The Cost-Reward Analysis of Electronic Portfolios: Towards Best Practice and Improved Student Engagement

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Abstract

This study extends the social exchange theory framework with electronic portfolio (e-portfolio) systems in a cost-reward analysis to identify specific observable elements of the system that would lead users to either a) compliance or b) quality engagement with the system. This thesis utilized three studies using a multiphase design and combining the sequential qualitative and quantitative data sets over multiple phases and in a single academic institution, the University of Auckland, New Zealand, and two faculties, the Faculty of Education and Social Work and Faculty of Medical and Health Sciences.

Study 1 employed a comparative analysis of prevailing e-portfolios using the essential technology features, user satisfaction, and usability of e-portfolios at the Faculty of Education and in the initial teacher education program (i.e., professional practice setting). A semi-structured interview with a sample of course participants ascertained the factors of training and support, assessment processes, and long-term benefits as facilitating factors that can potentially assists students with their quality of engagement with e-portfolios. These factors were then evaluated in Study 2 using confirmatory factor analysis (CFA) and structural equation modeling (SEM) techniques. Study 3 evaluated e-portfolio use in the Faculty of Medical and Health Sciences and a semi-structured interview with a sample of nursing students to ascertain the cost-reward analysis of e-portfolios in a nursing program (i.e., professional practice setting).

Results showed that attending training and support sessions, and the personalization of e-portfolios, increased the quality of student engagement in terms of students leveraging their e-portfolios to improve their technology skills, showcasing of their creativity, reflecting on projects, and understanding alternative forms of assessment, and also reported that they would potentially show their e-portfolios to employers. Further, results from the qualitative interviews confirmed that students from Study 1 and Study 3 wanted to engage with the combined functionalities of reflection (i.e., formative learning) and the summative evaluative processes. The contribution of this thesis is in its detailed examination of the relationship of technology systems and software to the education goal of learning and the administrative goal of ensuring professional certification.

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Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction

1.1 Electronic Portfolios (E-Portfolios)

Electronic portfolios (e-portfolios) have brought innovative and creative ways for educators to think, re-think, and reconstitute their pedagogical designs to enhance student learning in the 21st century. Similar to its paper-format portfolio counterpart, the purpose of an e-portfolio is for learners to collect, document, grow, develop, achieve, showcase, and reflect on and assess their progress and results (Barrett, 2011; Bartlett, 2009; Chau & Cheng, 2010; Deneen, Brown, & Carless, 2017; Hartell & Skogh, 2015; San Jose, 2017; Vlachopoulos & Wheeler, 2013). E-portfolios are customizable, web-based, intentionally selected artifacts, and (ideally) students' reflective commentary (Bartlett, 2009; Oakley, Pegrum, & Johnston, 2013). Within an e-portfolio, learners can upload digital items, for example course work, assignments, curriculum vitae, syllabus details, program activities, program assessments, evaluations, achievements, certifications, recommendations, references, and any electronic materials for storage, evaluation, or showcasing (Bartlett, 2009; Chau & Cheng, 2010; Deneen, 2013; Deneen et al., 2017; Shroff, Deneen, & Ng, 2011). The success of e-portfolios is centered around learners' ability to organize, re-organize, and modify contents flexibly and with ease. Further, e-portfolios allow learners to capture peer-to-peer and teacher-student computer-mediated communication, and provide an interactive approach to reflective practices, innovative assessments, and the public showcasing of works.

The components of e-portfolios allow learners to create their own personal and professional learning environment, promoting personal value for, and ownership of, learning (Love, McKean, & Gathercoal, 2004; San Jose, 2014; Shroff, Deneen, & Lim, 2014; Shroff, Trent, & Ng, 2013). Enthusiasm and interest for e-portfolios in higher education largely revolves around the learner's active participation in the learning process, as seen in the selection and collection of digital materials to store, and the showcasing of these achievements to the public (Baeten, Dochy, & Struyven, 2008; Deneen et al., 2017; San Jose, 2017). When developing and maintaining an e-portfolio, students need to be self-regulated, goal-oriented, and acquire knowledge and skills to create their own e-portfolios. Leading researchers and advocates of e-portfolios assert that learners can accrue immense learning and technological skills as they compile, include, self-assess, self-scrutinize, justify, satisfy learning needs and goals, and think critically with the software system (Beck, Livne, & Bear,

2005; Hartnell-Young & Morriss, 2006; Lorenzo & Ittelson, 2005).

Educational technology systems have been continuously adopted in schools for the purpose of enhancing and improving learning outcomes. E-portfolios have been adopted, not only to enhance learning, but also to foster independent and lifelong authentic learning. E-portfolios can facilitate student learning through reflective practices, cooperative learning (peer groups and mentorships), career preparation, credential documentation, and presentation of evaluative-assessment and program-accreditation processes (Lorenzo & Ittleson, 2005). Portfolios in general, or e-portfolios in particular, can emphasize and serve both formative purposes and summative-assessment functions. Formative learning occurs in e-portfolios when students receive and include active feedback; reflect upon; and adjust, change or improve their work, as they create, build up, and develop their student e-portfolios (Bartlett, 2009; Buzzetto-More & Alade, 2008; Hartell & Skogh, 2015). Then, summative evaluation occurs during the final completion and submission of the e-portfolios (Bartlett, 2009; Oakley et al., 2013). At that point, it is either marked off as completed, graded with or without evaluative feedback, or any combination of these summative processes.

But, despite enthusiasm for and claims of learning benefits from them, e-portfolios in practice have seen their fair share of modest success compared to what has been promised. It has been well documented in prior studies that e-portfolio use has resulted in mere and simple compliance, and it has even been regarded with unwelcome sentiment (Chau, 2007; Chau & Cheng, 2010; Oliver & Whelan, 2011; Swan, 2009). According to Barrett and Carney (2005) and Chau (2007), in practice e-portfolios often lead to confusion and frustration. This is especially true if (a) technical support for users is not available or it is offered in a limited timeframe, (b) the conceptual purpose for adopting the e-portfolios is not clearly defined, (c) e-portfolio goals are not linked to curriculum goals, (d) assessment practices and methods are undefined or omitted from the e-portfolio objectives, and (e) ownership of student e-portfolios is not emphasized (Barrett & Carney, 2005; Bartlett, 2009; Chau & Cheng, 2010; Chien, Wu, & Hsu, 2014; Havelock, 2009; San Jose, 2017; Shroff et al., 2011; Shroff & Ng, 2013). Compliance refers to minimal engagement, sufficient to meet the evaluative requirements but without substantial engagement to learn the substantive goals (i.e., going through the motions of assembling materials according to a predated checklist; Barrett & Carney, 2005).

It is for these factors that it is necessary to explore and delve into elements of e-portfolios that lead to either compliance and/or learning. Structuring and arranging e-portfolios in a manner in which users are trained and supported, curriculum goals are clearly

linked, and assessment practices (formative and summative) are well-established and fully conceptualized, seem plausible implementation criteria. Thus, affordances and benefits from e-portfolios seem feasible. However, considerable research has shown issues and challenges with e-portfolios in practice (Deneen, 2014; Deneen et al., 2017; Hartell & Skogh, 2015; San Jose, 2017; Shroff et al., 2011; Vlachopoulos & Wheeler, 2013). Perhaps information technologies are like Alice walking through the looking glass, because while educators and learners can immerse themselves in technology, at the same time immersion introduces new subtleties to the intercommunication and social construction of learning (Dede, 1998). At present, it is not rare to witness compliance and lack of adequate integration of e-portfolios into courses and programs. Conflicting paradigms, purposes, and underdeveloped technology-based assessment systems have continued to plague e-portfolios (Deneen, 2013; Deneen et al., 2017; Hartell & Skogh, 2015; San Jose, 2017).

