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ePortfolio-Based Learning Environments: Recommendations for Effective Scaffolding of Reflective Thinking in Higher Education

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ABSTRACT

In addition to providing a useful repository for learning products, ePortfolios provide enhanced opportunities for the development of advanced learning skills. It can be argued, however, that ePortfolios are not being implemented effectively towards fulfilling this important function. This paper presents an investigation of an ePortfolio environment that scaffolded the learning of pre-service teachers. The environment was embedded within the PebblePad platform and utilised the Blog function to provide students with activities that were designed to enhance and support the skills and dispositions required to undertake action research. Prompts were provided to students to scaffold the completion of an action research project and provide additional activities that supported the enhancement of reflective thinking. The research study utilised an eLearning Lifecycle that provided a cyclic framework of review and implementation. The purpose of this model was to identify design principles for future iterations of ePortfolio-based learning environments. Findings suggest that the prompts and the ePortfolio environment were effective in scaffolding students' reflective thinking. Additionally, design principles are suggested to ensure this research has both practical and theoretical significance for implementation in similar environments.

Keywords

ePortfolio environment, Scaffolding, eLearning lifecycle, Learning environment

Introduction

In recent years, the increased use of electronic portfolios (ePortfolios) has seen the enhancement of the affordances these programs provide. No longer confined to the role of “evidence repository,” ePortfolios now provide features that enable the scaffolded development of advanced learning skills (Barrett, 2006). As part of this development, ePortfolios have moved beyond the traditional purpose of assessment to one that more deeply facilitates and enhances student learning. This maturation of ePortfolio environments, along with recognition of their educational strengths, led to the implementation of this research study that examined the use of the Pebblepad ePortfolio platform as a learning environment.

Portfolios have been used for many years in artistic fields as a means of showcasing skills and abilities through work samples and documentation of performances (Drier, 1997). In education, they have also been used as assessment tools to demonstrate achieved competencies, to allow students to document learning reflections and to understand how they have applied their knowledge (Hartnell-Young et al., 2007; Shepherd & Hannafin, 2011). Portfolios are also strongly aligned with integrated and authentic assessment (cf. Gikandi, Morrow, & Davis, 2011; Herrington, Reeves, & Oliver, 2010).

The development of technology and the increased availability of web-based platforms to document and present work in multi-media formats has led to widespread use of ePortfolios (Clark & Eynon, 2009; Duncan-Pitt & Sutherland, 2006; Khoo, Maor, & Schibeci, 2011). The ePortfolio has been described as, “one of the most adaptable tools currently available to educators around the world” (Littlejohn & Pegler, 2007). One of the key affordances of an ePortfolio, in comparison with its paper-based predecessor, is its ability to contain several layers of evidence that can be used for varying purposes (Lambert & Corrin, 2007) and to portray learning to alternate audiences (Chesney & Marcangelo, 2010). Three important differences between ePortfolios and their paper-based equivalent are:

- Digital formats are easy to rearrange and edit
- ePortfolios allow hyperlinks to connect documents and link to external sources/ references
- The electronic format is portable and mobile (Stefani, Mason & Pegler, 2007, p. 17).

Building on these developments, ePortfolio technology has now progressed to a point where it is being suggested as a platform for learning (Barrett, 2005). ePortfolio platforms provide access to tools and resources that can be designed and implemented to guide student learning and allow for collaboration with others in this process

(Strampel & Oliver, 2010). A great deal of research highlights the potential of the ePortfolio as a learning tool (Housego & Parker, 2009), although the evidence of the effectiveness of these initiatives is still being collected (e.g., Oakley, Pegrum, & Johnston, 2014).

This paper aims to provide this missing evidence by investigating the implementation of an ePortfolio-based learning environment that was used to enhance reflection in pre-service teachers as they completed an action research project. The research was guided by the overarching research question of: How effective is an ePortfolio environment in providing the scaffolding required to enhance reflective thinking in pre-service teachers?

The scaffolding process was initiated within the PebblePad ePortfolio platform. In this context, scaffolding supported the learning process that was tailored to the needs of the students with the aim of helping them achieve their learning goals (Sawyer, 2006). PebblePad was chosen as the ePortfolio platform for this research because: it allowed students to share resources through the Blog function; it used privacy settings so that students' assets remained private until they chose to share them; and it offered options for sharing and collaboration of assets. The environment was designed from the perspective of an Enculturation Teaching Model (Tishman, Jay, & Perkins, 1993) that utilised a series of prompts to detail activities designed to target reflective skills and dispositions that could assist the completion of an action learning project.

