013); it is something that the student does to demonstrate learning. And by focusing upon the use of technology, the PLE Framework for Assessment places assessment firmly in the student’s sphere of activity.

As mentioned above, the above framework is based upon a similar framework developed by Dabbagh and Kitsantas (2012). While Dabbagh and Kitsantas’s model focuses upon the learning process, it does not directly address assessment, which is the focus of the current model. However, the two models are not that far apart in that learning occurs during an assessment task. In contrast to the way that assessment is sometimes distinct from the learning (Crooks, 1988), the current model views assessment as an extension of and integrated into the learning process as defined by Dabbagh and Kistsantas (2012). Hence, the added column (Level 4: Assessment output) addresses assessment activities as the output of the achievement of learning outcomes.

The inclusion of community, in Stage 2 of the framework, focuses upon learning from others. One of the characteristics of millennials is that they prefer communal over individual learning (Dede, 2005) which involves “diverse, tacit, situated experience, with knowledge distributed across a community and a context as well as within an individual” (Dede, 2005, p. 1). In other words, learning does not come from a single person, but is derived from experiences with others and is then shared with others. These experiences may be facilitated locally through online discussion boards, for example, or globally accessing blogs or social media sites. The framework also can be used by academic teaching staff to guide students' choice of technologies, as they come to learn to distinguish between a casual source and an expert; between an opinion and an evaluation. Using multiple sources will help students learn that even among the informed, there may be a diversity of perspectives. Comparing information from different sources and understanding the diversity of perspectives among professionals in their profession will help the student in becoming more sophisticated in their thinking about the topic, as well as their profession. The PLE Framework for Assessment offers suggestions for relevant technologies to achieve this type of learning.

The focus of Stage 3 in the framework will be upon the evaluation and synthesis of the information gathered in the previous stages. Dede (2005) reports that learning for millennials is “based on collectively seeking, sieving, and synthesizing experiences” (p. 643). This process of sieving and synthesising is not just an individual evaluation, but is done collectively or communally. This can be facilitated by the teacher either setting up structures locally to facilitate the evaluation of ideas, such as groups or discussion boards, or point the student to resources online where they can interact with others about their topic. Posting their ideas online can be positive in that students may grow in their professional confidence by having their ideas validated by experienced professionals.

The PLE Framework for Assessment provides an overall structure for designing assessments within the context of the instruction. However, how the instructor applies the framework to each course will be different, and will depend upon the type of course and subject matter. In any case, the application of the framework to each course will need to be done carefully so as to produce the ideal experience for the students.

Recommendations

Several recommendations have arisen organically out of the creation of the PLE Framework for Assessment. To begin with, further phases of the project will need to analyse the effectiveness of the framework itself in encouraging students to refine and expand their PLEs in regards to assessment.

Another recommendation is that there could be a shared construct of "the use of ICT" in the learning process among students at the university. This construct would ideally come from the institution level (e.g., it may include use of the LMS) as it would then influence the ways academic departments, and thus academics and students within those departments, view and understand the use of ICT in the teaching and learning process. The existence of such a construct is useful, as it would determine the ways ICT is used among students in their academic practices, building on the work of Gosper et al. (2013; 2014). These academic practices include personal information management at the individual level (e.g., OneNote), use of ICT within a community, social interaction and collaboration (e.g., Linkedin), information aggregation and management (e.g., Endnote), as well as assessment outputs (e.g., Academia), to align with the four stages of the PLE Framework for Assessment outlined in this paper.

The study has also illuminated the need for further normalisation of the concept and (ubiquitous) role of ICT in the teaching, learning and assessment processes in higher education (Attwell, 2007; Blaschke, 2012; Dede, 2005; Gasson & Haden, 2014). This would involve rebuilding the "social" (the academics and the students) and the "technical" (the use of ICT) systems so that they could work in a parallel manner in this process, towards the goal of accomplishing a degree in the notion of "the best possible ways". This parallel relationship could be beneficial in the generation of an optimum educational outcome, in terms of increased productivity of work as well as increased effectiveness and efficiency for academic practices, especially in relation to assessment practices.

The constructs of higher education and technology, with student perceptions focused on "needs" and "outcomes" related to "satisfaction" and "comfort" in relation to ICT could be challenged to embrace efficiency and productivity by introducing a level of academic development focused on application use to support the learning and assessment processes. This may then lead to increases in "computer literacy" promoting changes in thinking and practice, leading to "optimal solutions" in accordance with both "social" and "technical" agendas in a more strategic use of ICT to promote learning and assessment, in accordance with the recommendations of Baskin, Barker and Woods (2003).

Several inherent limitations with the study have also been noted and the challenges arising from these will be work through in future phases of the project. The study has so far only reached a small number of students and further studies will be done to provide greater response potential. The study also needs more qualitative feedback about the value of the PLE guidelines provided by lecturers prior to assessments before it can gauge the value of such a practice. This will be developed and investigated further in the next phase of the study.

Further engagement between the university, the lecturer and the students about ICT for study and, in particular, for their assessment tasks is encouraged; this involvement across students and lecturers for assessment purposes has also been identified by other researchers (Australian Learning and Teaching Council, 2009; Boud & Molloy, 2013). Further investigation into the way this interaction plays out and influences practice is also suggested.

Conclusion

This paper has provided examples of the types of technologies used for assessment purposes which constitute a Personal Learning Environment (PLE) used by selected groups of students in two higher education settings. The data gathered from the student-participants in the study were analysed and used to inform the development of a research-informed, learning-focused PLE Framework for Assessment. The framework is intended to be used by academic teaching staff as a tool to guide their students' appropriate and focused use of technologies for assessment purposes, including the analysis, preparation, completion and submission of assessment tasks. Furthermore, the framework may provide guidance to university lecturers who engage in the design of assessment tasks, resources, instructions and rubrics, by offering specific recommendations to students about the use of relevant soft and hard technologies to use when completing assessment tasks. Although research into students' use of technologies specifically for assessment purposes has not yet been investigated extensively in higher education settings, the outcomes of the research outlined in this paper and the PLE Framework for Assessment that emerged from the research represents two contributions to our current understanding of how students' use technologies as part of their assessment practices.

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