1.2 E-Portfolios at The University of Auckland: A Tale of Two Faculties

The University of Auckland is the largest university in New Zealand and it is ranked 81st worldwide, 56th for academic reputation and 20th in education (QS World University Rankings; 2016/2017). The University of Auckland is a research-intensive institution that emphasizes creative works from students and teaching excellence from teachers (McCutcheon, 2012). Further, the university prides itself in making significant contributions to the advancement of knowledge to serve its local, national, and international communities (McCutcheon, 2012). The research-intensive focus and promotion of innovative practices under the university's mission and values have promoted the implementation of e-learning practices in its curriculum, and this includes the adoption of e-portfolios in the Faculty of Education and Social Work (EDSW) and the Faculty of Medical and Health Sciences (FMHS).

At EDSW, University of Auckland, several different e-portfolio software platforms have been adopted and implemented for the purpose of what Barrett and Carney (2005) term the "story of learning," and to display satisfaction of the Graduating Teacher Standards (GTS; NZTC, 2010). The scope of practice for the Initial Teacher Education (ITE) and items that must be captured in a pre-service student teacher's e-portfolio include professional knowledge, professional practice, and professional values and relationships. All in all, the GTS consists of 29 standards, which are considered essential for successful entry to the teaching profession. Likewise, in FMHS, an e-portfolio software system has also been

implemented for nursing students to show program mastery and attend to the competencies for pre-registered nursing students (Nursing Council of New Zealand, n.d.). The overarching principle of the nursing competencies are divided into four domains: professional responsibility, management of nursing care, interpersonal relationships, and inter-professional health care and quality improvement. These domains consist of 24 competencies and indicators for accountability, responsibility, and development of complex nursing judgment to assess health needs and care.

Thus, these e-portfolios at the University of Auckland have been implemented to attest to the standards and competencies established by New Zealand government agencies and as an evidence portfolio of students' learning, mastery, and ability to adhere to the national standards of their professional practice. The GTS standards provide a comprehensive and summative assessment that requires students to show that they can develop, implement, and evaluate an integrated plan of teaching. Likewise, the nursing competencies require nursing students to demonstrate an encompassing plan for health care in intervention scenarios that require substantial scientific and professional knowledge and skills, and to demonstrate their mastery of clinical decision making around patient care and well-being.

Both programs adopted an e-portfolio solution to satisfy these specific standards and competencies. Additionally, e-portfolios are a purposeful method by which students demonstrate their knowledge and understanding across all courses with visibility, accountability, and reflection. Thus, the e-portfolio constitutes an effective tool for an end-of-program assessment.

1.2.1 E-portfolios in the ITE.

In the graduate diploma (GradDip) teaching program, two e-portfolios have been adopted to document pre-service teachers' course work and achievements. The GradDip teaching program at the University of Auckland is an intensive 1.25 years of full-time study which combines theory and practice. The program is designed for students who already hold a bachelor's degree and want to commence a career in teaching or in education. The primary and secondary teaching program adopted the MyPortfolio (Mahara) system, which was funded by New Zealand's Tertiary Education Commission on E-Learning Collaborative Development Fund (NZTC, 2010). In contrast, the early childhood education (ECE) teaching program adopted the Google Sites system, which is an open-source web system created by Google Incorporated for the promotion of portfolio development and a software-learning platform for users. Pre-service student teachers are required to use the e-portfolio software

platform assigned to their program to demonstrate fulfillment of the GTS standards by inclusion of curricular objects, lesson plans, teaching events, mentor-teacher evaluations, and critical-reflection statements. Then, by inspection and student presentation of their e-portfolios, the evaluators (i.e., course coordinators and assigned evaluators) are required to sign off that graduating pre-service student teachers have met and exhibit full satisfaction of the 29 standards.

1.2.2 E-portfolios in the FMHS.

In the FMHS, the faculty collaborated with the University of Auckland's Learning Technology Unit and Chalk & Wire to develop an e-portfolio software platform specifically usable for nursing students meeting their required nursing competencies. Chalk & Wire is a privately traded company and a higher education assessment software company, which created their first e-portfolio platform in 1995 (chalkandwire.com). Chalk & Wire offers a paid service and customizable e-portfolio software system solution. The Nursing Council New Zealand (NCNZ) developed the nursing competencies for pre-registered nursing students to adhere and attest to. The competencies indicate that registered nurses utilize complex judgment to evaluate health needs and provide patient care. Therefore, the platform had to allow pre-registered nursing students to capture and showcase their skills during clinical placements and trials (NCNZ, 2007). Similar to pre-service student teachers, nursing students are required to use the Chalk & Wire e-portfolio to exhibit competencies based on four domains, as they go through their program and clinical practice. The evaluation of nursing students' e-portfolios consists of a check list showing that they have met and satisfied all 24 nursing competencies.

1.2.3 Evaluating and exploring e-portfolio usage between two programs.

The importance in evaluating e-portfolios against the GTS and the Competencies for Registered Nurses is the e-portfolio for ensuring compliance (i.e., all standards and competencies have been ticked) or whether both pre-service student teachers and nursing students can use the system to demonstrate the standards and competencies in their own professional practices. Thus, the goal of this thesis is to examine whether students were able to: 1) draw upon discipline-specific theoretical knowledge and content in their use of e-portfolios, 2) reflect upon the relevant knowledge and content to show growth and development, and 3) exhibit the relevant standards or competencies within the e-portfolio environment. These points are important because of the likelihood that these challenges with

e-portfolios may interfere with students' learning, leading them to simply engage in compliance or simply go through the motions of assembling their e-portfolios without deeper engagement. Compliance is not necessarily problematic as it can be a form of task completion (i.e., it is either ticked or marked off as completed). However, if the goal of e-portfolios is for students to be in the center of their learning (i.e., student-centered) and for more meaningful learning from the system, then better evaluative practices within the e-portfolio domain and better understanding of how technology systems impact learning are required to ensure that e-portfolio usage, purposes, and learning quality align.

1.3 The Cost-Reward Analysis of E-Portfolios

The foundation of this study will involve the exchange or interplay of the utility of cost-reward dynamics within the theoretical foundation of the social exchange theory (Emerson, 1976; Thibaut & Kelley, 1959). The basic principle of the cost-reward analysis (i.e., the social exchange theory framework) is whether or not a complex blend of advantageous and disadvantageous behavior can be reliably reduced to a single factor. In other words, what is the specific cost factor of e-portfolios that will lead to compliance and what is the specific reward factor of e-portfolios that will lead to quality engagement the system?

The rewards from e-portfolio use can be observed as:

- the learner getting quickly on task because the system is easy to use,
- the learner being able to personalize his or her e-portfolio (i.e., increasing the personal value),
- clearly visible reflective summaries,
- visible communication and feedback from peers and tutors,
- a showcase of student works and artifacts, and
- fulfilment of the summative evaluation that rewards with professional certification.