To evaluate the effectiveness of this environmental approach, the research study involved a cyclic implementation and review approach that followed the stages of the eLearning Lifecycle (Phillips, McNaught, & Kennedy, 2011). This model was developed to specifically provide a framework for the development, implementation and review of electronic learning environments and, as such, was appropriate for the research focus.

The intended outcome of the eLearning Lifecycle is the identification of design principles to guide the design and development of future eLearning environments (Phillips et al., 2011). Based on the research study described here, several design principles were identified. Each is presented, in detail, together with key findings later in the paper.

The emergent functions of the ePortfolio in education

ePortfolio implementation has increased over recent years, driven largely by government policies that dictate their mandatory use (particularly in the United Kingdom) (Joyes, Gray, & Hartnell-Young, 2010; McAllister, Hallam, & Harper, 2008). An ePortfolio is:

A collection of authentic and diverse evidence, drawn from a larger archive representing what a person or organization has learned over time on which the person or organization has reflected, and designed for presentation to one or more audiences for a particular rhetorical purpose (Barrett, 2005, p. 5).

This definition introduces the notion that a person may use an ePortfolio as a collection of documents and products for the purpose of evidence, possibly including personal records and reflections. However, the ePortfolio has clearly moved beyond this simple original function to facilitate the creation of a more purposeful and comprehensive presentation portfolio (Pelliccione, Dixon, & Giddings, 2005) that demonstrates a range of skills and abilities and that may be adapted to meet different purposes (Clark & Eynon, 2009).

A more comprehensive definition of the variety of ePortfolio affordances was elucidated by Duncan-Pitt and Sutherland (2006) who described it as:

A system that belongs to the learner, not the institution; populated by the learner not their examiner; primarily concerned with supporting learning not assessment; for life-long and life-wide learning not a single episode or a single course; that allows learners to present multiple stories of learning rather than just a simple aggregation of competencies; and, importantly, where access to them is controlled by the learner who is able to invite feedback to support personal growth and understanding. (p. 70)

With technological developments and the increased use of ePortfolios, a comprehensive range of functions has been identified. The key learning requirements that can be met through ePortfolios include: assessment, presentation, learning, personal development, collaboration, and ongoing working documents (Stefani et al., 2007, pp. 13-14).

There are three key aspects of ePortfolios that were particularly relevant to the current study—specifically assessment, learning and the scaffolding of complex tasks—which are discussed in detail in the following section.

The ePortfolio as an assessment tool

ePortfolios are being used increasingly as an assessment tool (MacEntee & Garii, 2010), particularly in terms of demonstrating skills, abilities and achievements against set criteria or required competencies (von Kinsky & Oliver, 2012). A key advantage of the ePortfolio is that it can incorporate a variety of digital media that provides opportunities for a wide range of assessment submission formats, including the evidence of achievement against industry competency standards (Moran, Vozzo, Reid, Pietsch, & Hatton, 2013). An ePortfolio may also create a more authentic opportunity for students to demonstrate their learning (Raison & Pelliccione, 2006), and it allows for reflection in relation to learning goals and the planning of professional development (von Kinsky & Oliver, 2012). While assessment is an important part of the learning process, using an ePortfolio for this purpose focuses specifically on the end product and may not fully explore the potential of the platform as a learning tool.

A useful extension to the understanding of ePortfolio environments was provided by Joyes and colleagues (2010, p. 2) who added that, “behind any product, or presentation, lie rich and complex processes of planning, synthesising, sharing, discussing, reflecting, giving, receiving and responding to feedback.” The encompassing term used by these authors to describe these processes was ePortfolio-based learning, which became the preferred term of the Joint Information Systems Committee (JISC) (Joyes et al., 2010). It was this extended focus on the ePortfolio as a learning tool that provided the next area of focus.

The ePortfolio as a learning tool

In 2005, Helen Barrett advocated that ePortfolios be utilised primarily as learning tools. She proposed that the technology was available to “engage students in active participation” using reflection by “assessing and managing their own learning” (Barrett, 2005, p. 23). As technology changes so rapidly, this statement is perhaps even more apt now.