Such a set of benefits should increase the user's understanding of the importance and usefulness of the e-portfolio. The e-portfolio, in this instance, is a necessary tool for his or her personal and professional growth. In this reward scenario, the buy-in and continued use of the e-portfolio is highly likely and the ownership of the system as a personal learning environment is also highly plausible. To that end, the e-portfolio is an ownership-based system and a compilation of personal value and achievements is a common by-product when e-portfolios are positioned in this manner.

On the other hand, costs of use involve such things as:

- difficulty in learning, operating, or using the technology system,
- time and resources spent in figuring out how to use the e-portfolio,
- e-portfolio goals not being linked to curriculum goals, and
- assessment practices being omitted from the e-portfolio's objectives or a lack of assessment functions within the mechanism of the software platform.

In these costly conditions, superficial compliance is a likely outcome. When users are faced with a steep learning curve within an educational technology, they are highly likely to disengage or abandon it altogether (Jafari, 2004; Oberg, 1964; Redmond, Devine, & Basson, 2014; San Jose & Kelleher, 2009). Learners, when faced with these types of educational technology costs or drawbacks, tend to complete just the necessary things (i.e., compliance) and interact with the technology as little as possible. If the value of e-portfolios is in the ownership of, and students taking responsibility for, their learning, then more is needed to bridge the gap between conceptualization of benefits to actual successful practice and use.

1.4 Research Significance

Barrett (2011) claims that the overarching purpose of e-portfolios is to create a sense of personal ownership over one's learning and achievements. When ownership of one's learning occurs, students are able to work toward authentic learning and mastery (Love et al., 2004). The e-portfolio becomes more than just education technology, but rather a representation of the student's identity and a narrative of the journey of growth and development reflected in high-quality e-portfolio engagement (Hecht, 2002; Love et al., 2004). Thus, for students, an e-portfolio can be more than simply a repository of their work or compliance with an end-of-program summative assessment. E-portfolios can be a system where they leverage their learning and transform it into their own personal learning environment and transparently represent their growth, development, and specialization.

For educators, the value of an e-portfolio is potentially high because it can help them focus their teaching more on higher order thinking (Love et al., 2004). It can also enrich the curriculum through additional content and creative assessment practices (Bartlett, 2009; Chau & Cheng, 2010; Deneen et al., 2017; Hartell & Skogh, 2015). From program and institutional perspectives, e-portfolios can be positioned as products and, therefore, collations of user achievements and course/program aggregated outcomes to represent measures of fulfillment of National Standards for accreditation, funding, and other educational or professional

organizational motives (Barrett & Carney, 2005; Jafari, 2004; Love et al., 2004; Oakley et al., 2013).

It matters how students are learning from technology such as e-portfolios, how teachers are supporting and evaluating our students, and ultimately, how e-portfolios can assist to improve the quality of student learning. The utilization of the exchange theory (i.e., cost-reward analysis), will potentially help in deepening our understanding and improvement of e-portfolio usage in higher education, through the exploration of factors (e.g., training and support, long-term benefits, and assessment practices) that can lead to improved user engagement, student ownership of learning, and greater conceptualization of e-portfolios as an assessment function. The establishment of these facilitating factors of e-portfolios in educational contexts and professional practice could effectively lead students and teachers to a set of guiding protocols as to how education-technology, such as e-portfolios, can become a powerful catalyst for high-quality student engagement, and possibly inform further innovative instructional and transformative learning-software development.

1.5 Structure of Thesis

Chapter 1 has presented literature on the concept of e-portfolios, benefits of and challenges with e-portfolios. It has elaborated on e-portfolios at the University of Auckland and proposed a cost-reward analysis to explore factors of compliance and learning from them. The second chapter reviews the literature on the social exchange theory framework and the conceptual cost-reward analysis of the successful implementation of e-portfolios. The chapter concludes with a discussion on the challenging issues around e-portfolios in practice and positions this thesis and study in exploring factors that facilitate high-quality engagement. Chapter 3 overviews the methodology, which consists of three studies from two different faculties, using mixed-methods. This involves retrospective interview feedback from users of e-portfolios, getting participants to indicate degree of agreement, factor analysis of responses to detect mathematical patterns that could be meaningfully interpreted in light of the literature, and verification of the factor structure through equation modelling. Chapter 4 presents a published manuscript (Study 1) that evaluates prevailing e-portfolios and compares the two e-portfolios utilized at the University of Auckland, EDSW. This chapter also includes the cost-reward analysis (i.e., post-discussion analysis) from Study 1. Chapter 5 builds upon the previous study (Study 1) and presents the data-analysis procedures and results of Study 2. Study 2 investigates beginning and graduating primary and secondary pre-service student

teachers using confirmatory factor analysis (CFA) and structural equation modelling (SEM) techniques. The chapter details the relationship of training and support and personalization to students' understanding of the items required for summative evaluation and the continued and long-term benefits of e-portfolios. Chapter 6 reports on the data-analysis procedures and results of Study 3. Study 3 employs the dimensions of student ownership of learning with e-portfolios as a cost-reward analysis and identifies tensions between compliance and learning.

The last chapter summarises the overall findings and discusses possible implications of the data. From a series of interconnected studies, an integrated understanding has grown of the facilitating factors of e-portfolios (i.e., training and support, personalization, and assessment practices) and the conceptual relationship between technology use, assessment, and improved quality student engagement with e-portfolios. This chapter also concludes with possible directions for future research based on the findings and results generated by this research.

Chapter 2. Literature Review

The previous chapter presented an introductory overview of the affordances from and the challenges with e-portfolios in practice. Research has confirmed that difficulty with e-portfolios occurs not only in the adoption and implementation of the technology, but also in understanding how software technologies are being utilized to demonstrate the objectives and purposes of the curriculum design and how e-portfolios work as a technology-enabled assessment (Chien et al., 2013; Deneen, 2014; Deneen et al., 2017; Hartell & Skogh, 2015). Jafari (2004) labelled this as the *human aspect*. The human aspect of the software design deals with the requirements intended to satisfy the desires and needs of the end user (Jafari, 2004). In an educational context, this includes teachers' and students' needs and goals, learning and assessment processes, and the overall purpose of the software system in connection with the learning objectives, for example professional external standards. The technology implementation is the *computer aspect*. The computer aspect of the software design mainly concerns the mechanism and the user interface or usability, that is whether it is easy or difficult to use (Zaharias & Poylymenakou, 2009). Therefore, the successful adoption of e-portfolios hangs on the alignment of the human and computer aspects of the system design.

Given the scale of e-portfolios and the differing purposes of the system, this chapter presents a review of the literature of the social exchange theory as a framework to position the cost-reward analysis of e-portfolios. This is then followed by literature on e-portfolios as an educational technology, on classification, and on the taxonomy of the stages of maturation of e-portfolios. Conceptually, these reward factors and affordances from e-portfolios are the factors and components of e-portfolios (i.e., benefits from and assessment practices of e-portfolios) that will lead to improved student engagement and, potentially, learning with the system. Lastly, the chapter will conclude with the cost factor and challenges with e-portfolios in practice. The information highlighted, and the objectives of the thesis have provided a rationale for the need to determine a cost-reward analysis of e-portfolios.