A number of authors have written about the potential of ePortfolio platforms for teaching and learning (Housego & Parker, 2009; Lorenzo & Ittelson, 2005; Stefani et al., 2007). Throughout the United Kingdom, ePortfolios are widely in use, but the implementation process is still under development due to wide variation of opinion across the range of involved stakeholders (Joyes et al., 2010). Similar patterns appear to be occurring in the United States.

The collaborative work of the Australian ePortfolio Project (Hallam et al., 2010) and others have developed some important guidelines around the implementation of ePortfolios for teaching and learning. A review of these implementation initiatives reveals key recommendations for a successful environmental implementation. These include:

- Focus on the reason for the use of an ePortfolio (McCowan et al., 2005)
- Embed the implementation into coursework with a clear framework (Hallam et al., 2010)
- Scaffold the approach with both pedagogical and technical support (Pelliccione et al., 2005) and
- Allocate time to effect long-lasting change (Hiller et al., 2007).

Much of the existing research into the use of ePortfolios as learning tools in education has been specific to the platform being used (e.g., Mahara, PebblePad, WordPress). What was needed was a more universal approach with a focus on pedagogical considerations that could be applied across numerous electronic platforms (Shepherd & Hannafin, 2011). The ePortfolio can be used to complete a multitude of tasks, including those that require higher order thinking skills as discussed in the next section.

Using ePortfolios to scaffold complex tasks

When deciding to use an ePortfolio, it is important to first examine the task(s) to be completed within the environment and ensure that they are matched to the strengths and capabilities of the platform. For the ePortfolio in this study, the primary task for the students involved was the completion of an action research project. Action research involves the selection of an area that is of concern for the student in practice, and the subsequent design

and implementation of a cyclic approach of action and review to improve their abilities in this identified problem area (Grundy, 1995; McNiff, 1995).

The execution of such a research project is a complex and authentic task that requires students to self-regulate their learning performance by examining their own practice, comparing it to the literature and making positive change to their performance (McLoughlin & Lee, 2010). Through the completion of complex projects, students can assemble and display contributory products as they work towards a polished product, rather than assemble a range of possibly disconnected artefacts that demonstrate evidence of achievement (Herrington et al., 2010). An authentic task—in this case, the design, implementation and presentation of an action research project—provides opportunities for students to make decisions and reflect, as well as articulate and collaborate as they prepare their final publishable report. This is imminently achievable through the completion of a genuinely engaging and complex task supported within an ePortfolio environment.

The context of the study

This research study involved 4th year pre-service teachers in an Australian university. A compulsory unit in this final year required students to complete an action research project in an area of their choice. The implementation of this project required the students to access a classroom environment to trial and review the strategies under investigation as part of their action and review cycles. The project was scaffolded in the PebblePad ePortfolio through the provision of prompts to outline the assessment items and additional tasks to enhance reflective thinking.

Methodology

The implementation of this environment as part of the research study followed the cycles of the eLearning Lifecycle (Phillips et al., 2011). The model is based on the tenets of both Action Research, in terms of the cyclic implementation towards improvement in practice, and Design-Based Research that Phillips and colleagues (2011) believed provided a more structured research approach and focused on the creation of design principles.

The outline of the implemented Lifecycle, as shown in Figure 1, provides a framework of the stages implemented in the research and the phases of action and review that occurred at each point of the study.

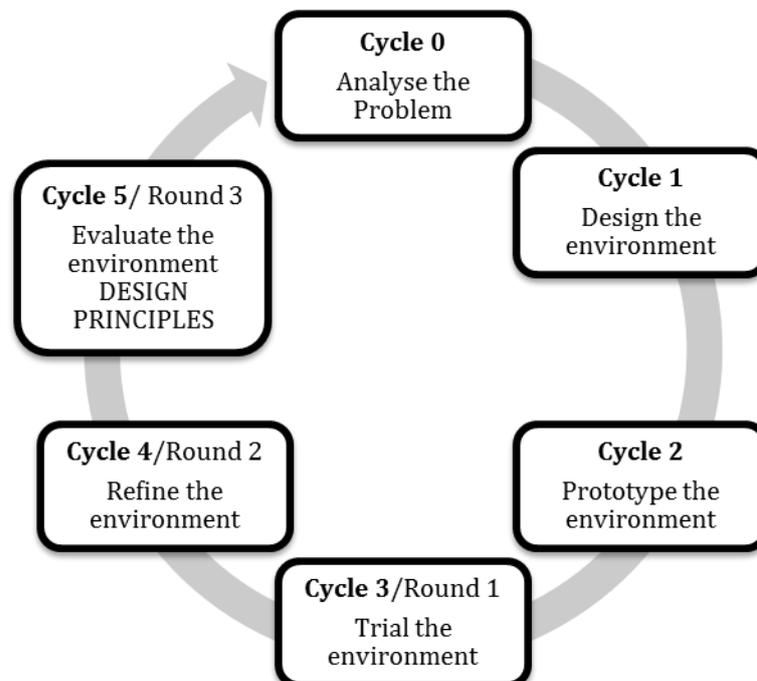


Figure 1. The eLearning lifecycle (Phillips et al., 2011)

The ePortfolio was introduced to the students to complete the stages of their action research project and report on their results. The students were expected to continually use the ePortfolio to demonstrate their learning during the semester and document the project's development. Within the PebblePad platform, the researcher provided prompts to the students via a Blog facility to scaffold the completion of the assessment tasks. The prompts in this Blog were designed to develop an ePortfolio-based learning environment to scaffold not only the assessment tasks, but also the development of reflective skills and dispositions through the stages of the action research project. The prompts were planned to meet the components of the Enculturation Teaching Model (Tishman et al., 1993) in the three areas of exemplars, activities and interaction. Although interaction was part of the wider study, the discussion in this paper is focused on exemplar and interaction prompts only.

The exemplar prompts were designed to demonstrate to students how to use the ePortfolio together with the frameworks required for the submission of assignments. These were detailed step-by-step instructions that guided the students through the stages of completing and submitting the assignment tasks within the PebblePad environment.

The activity prompts of the enculturation teaching model were designed to provide opportunities to practice higher-order thinking (Tishman et al., 1993). After examination of research into reflection, these activity tasks were developed based on strategies that had been found to be successful in enhancing reflective thinking and writing.

Participants

The students who accessed the learning environment were 4th year Bachelor of Education students completing a specialisation in either Early Childhood or Special Needs education. There were originally 84 students enrolled with access to the PebblePad Gateway that housed the scaffolding prompts. In total, 79 students completed the unit.

Implementation

The initial environment was implemented with a small group of students (see Round 1 in Figure 1) who were given prompts based on self-identified areas of need. In Round 1 most requests related simply to the assessment requirements of the unit and how to use the platform, rather than more complex, higher order learning issues. From this round of implementation it was decided that the activities needed to be pre-planned to meet the needs of students, but also to guide and prompt further exploration of the ePortfolio platform and to extend student thinking in the areas of their action learning project. Throughout the implementation of Round 2, the students were provided with the prompts outlined in Table 1.

The table outlines the number and name given to the prompt in the Blog, the source that was the basis of the idea for the prompt - either from literature or experience of Round 1 - and the purpose in the provision of each prompt. The shaded sections represent the prompts directly relating to the assessment tasks the students were required to complete.

Based on initial student feedback throughout this level of implementation, it was identified that while students utilised the prompts they did so to varying degrees. It emerged that the students accessed and implemented tasks mainly focused on the assessment tasks (the shaded prompts), but not those designed as higher-order activities or to enhance interactions and reflection.

Table 1. Prompts for Round 1

Prompt no.	Activity prompt	Source	Purpose
1	Reflection on teachers	Phillips & Carr (2006)	The students were asked to describe and share what they think are the attributes of a good teacher. This was part of the action research project in terms of identifying something from their practice that needed improvement.
2	Something to talk about	Round 1 experience	This prompt was designed to encourage the students to use the blog for discussion.
3	Reflective Journal as a Blog	Spalding, Wilson, & Mewborn (2002)	Reflective writing can promote reflective thinking because it is a permanent record of thinking, is an outlet for feelings, and can open up dialogue.

4	Plan/Rationale Outline	Round 1 experience	This was an outline for the assignment submission. It provided step-by-step instructions for the students to complete their 1 st assignment. It was designed to provide the format of the submission so the students could then focus on the content.
Prompt 5 was specific to the unit and has been removed from the research.			
6	Adding ethics checklist	Student questions	This prompt gave the instructions of how to complete this action within the platform.
7	Progress report	Round 1 experience	This was the outline for the second assignment submission and was included for the same reasons as the Plan/Rationale prompt.
8	Uploading evidence	Student questions	This prompt was again added due to questions from students regarding how to utilise the uploading options of the platform.