2.1 E-Portfolios and the Social Exchange Framework

E-portfolios and the social exchange framework may shed some light on which cost components lead to compliance and which reward factors will result in quality learning with e-portfolios. Elements of exchange theory such as reward, reinforcement, cost, utility, resource, comparison level, and profit, and so on, blend ordinary and technical vocabularies

of research in psychology and economics (Emerson, 1976; Thibaut & Kelley, 1959). Reward is virtually synonymous with positive reinforcement – satisfaction and success (Van den Beemt, Ketelaar, Diepstraten, & De Laat, 2018). On the other hand, though, cost is in the form of the aversive stimuli encountered, such as the process being painful or boring, or taking time and effort that could have been spent otherwise (Van den Beemt et al., 2018).

The cost components of e-portfolios could be the technology system itself being difficult to use, or a lack of support and proper training to use the system effectively. The costs could also be in the integration and implementation processes by which the system appropriately reflects the curriculum design and assessment practices. While the reward components of e-portfolios could be their transparency and their emphasis on reflective practices, or formative assessment, they could also be in the showcasing of achievement and skills for leveraging e-portfolios for future employment or career advancement, or in the satisfaction of the objectives and goals, or summative assessment. The exchange theory framework isolates user experience and the specific cost factor that will lead to compliance, and the reward factor that will lead to improved engagement with e-portfolios.

For instance, Deneen et al. (2017) asserted that a better understanding of e-portfolio success or failure will come through the simultaneous interaction of the mechanical aspects of technology and assessment practices in e-portfolios. Therefore, the question is whether the assessment practices of e-portfolios or the lack of thereof will lead users simply to comply and go through the motions of assembling materials according to a checklist of objectives. If the system is too difficult to use, will this cost component lead users to disengage (Redmond et al., 2014; San Jose & Kelleher, 2009) and, once again, simply go through the motions of compliance? Similarly, will the assessment device of e-portfolios, that is the utilization of both formative and summative-assessment functions, lead to improved engagement and learning, high-quality engagement with the system? In this instance, the exchange theory presents two standards of comparison by which to evaluate a given outcome. Thibaut and Kelley (1959) called this the comparison level. It is the weighing of the tension between the cost-reward and the comparison level that is the threshold at which an outcome seems attractive. For instance, when e-portfolios are used to demonstrate student learning with both formative and summative-assessment functions, will this then show observable rewards from e-portfolios? Or, if the e-portfolio is easy to use and users are able to demonstrate their learning from the system, through satisfaction of learning objectives or external professional standards, will this also show observable rewards from e-portfolios? For all intents and purposes, the utilization of the social exchange theory and the cost-reward analysis will

potentially help to expand our knowledge and will serve to identify factors which will improve student engagement with e-portfolios.

Van den Beemt et al. (2018), examination of teachers' motives for participating in e-learning networks, found that if teachers do not feel part of a professional community, their engagement in networking activities is not self-evident because they will look for a cost-rewards balance. This means teachers will look for benefits from positive engagement in e-learning networks to maintain a connection with others. This consists of ICT-mindedness; direct benefits from the learning management system (LMS), with respect to e-networking within the LMS; and the observable reward, for being part of the e-learning network group, to his or her professional practice. The connection of Van den Beemt et al.'s (2018) study to the current research undertaking revolves around the understanding of the reward factor of being part of the e-learning network and the direct benefits of it to professional practice. In e-portfolios, learners' engagement can improve if reward and benefits can have an immediate effect on learning, development, and future professional practice.

Fortunately, the e-portfolio can be positioned as an owner-centric and an evidence-based system that encourages students to take ownership and responsibility for their learning (Shroff et al., 2013). Several benefits and affordances from e-portfolios also lie in increased personal value, reflective practices, growth, and the development of the system as a personal learning environment (Barrett, 2009; San Jose, 2014; Shroff et al., 2014; Tyler, 2017). The literature on e-portfolios seems to suggest the reward factors of e-portfolios in practice are highly plausible, but, yet, there seem to be components of e-portfolios, such as cost, that prevent users from benefitting from and experiencing the affordances from use.

The next section discusses the conceptualization of e-portfolios, classification of e-portfolios, and the taxonomy stages of e-portfolio maturation.

2.2 The Classification of E-Portfolios and the Stages of E-Portfolio Maturation

By and large, technology enthusiasts regard ed-tech as the answer to advancing and cultivating meaningful learning in the 21st century (Hew & Brush, 2006; Hughes, Thomas, & Scharber, 2006). Since the advent of computers in the mid-1970s, educators have been fascinated with the affordances from technology systems and in transforming education to improve teaching and learning (Hughes et al., 2006; Laxman & Holt, 2017; Lui & Tsai, 2013). There are several unique advantages in using education technology such as computers,

software systems and applications, and the Internet; as research studies in education demonstrate, these can help improve students' inventive thinking or problem solving (Salmon, 2002). Technology can also improve students' self-concept by promoting meaningful learning through real-world problem solving (Laxman, 2010; Laxman & Holt, 2017). The belief that technology can positively impact student learning has led to several government agencies, private corporations, and institutions investing in programs that promote technology use in classrooms (Blackley, Bennett, & Sheffield, 2017; Lim & Lee, 2014; Tyler, 2017).

The development of e-portfolios out of the faculty-assigned, print-based student portfolios dates back as far as the mid-1980s. E-portfolios gained educational traction because not only do they document and showcase a body of student work, but also they grant students opportunities to develop critical thinking skills, reflective practices, and promote independence and ownership of their learning (Blackley et al., 2017; Sherman & Byers, 2011; Shroff et al., 2014; Shroff et al., 2013). This is because e-portfolios are highly customizable and allow learners to create their own learning goals, express their own views, and publicly showcase their growth, development, and specialization (Ayala, 2006; Barrett, 2011; Lim & Lee, 2017; Sheffield, Blackley, & Bennett, 2016). In essence, the diverse and multiple purposes of e-portfolios may cater to several different types of learners and purposes to satisfy any personal, learning, and professional goals or external standards and competencies.

2.2.1 Classification of e-portfolios.

There are several different types of e-portfolios and each portfolio represents different uses and purposes. For instance, there are artist portfolios, which consist of a collection of artworks that usually includes the person's best work (Barrett & Carney, 2009). Artist portfolios may also include breadth or a range of artworks to show diversity of ideas, and concentration such as a body of artworks based on the artist's investigation, growth, and discovery (Lim & Lee, 2017). Comparatively, teacher portfolios are portfolios that showcase teaching and personal skills (and may also include breadth and concentration), and teacher accomplishments for career development (Sheffield et al., 2016). Teacher portfolios can show publications, courses taught, teaching syllabi, learning objectives and activities, and teaching awards (Mansfield, Beltman, & Price, 2014). There are also financial portfolios; this type of portfolio shows financial and fiscal transactions (Barrett & Carney, 2009), and can also show monetary losses and gains or the entire earnings of a person (Barrett & Carney,

2009). Table 1 presents the classification of different types of e-portfolios. It also provides examples and the functionality of e-portfolios presented. For the purpose of this thesis, the primary aim is to explore elements of student e-portfolios.

Table 1

E-Portfolio Classification

Types of E-Portfolios	Example	Functionality
Professional	Artist, Writer, Model, Actor portfolio	Collection of art, written work, photographs. Portfolios usually include only a person's best work (Barrett & Carney, 2009).
Teaching	Teacher portfolio	Teaching portfolios can serve as documentation of skills and accomplishments for career development (Lorenzo & Ittelson, 2005). They are also used for critical reflection and teaching purposes; and can be used to introduce one's self and show publications and accomplishments (Mansfield et al., 2014).
Student	Student portfolio	Student portfolios are considered an official representation of a particular learning experience or skill achievement (Lim & Lee, 2017). They are used for critical thinking, reflection, and learning growth (Love et al., 2004). They contain work that a learner has collected, reflected on, and selected; they show growth over time (Barrett & Carney, 2009). They can also serve to satisfy course and program standards and competencies (San Jose, 2017).
Financial	Fiscal transaction	Financial portfolios contain a comprehensive record of fiscal transactions and investment holdings that represent a person's monetary worth (Barrett & Carney, 2009).
Institution	School portfolio	An institutional portfolio, typically, presents a selection of authentic work, data, and analysis that demonstrates institutional accountability and serves as a vehicle for institution-wide reflection, learning, and improvement (Lorenzo & Ittelson, 2005).
Others	Corporate prospectus, personal portfolio, collector's portfolio etc.	There are several other different portfolios consisting of a collection of information: corporate (company prospectus), personal, or other forms of information that can be showcased and evaluated (Barrett & Carney, 2009; Lorenzo & Ittelson, 2005)

Many institutions, commonly in higher education, are using student e-portfolios as a way to demonstrate what learners have learned (Barrett, 2009; Buzzetto-More & Alade, 2008; Lim & Lee, 2017; Hartell & Skogh, 2015). Typically, learners begin with a blank web page. Next, students are able to upload or link different multimedia materials such as electronic documents (Word documents, Google documents, text files such as txt., ptt., xls.,

csv., etc.), portable document files (PDF), image files (jpeg., tiff., & png.), sound files (wav., mp3., mp4., etc.), hypertext markup language (HTML), and video files (avi., wmv., mov., & mp4.) to show transparency of works, artifacts, peer and teacher feedback, evaluation and assessments, personal and professional philosophy, certifications, accomplishments, curriculum vitae, cover letters, and other personal and professional information about themselves.

Student e-portfolios have several different functions, objectives, and goals. The objectives and goals of e-portfolios are (normally) structured by the instructor, but how these objectives and goals are satisfied, for example what to upload and the justification for how it satisfies, are up to the student. Moreover, e-portfolios are also utilized to promote critical thinking, reflective practices, transparency of learning, sometimes visibility of growth and development, and have some form of summative assessment upon submission (Bartlett, 2009; Havelock, 2009; Lorenzo & Ittelson, 2005; Love et al., 2004). Lastly, e-portfolios can also serve to satisfy any professional external standards and competencies such as teaching standards and nursing competencies (San Jose, 2017).

The affordance from e-portfolios may accommodate and provide advantageous proceeds to stakeholders, including teachers, students, course coordinators, digital learning designers, and program and institutional leaders, due to the flexibility and versatility of this educational tool. Similar to any ed-tech, the attractions of e-portfolios are the *portability*, *communication*, *collaboration*, *interaction*, *presentation*, and *online learning environments* they promote (Blackley et al., 2017; Hughes et al., 2006; Koole, 2009; Romrell, Kiddler, & Wood, 2014; Sheffield et al., 2016). These attractions can be described as follows:

- *Portability*. Portability can be defined as offering the ability to learn at different times, in different places, and increasing accessibility of learning opportunities for users (Blackley et al., 2017; Hughes et al., 2006; Laxman & Holt, 2017; Puentedura, 2013). Vlachopoulos and Wheeler's (2013) study of reflective practices with e-portfolios found that students were able to reflect on their learning through the process of collecting, selecting, and self-scrutiny of the artifact they uploaded to their e-portfolios. Once again, this can occur using any device, anytime and anywhere.
- *Communication*. Communication processes in e-portfolios tend to be in some form of computer-mediated communication (CMC) such as email, direct messaging, or posting on comment boxes or walls, and can be enabled as a push notification. Kaplan and Haenlein's (2009) study of wiki-based websites, a form of e-portfolios, reported

that students expressed enjoyment with the use of wikis during the length of the course. Users expressed that the collaborative approach to learning in wikis was highly informative and beneficial to their learning (Kaplan & Haenlein, 2009).

- *Collaboration*. Collaboration in e-portfolios is in the form of discussion-type walls and comment sections based on what students have uploaded and posted, such as works, activities, and achievements, onto their e-portfolios. According to Salmon (2002), this form of discussion and peer-collaborative approach to learning can expand student ideas and learning. Nguyen's (2012) qualitative analysis of learning with blogs examined the use of a peer-feedback tool in learning English writing among Vietnamese EFL students. Students were to post or blog their writing draft and they were required to peer review and comment on each other's work. Peer reviews and comments were then taken into consideration and students were allowed to revise their written work prior to the official submission. This form of collaborative approach to learning is what e-portfolios are about. Positioning e-portfolios with a reflective practice approach and promoting peer-to-peer and teacher-guided feedback increases the quality of learning with e-portfolios.
- *Interaction*. The interactivity of e-portfolios is not just the immediacy of communication but also the personalization and customization of the system. Users normally create a profile where they populate personal and professional information, interests, philosophy, values, goals, and skills. The value in students' interaction with their e-portfolios is in the increased control over their learning. According to Shroff et al. (2014) students' control of their learning occurs when they take ownership of their learning; one way to increase ownership is for them to personalize their e-portfolios.
- *Presentation*. E-portfolios enable the presentation of student achievements and exemplar works to the public. The showcasing feature of the system not only allows accountability and public examination but highlights students' growth and development. San Jose (2017) also expressed that showcasing personal abilities and achievements can stimulate active planning, outcome sharing, and making oneself responsible for one's personal goals.
- *Learning environment*. Learning, of course, is always the primary goal in any ed-tech or learning management system (LMS; Cuban, Kirkpatrick, & Peck, 2001; Hattie, Brown, Ward, Irving, & Keegan, 2006; Havelock, 2009). In e-portfolios, learning can be promoted if the system is integrated into the core curriculum design, and

assessment practices are embedded (Bartlett, 2009; Blackley et al., 2017; Sheffield et al., 2016). Positioning e-portfolios as a personal learning environment enables students to work toward mastery of each teaching and learning assignment and to display achievements in a curricular context (San Jose, 2017).