Table 2. Prompts for Round 2

Prompt no.	Activity prompt	Source	Purpose
9	Reflective writing review	QUT (DRAW Project),(n.d.)	This activity was a link to a platform for evaluating the level of reflection in student writing. Students could reflect on their writing against the determined criteria to make improvements.
10	Outline of 4R Framework	Ryan (2011)	This provided the graphic of the 4R framework mentioned in Prompt 9 for the students to use.
11	Video Review	Jensen, Shepston, Connor, & Killmer (1994)	The students were asked to video or audio record a teaching experience to review their practice with the review statements.
12	Verbal 3 step framework	Donaghy & Morss (2007)	The students completed a mini action research cycle on one event in their experience.
13	Reflective journal review	O'Connor & Diggins (2002)	As the students began to put their projects together, this prompt aimed to get them to go back over their entries to add further detail or extra links to theory.
14	Conclusion questions	Phillips & Carr (2006)	This assisted the students to bring their projects together and provided an overall review for their concluding chapter.
15	Final report	Round 1 experience	As with the Plan/Rationale and Progress Report, this prompt gave the guidelines for the assignment submission.
16	Attachments	Student request	This provided students with instructions to upload evidence and forms required with their submissions.

To address these issues, changes were made to the prompts provided. These included: (1) the addition of a source citation for the activity to demonstrate to the students that there was a theoretical basis to the prompts, and (2) the inclusion of questions to prompt discussion among the students. These changes were implemented (Round 3) and included the prompts listed in Table 2. The prompts most relevant for assessment tasks are again shaded for comparison.

At the conclusion of the implementation, students were invited to take part in the formal review process. This review employed a number of data collection methods including an online survey, focus group and individual interviews, together with the low-level utilisation of learning analytics and document analysis.

In all, 25 students responded to the online survey, 7 were involved in focus group interviews, 8 in individual interviews, 10 provided comments on the blog and another 10 provided feedback via email. As such, feedback in some form was received from over 50% of the cohort. The data from all these sources were then reviewed and analysed to identify possible improvements in the learning environment, and to create design principles for future iterations of ePortfolio-based learning environments.

Findings

To examine the students' reported engagement with specific prompts, descriptive statistics were collated from the online survey. A question in the survey included a Likert ranking scale for the prompts that were used in the implementations and the students were asked to rank their level of engagement with each prompt as shown below:

- Did not look at
- Read only
- Read and used in project
- Read and completed activity
- Shared writing from activity with others.

The differentiation between “read and used in project” and “read and completed activity” was important to identify whether or not students were completing work unrelated to assessment items. The final category of “shared writing from activity with others” was to examine the use of the collaborative nature of the platform.

Table 3 presents the data collected from this question in the online survey. The numbers in the table represent the percentage of students who reported using the prompts at each level on the Likert scale question in the online survey.

Table 3. Prompt usage as detailed in online survey.

Prompt number	Prompt provided to students	Didn't look	Read only	Read and used in project	Read and completed	Shared
1	Reflection on teachers	46.7	46.7	6.7	0	0
2	Something to talk about	33.3	60	6.7	0	0
3	Reflective Journal as a Blog	26.7	53.3	6.7	13.3	0
4	Plan/Rationale Outline	6.7	13.3	66.7	13.3	0
5	Time to refine	40	40	13.3	6.7	0
6	Adding ethics checklist	6.7	6.7	60	26.7	0
7	Progress report	0	6.7	66.7	26.7	0
8	Uploading evidence	0	7.1	57.1	35.7	0
9	Reflective writing review	0	42.9	42.9	14.3	0
10	Outline of 4R Framework	6.7	33.3	60	0	0
11	Video Review	46.7	53.3	0	0	0
12	Verbal 3 step framework	42.9	57.1	0	0	0
13	Reflective journal review	20	60	13.3	6.7	0
14	Conclusion questions	26.7	26.7	40	6.7	0
15	Final report	0	0	73.3	26.7	0
16	Attachments	0	21.4	42.9	35.7	0

The data shown in Table 3 highlights the increased usage of prompts that were provided as examples or directions for the completion of assignment tasks (the shaded sections). Based on the sum of the columns of “read and used in project” and “read and completed activity”:

- 80% (66.7+13.3) of students who completed the survey reported using or completing the Plan/Rationale activity from the outline.
- 93.4% (66.7+26.7) the Progress Report prompt.
- The full 100% (73.3+26.7) of the respondents (32% of the cohort) reported using or completing the Final Report submission from the exemplar prompts provided in the Gateway Blog.