2.2.2 Stages of e-portfolio maturation.

In effect, an e-portfolio can be a transformative software system that can assist students towards authentic learning. But, for this to occur, the technology features and usage protocol of e-portfolios need to align. According to San Jose (2014), e-portfolio maturation occurs when the technology system becomes more sophisticated and more interactive (i.e., from a hard-copy portfolio to a fully digitized and web-accessible software system), and in connection with how the system is being used, in terms of teachers, students, administration, and institutional entities utilizing the e-portfolio in all aspects of their daily tasks. For instance, a fully integrated e-portfolio, maturation level 5, is student-controlled and student-centric (i.e., the e-portfolio is owned by the student). It will be personalized with the student's personal and professional information and he or she has the ability to "showcase" or make it private (Mansfield et al., 2014; San Jose, 2017). It is an enhanced communication mechanism and will be populated with multimedia messages such as feedback, reflection, and self-appraisal from peers, teachers, mentors, recruiters, employers, and with self-scrutiny and reflective practices (Lim & Lee, 2017; Tyler, 2017). Further, teachers can use the e-portfolio as a "virtual classroom" complete with faculty and program objectives and goals, specific syllabi, assignments, additional help and resources, student work examples, and comprehensive assessment criteria (Barrett, 2009; Love et al., 2004). For the institutional entities, e-portfolios at this level are highly efficient and economical because the institution can repeat the instructional design by copying course content from one instructor to the next and can use assessment data to assist, improve, and fund specific courses and programs (Mansfield et al., 2014).

Figure 1 shows the taxonomy and the stages of e-portfolio maturation. According to San Jose (2014) and Lim and Lee (2017), the taxonomy of e-portfolios represents the stages of system usage and an implementation strategy for educators and institutions to follow. The criteria for ascertaining the level of maturation of e-portfolios are based on the type of educational tool (i.e., paper-format portfolio or an electronic portfolio) that is being used by the teacher or institution, and how the portfolio is integrated into the core curriculum goals of

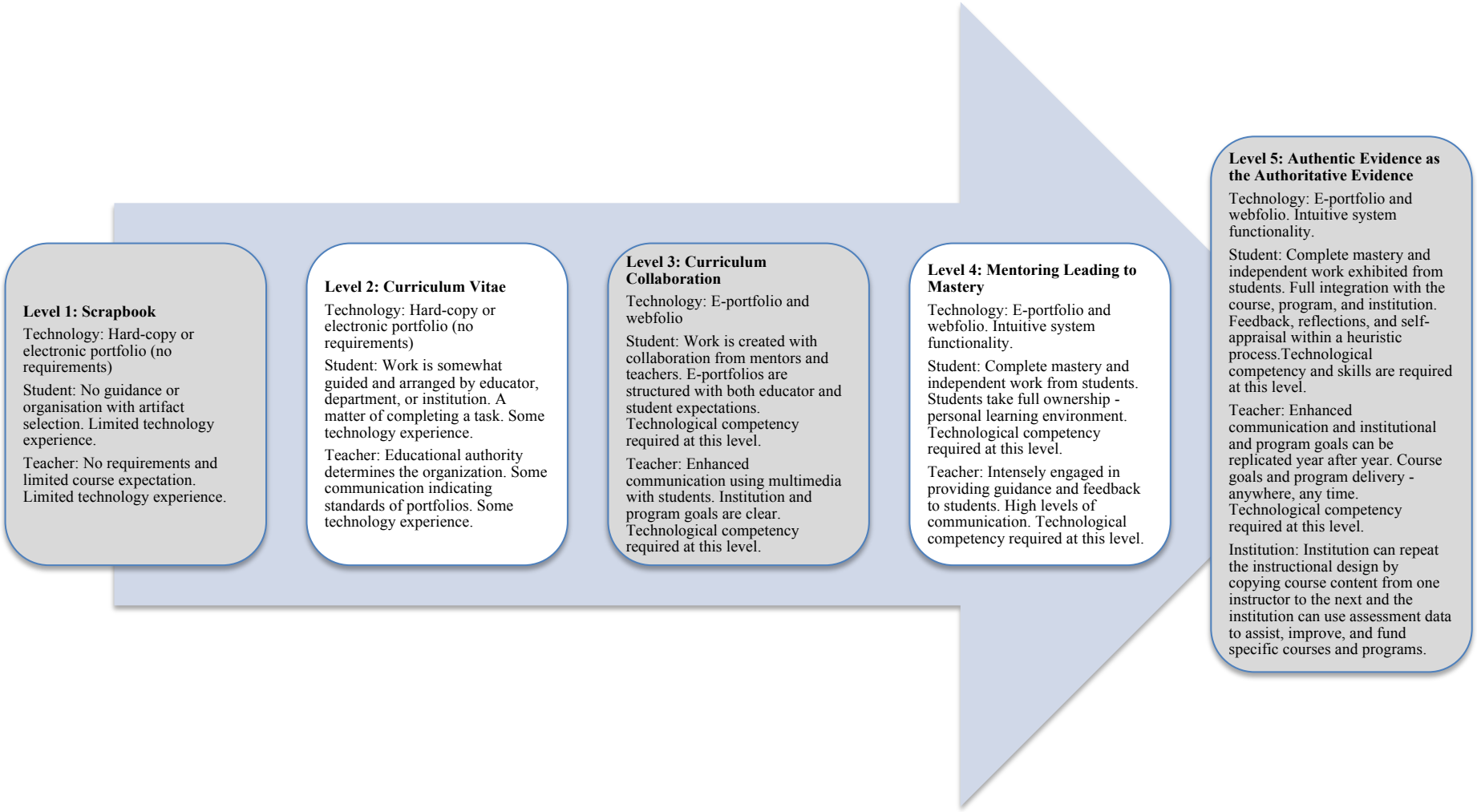

Figure 1. The taxonomy stages of e-portfolio maturation (Love et al., 2004; San Jose, 2014)

the course and program. Therefore, Love et al. (2004) determined the stages of e-portfolio maturation by categorizing the physical (i.e., technology features) and theoretical qualities inherited in the portfolio/e-portfolio processes: level 1: scrapbook; level 2: curriculum vitae; level 3: curriculum collaboration; level 4: mentoring; and level 5: authentic evidence for assessment, evaluation, and reporting.

The stages of e-portfolio maturation are as follow (Balaban & Bubas, 2010; Love et al., 2004; San Jose, 2014):

- *Level 1: Scrapbook*. At this initial stage, students' e-portfolio usage does not reflect course and program learning objectives. Students collect some of their course work and achievements but reflections are unguided. Students' work may be arranged in chronological order but viewers can only guess at the meaning of each item (Love et al., 2004).
- *Level 2: Curriculum vitae*. At level 2, the collection of students' work is guided and driven by a teacher, mentor, or department and institutional goals (Balaban & Bubas, 2010). E-portfolios are organized and structured with a purpose. However, there is very little consistency in the student-generated content and students do not fully assess the importance of the e-portfolio. The educational authority determines the organization and purpose, and students merely conform.
- *Level 3: Curriculum collaboration between student and faculty*. Students understand the purpose and value of the system. Collaboration is visible through the enhanced level of communication and reflections between student and teacher. Communication and presentation consist of papers, photographs, videos, and appropriate feedback among students, teachers, mentors, and possible recruiters/employers (Love et al., 2004).
- *Level 4: Mentoring leading to mastery*. Love et al. (2004) stressed that at this level of e-portfolio maturity it is more than just "meeting minimum standards" or to "please the professor" (p. 30). E-portfolio technology platforms are intuitive with complete training and technical support for learners and educators. Students have gained ownership of their e-portfolio and view it as their own personal learning environment.
- *Level 5: Authentic evidence as authoritative evidence for assessment, evaluation and reporting*. E-portfolio usage is organized by curricular requirements and standards established by a nucleus of effort from educators, program leaders, and the institution (Love et al., 2004). Students' use is at the maximum level. Educators and the

institution perform formative and summative assessments through the e-portfolio and program goals are highly visible and easily linked.

It is necessary to review the literature on the classification and taxonomy stages of e-portfolio maturation, as it provides a clear typology and an understanding of what e-portfolios are all about. However, as stated by Love et al. (2004), higher level or quality engagement with e-portfolios must also adhere to the technology features of the software system. Fundamentally, the technology features of an e-portfolio are the core functionality of the system. For instance, an e-portfolio must have storage capabilities, similar to a hard-copy portfolio, and requires a folder or electronic folders for users to upload to and in which to store electronic files.

The next section will further discuss the essential technology features of e-portfolios and the core system functionality that makes up what e-portfolios are all about.

2.3 The Essential Technology Features of E-Portfolios

The essential technology features of e-portfolios are the core system features that constitute an e-portfolio software system by definition. For that reason, five key technological features have been identified through careful inspection of e-portfolio literature and research: (i) electronic storage capabilities to store user information and artifacts, (ii) personalization and customization of the system, (iii) the ability to showcase selected artifacts and achievements, (iv) communication for reflection and feedback, and (v) evaluation and assessment processes (Chau, 2007; Imhof & Picard, 2009; Jafari, 2004; Love et al., 2004; Shroff et al., 2014; Swan, 2009; Vlachopoulos & Wheeler, 2013). The purposes of these essential technology features are to define what e-portfolios are and to allow users to achieve their learning purposes, objectives, and goals within the e-portfolio environment. These essential technology features are as follows:

- *Electronic storage*. E-portfolios permit upload, storage, and retrieval of documents and digital objects. Storage capacity must align with expected user requirements and permit a variety of electronic files such as text, image, audio, video, and common Microsoft Office application document types (e.g., spreadsheets, presentations, etc.) to be uploaded and stored. Some e-portfolios allow embedding and hyperlinks or linking of web pages and other media sites.
- *Personalization*. User control – personalization and customization – over the system reduces the learning curve and increases responsibility and ownership of the system

(Shroff et al., 2014). Personalization consists of entering personal and/or professional information. Some e-portfolios have a profile page where users can populate their information. Once again, e-portfolios begin with a blank web page (i.e., no content) and it is up to the student to populate his or her page via text, image, audio, or video files. Some e-portfolios have "skins," which allow different colorful or image content around the borders of the web page. According to Baeten et al. (2008), students want to have control over the e-portfolio design, what to include and exclude, so as to best represent who they are, especially if certain parts of the e-portfolio are required to be publicly accessible.

- *Showcasing*. Another important requirement of an e-portfolio is the flexibility and ability to purposively showcase (as it has the option to remain private) and highlight the student's work and achievements. Flexibility in this aspect of the technology adds utility to the user in that different "virtual identities" and individual stories can be carried and communicated through the e-portfolio environment (Blackley et al., 2017; Sheffield et al., 2016). Showcasing is important because students can leverage their e-portfolio as a self-marketing website to show potential and existing employers their capabilities (Shroff et al., 2013).
- *Reflection and feedback*. The reflective process in an e-portfolio shows formative learning and can communicate the process of student learning and development. An e-portfolio and the accessibility of CMC within its mechanism can promote reflective processes and self-scrutiny of experiences if guided by the teacher for better results (Hartnell-Young & Morriss, 2006; Imhof & Picard, 2009; Vlachopoulos & Wheeler, 2013). E-portfolios that permit both confidential and public feedback from peers, instructors, tutors, supervisors, and future employers are likely to enhance the personal and professional value of the system (Buzzetto-More & Alade, 2008; Vlachopoulos & Wheeler, 2013).
- *Assessment*. E-portfolios can have both formative and summative purposes. E-portfolios can be supplemented with reflective practices (assisted or unassisted) and other assessment tools such as electronic rubrics and built-in system-evaluation mechanisms showing completion of tasks. Whatever assessment framework and mechanisms are used, it is imperative that instructors provide a clear and responsive support for learners, which illustrates precisely what the student is learning, and how he or she is evaluated (Deneen, 2014; Deneen et al., 2017).

It is relevant to specify that not all e-portfolios have all of these essential technology features built in. Several different substitutions or work-arounds have been deployed by teachers, digital learning designers and users to alleviate the lack of certain technology features. For example, evaluations and assessments carried out through the e-portfolio must articulate the learning goals and allow complex and subjective skills to be measured (Blackley et al., 2017; Deneen, 2014; Deneen et al., 2017; Lim & Lee, 2014). This, of course, can be difficult if the in-system assessment mechanism of e-portfolios are not enabled or not built-in. Yet, external rubric assessments and learning-objective pellucidity can be relayed to students early and often during the course or program. Other work-arounds for missing or unavailable essential technology features include storage and files. E-portfolios without storage or cloud-space file capabilities will require users to use portable thumb drives, external hard drives or cloud-storage sites such as Dropbox, or Google Drive. Some e-portfolio sites, such as blogging e-portfolio sites, do not have privacy settings, which means all works are public by default. Moreover, certain e-portfolios do not have comment or feedback capabilities and thus require users to communicate via email or Word documents, or other related text-based files. Lastly, other e-portfolio software platforms only allow basic e-portfolio layouts (i.e., white space) and consequently, personalization and customization are not available.

It has been suggested that successful implementation of an e-portfolio is often subverted by the technology characteristics because it is either too difficult to use or it does not have the essential technology features (i.e., assessment practices) required to meet user needs and goals (Deneen, 2014; Deneen et al., 2017; Sheffield et al., 2016). For this reason, the initial research objective of this study is to sample open source and current known e-portfolios being used at EDSW and FMHS and the essential technology features.

In Blackley et al. (2017), the simultaneous interaction of the technology mechanisms and the assessment practices of e-portfolios challenged students' epistemological understanding of themselves, and the interpersonal and intrapersonal reflections needed to make decisions about layout, content, detail, and relevance contributed to the transition from personal student identity to professional teacher identity. The rationale for evaluating the technology, learners' perspectives, cost-reward factors, assessment practices, and how elements of e-portfolios may be beneficial to learners as they transition from pre-service student teachers to professional registered teacher identity.

The following sub-section discusses these essential technology features of e-portfolios and how they can impact the *usability* of the system: how easy or difficult they are to use

and/or how helpful or not helpful they are in meeting and satisfying user needs and professional practice goals.

2.3.1 The usability of e-portfolios.

The usability evaluation of an e-portfolio depends on the experience students have with the system. Therefore, usability can be defined as the performance of the e-portfolio in effectively and efficiently meeting and satisfying students' needs and goals such as meeting and satisfying the course objectives and the professional external standards. According to Zaharias and Poylymenakou (2009) usability is a "heuristic" evaluative approach of ed-tech systems, which focuses on all aspects of the learning design of the system. For instance, the navigation menus and dashboards, or user interface, need to be accessible and easy to use. Next, the e-portfolio must be free from technical and operational problems so that users are able to learn the system, and learn from the system, quickly. Lastly, the system must allow for interactivity, instructional feedback, customization, and instructional assessment design (Zaharias & Poylymenakou, 2009).

The connection between the essential technology features and usability of e-portfolios is in how the system, as an educational tool, supports learners in learning the didactic content material while devoting minimal effort to actual interaction with the system. The ambition of this research undertaking is that it will ascertain the cost-reward factors including the examination of the essential technology features and usability of e-portfolios. Next is the review of the affordances and benefits from e-portfolios, prior to the challenges or cost components of e-portfolios.