This indicates that the students were fully engaged with the exemplar prompts that were related to the practical aspects of assignment submissions.

In contrast, the activity prompts that were provided to enhance the process of reflection were less frequently utilised. More specifically, the Reflective journal as a blog, the Time to refine, and the Reflective journal review were used by 20% of the respondents, while the Video review and Verbal 3 step framework were not used at all. The average use of the activity prompts was bolstered by the reported usage of the Reflective writing review (57.2%), the Outline of the 4R's (60%), and the Conclusion questions (46.7%), which related specifically to reflective writing. This research finding is important because these prompts were directly related to the process of reflective writing that the students needed to complete for their assignment submissions. This finding places

these prompts at the intersection of process and product and reinforced the students' preference for tasks related to the submission of assignments.

Responses from focus group and individual interviews were examined to further understand why students had utilised the prompts in this way. During the focus group interviews, several students identified that they completed only those elements associated with assignment tasks for a number of reasons: firstly, time constraints—the students had time to complete only tasks they felt were of greatest value for assessment; secondly, confusion about the purpose of the additional tasks; and thirdly, resistance to the use of a new platform that was imposed upon them in their final year.

Time constraints

Lack of time was mentioned repeatedly through the interviews as a contributing factor in the reduced engagement with the activity prompts. Many of students commented that they were “time poor” throughout the semester. Some said that even if the activity from the prompt had sounded interesting, they most likely would not have completed it unless there was an extrinsic value associated with it, in terms of their grade. One student described a somewhat cursory approach to completing the activities:

I read some of them but I just – time was a factor. I did the first one but then there was too much else going on to do it. (Alex, Individual Interview)

While others said they completed some but not all due to time:

Some of them I did, some of it I didn't to be honest. It came down to my time and what I needed. (Monique, Focus Group Interview 3)

The non-assessment of the activity prompts appeared to be a real factor in their decreased use. Generally, the students did not make the link between the activity task in the prompt and their future teaching practice, but recognised that assessment results did impact on their course completions (Van Dinther, Dochy, & Segers, 2011). Assessment was clearly their primary focus.

Because the additional activities were not assessed within the unit, the students were not motivated to complete the task. Motivation is defined as “a complex psychological construct that attempts to explain behavior and the effort applied in different activities” (Watters & Ginns, 2000, p. 302). It cannot be imposed but must be actively chosen (Cohen, 1983), meaning that the students had to decide for themselves to make the activities a priority.

The difficulty engaging students in activities that are not assessed has been identified as a major issue in many online learning platforms (Macdonald, 2004). Macdonald stated, “the design of assessment is critical in determining the direction of student effort” (p. 218). While assessing every task in the ePortfolio is not sustainable (or desirable), it is important to examine how to encourage student engagement in tasks that are not assessed, leading to the identification of Design Principle 1: Utilise the ePortfolio in the weekly tasks (either online or on campus) to get the students using the tool as part of their regular work routines.

If regular use of the ePortfolio is embedded within weekly tasks, and each builds upon the resources and assets stored within this space, it may increase utilisation of the platform and encourage students to engage with the data collected within their pages. The students can continue to build these stores and access the required pieces for assignment submission, thus providing the link to assessment that has been found to be required (van Dinther et al., 2011).

Purpose of the prompts

Analysis of the interviews revealed that there was confusion regarding the purpose of the activity prompts. The discussion in the interviews highlighted that many students thought the prompts were provided for students who were struggling with the unit and needed additional help, rather than of being of assistance to the whole student cohort. For example:

I think for someone who was really struggling in those aspects I would have used them but I didn't feel like I had to write it down. (Kate, Focus Group Interview 2)

Students need to identify the long term benefits of using an ePortfolio platform (Edwards, 2013) and then be able to make the link between the completion of the task required and long-term development. This led to the identification of Design Principle 2: Ensure the purpose of the task is clear and demonstrate to the students how completing it links with their learning.

In providing activities for the students, it is important that the process does not become one of direct instruction. Instead, the purpose must be made explicitly clear. The students need to identify “what’s in it for them” when completing the task as part of their development as self-regulated learners. By clearly outlining the purpose and demonstrating how useful the task may be in the future, they are then able to make informed choices about the value of task.

Resistance to the technology

The third area identified by students as a barrier to engagement was that the ePortfolio platform was a new and unknown program. PebblePad was introduced to the students in their final year of study and they were required to use it for only one subject. This was a key limitation of the research study and highlighted the need to introduce electronic learning platforms, such as ePortfolios, based on strong pedagogy from the commencement of their studies (Hallam et al., 2010). Although attempts were made to reduce the students’ discomfort with the platform, some resistance remained.

Several students highlighted negative perceptions of PebblePad and their preference for hard copies of documents as reasons for not engaging with the platform:

Because I’d not used PebblePad before and I didn’t know what it was. I’d just heard horror stories from other students so I was a little scared. (Chloe, Individual Interview)

I will do the hard copy cause I’m still learning a lot about technology as well so I think I still like doing hard copies. (Abigail, Individual Interview)

The format chosen as the assignment submission template was selected as it was the most flexible format in PebblePad and was the most similar to Microsoft Word. However, there were still small differences that may have presented challenges to students, as supported by the research of Janosik and Frank (2013). They found that students had difficulty adapting to format changes from those they were more comfortable with. This appeared to have been the case with the PebblePad environment, as many students reverted to the use of word processing or other familiar platforms to draft their work, which was then transferred to PebblePad.

The use of other platforms by students to complete the majority of the project work, and then transferring or “cutting and pasting” the contents over for submission, had a negative impact on their engagement with the ePortfolio platform. It reduced the amount of time students’ spent in PebblePad and, as such, decreased the depth of engagement with the platform.

It was not only the formatting of the platform that concerned students. Several voiced their frustration at having to learn another new and complex program towards the end of their degrees:

It is hard enough other than adding in new programs every change of subject. To me this is wasting my time, it is hard enough to survive and take out time to do study, let alone having to learn new programs all the time. (Respondent 2-Online Survey)

Rather than seeing the new program as a useful tool, one student identified it as a “hurdle”:

I found the use of PebblePad quite frustrating. I would have preferred to use PebblePad prior to my last year of uni rather than have another hurdle to try and overcome. (M- Email feedback)

The identification of factors that caused student frustration and resistance to the program emerged as an important consideration for anyone implementing an ePortfolio-based learning platform. This led to the development of Design Principle 3: Implement the ePortfolio with a strong pedagogical focus from the commencement of student degrees.

Linked with the first two design principles, this last one further highlights that the purpose of using the ePortfolio environment must be clearly embedded in a strong pedagogy. By introducing the platform to students

commencing their studies, individual ePortfolios can grow and develop alongside the students who create them throughout their degrees.

The findings of this research study provide some clear design principles for the ongoing implementation of ePortfolio-based learning environments. The goal in implementing these principles is to encourage students not only to create finished products, but also to become engaged in the process of developing reflective abilities.

Conclusion

The aim of this research study was to investigate the use of an ePortfolio platform as a learning environment to scaffold the enhancement of reflection in pre-service teachers. While there were some successful outcomes of this implementation particularly in relation to development of students' self-reporting of reflective skills, a number of design principles emerged to guide future iterations of these environments. The cyclic implementation of the eLearning Lifecycle showed:

- ePortfolios can be used to provide regular reflective tasks as an integral part of students' learning routines,
- The purpose for each task needs to be made clear to students, so they can appreciate the value of completing the work,
- For maximum benefit, there should be a strong pedagogy behind the implementation of the ePortfolio from the commencement of the students' degree programs, rather than an initiative introduced late in a program of study,
- Opportunities should be provided for the students to decide what could be included in their ePortfolios to achieve their learning goals.

These principles highlight the importance of the learning tasks implemented within an ePortfolio-based environment and the need for a strong pedagogical approach to the use of such platforms. The activities required of the students must engage them at a complex level and require multiple layers of scaffolding to be implemented—and acted upon—by the students within the environment.

These design principles can be applied to any ePortfolio platform for a multitude of task types and content areas. It is anticipated that the application of these design principles will meet the needs of the students and, in this way, increase the efficacy of ePortfolio-based learning environment implementation to better scaffold complex tasks for student learning and development.

This study also suggests at least two directions for future research. Firstly, this model could be re-implemented in a similar situation to examine design principles used in a different context. This would add to the evidence of the effectiveness of the recommendations. Secondly, further studies could build on these principles in terms of the collaborative affordances of ePortfolios, and investigate strategies to increase the use of these functions amongst students creating assets in collaboration.

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