2.4 The Affordances and Benefits From E-Portfolios

In e-portfolios, learners build, customize, and manipulate the system in a self-directed and goal-oriented fashion (Chau & Cheng, 2010). Thus, the affordances and benefits from the e-portfolio come not only through the completion of a task but also through the creation process (Allan & Cleland, 2012; Shroff et al., 2011). Hartnell-Young and Morriss (2007) labelled this process as the integration of the learner's personal vision into their own learning, while Milner-Bolotin (2001) and Shroff et al. (2014) labelled it as students' ownership of learning with e-portfolios. The conceptualization of the term *ownership* has roots in student self-regulation (Brown, 2011). Self-regulation views learners as metacognitively and behaviorally proactive participants in their own learning processes (Brown, 2011). In an e-portfolio setting, students are proactive participants in their learning as they must create and

develop their e-portfolios starting from a blank web page. Basically, students' work on their e-portfolios ranges from satisfactory and compliance with what is required of them, to developing exemplary e-portfolios based on their vision, growth, development, and on satisfying and exceeding the required elements of assessment. Hence, some proactivity, self-regulation, and learner's vision are required to have an e-portfolio suitable for submission and evaluation.

To further address the reward analysis of e-portfolios, Chau and Cheng's (2010) study drew attention to how e-portfolios impact student learning in terms of being: (1) an equalizer, (2) an authorship enabler, (3) a technology extender, and (4) a community connector (See Figure 2).

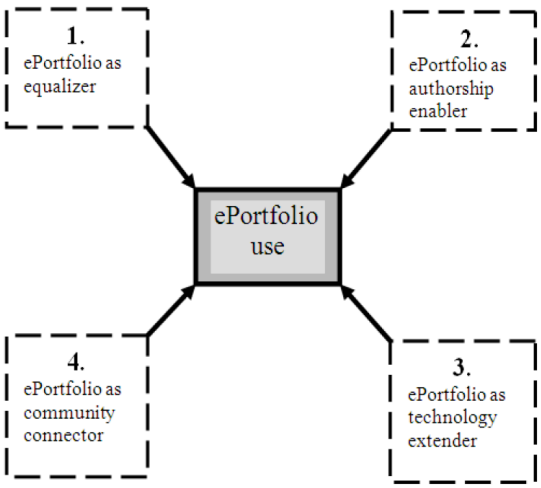

Figure 2. Chau and Cheng's (2010) affordances and benefits from e-portfolio use.

1. *E-portfolio as equalizer*. Learners have the opportunity to use several different multimedia materials and a variety of digital tools to demonstrate their learning with the system (Chau & Cheng, 2010). This process creates equity for learners, as they have the option to create and build their e-portfolio based on their personal and professional needs and goals. Learners are able to showcase what they have learned, and how they learned, in any format they want. Abrami and Barrett (2005) added that this is advantageous to learners with different learning styles and preferences as learners have complete control of the e-portfolio creation. This is because the system is flexible and allows multiple different digital files to be created, uploaded, stored, and coded. Regardless of whether a learner is a visual or aural learner, the system can accommodate any learning style. Learners of diverse learning styles and preferences

have the technology options for aligning authentic real-world examples of knowledge, skills, and dispositions (Chau & Cheng, 2010).

2. *E-portfolio as authorship enabler*. One of the core functionalities of e-portfolios is the ownership of a student's learning through the creation and building of the system. The system creates a sense of authorship through what learners select and choose to present or withhold (Chau & Cheng, 2010). Once again, learners begin with a blank digital web page and it is up to the student to create, develop, and build his or her e-portfolio through personalization, editing, adding texts, images, uploading, and embedding multimedia software items. E-portfolios are highly customizable, as the author's voice is promoted and affirmed through the system (Chau & Cheng, 2010). According to DiMarco (2006), this is a powerful concept and an outcome of our current ICT-rich society. Significantly, learners can be at the center and the agent of learning if they so choose.
3. *E-portfolio as technology extender*. E-portfolios have the capacity to teach learners about technology (Buzzetto-More & Sweat-Guy, 2007). Utilization of ICTs and software systems requires some technical understanding and competency skills. Learners will need some basic to advanced technological skills to operate the system. Depending on their technological abilities, acclimatizing to the system can be challenging or seamless. As all technology usage goes, training, support, and guidance must be a priority. Hartnell-Young and Morriss (2007) conveyed that e-portfolio usage focuses on its capacity to allow simple to sophisticated manipulation, creation of images, sound files, videos, and other new forms of communication to occur multi-modally.
4. *E-portfolio as community connector*. With e-portfolios, learners can communicate and connect with peers and other online communities if they wish to make their e-portfolio public (Chau & Cheng, 2010). Most common e-portfolios are online and accessible through the Internet. Learners are able to use their smart phones, tablets, and computers to access the system. E-portfolios allow learners to post and access online discussions in a collaborative form of communication via computer text, images, sound bites, web conferencing, web cast, blogs, and wikis (Abrami & Barrett, 2005). Communication and feedback are sometimes in a congratulatory form from peers, mentors, and teachers but often are directed in an instructive manner where learners are able to adjust and manipulate their learning. When e-portfolios are positioned as a community connector, they open up to a wider audience and provide unlimited

potential for networking opportunities (Chau & Cheng, 2010). E-portfolios can also serve as a personal and professional communication tool to help employment, job security, career advancement, to chronicle achievements, and for distribution of any personal and professional information (DiMarco, 2006).

The review of Chau and Cheng's (2010) e-portfolio use and benefits offers promise, and contributes to the reward analysis of e-portfolios. The next reward analysis to review is students' ownership of learning with e-portfolios. The terms *ownership*, or *to own* one's learning have been widely used by e-portfolio proponents, especially when describing the affordances and benefits from e-portfolios (Buzzetto-More & Alade, 2008; Edwards, 2015; San Jose, 2017; Shroff et al., 2014; Shroff et al., 2013).

2.5 The Student Ownership of Learning with E-Portfolios

Milner-Bolotin (2001) described student ownership of learning based on the factors of *personal value*, *feeling of control*, and *taking responsibility*. Ownership of learning requires learners to take responsibility for their learning and understand how this knowledge is connected to their prior knowledge (Milner-Bolotin, 2001). The process of involvement and decision making lends itself to the sense of responsibility or feelings of accountability and control (Milner-Bolotin, 2001; Shroff et al., 2013). In e-portfolios, students can work independently and, most often, they are required to link what they have uploaded and posted on their e-portfolios to specific learning objectives and goals. Personal value is then increased if these posts and links to specific works are also engaging (and connected) to the student; that is, he or she sees the benefits from and personal importance of them as they increase his or her knowledge/skills (Shroff et al., 2014). The feeling of control in e-portfolios occurs when students perceive that they have reasonable independence in the learning process (Shroff et al., 2013). Taking responsibility occurs in the selection and decision making about which works and achievements to showcase (Shroff et al., 2013).

Figure 3 is the visual representation of the framework of student ownership of learning and the interaction between the three factors of personal value, feeling of control, and taking responsibility. The highest level of student ownership of learning occurs when all three factors overlap.

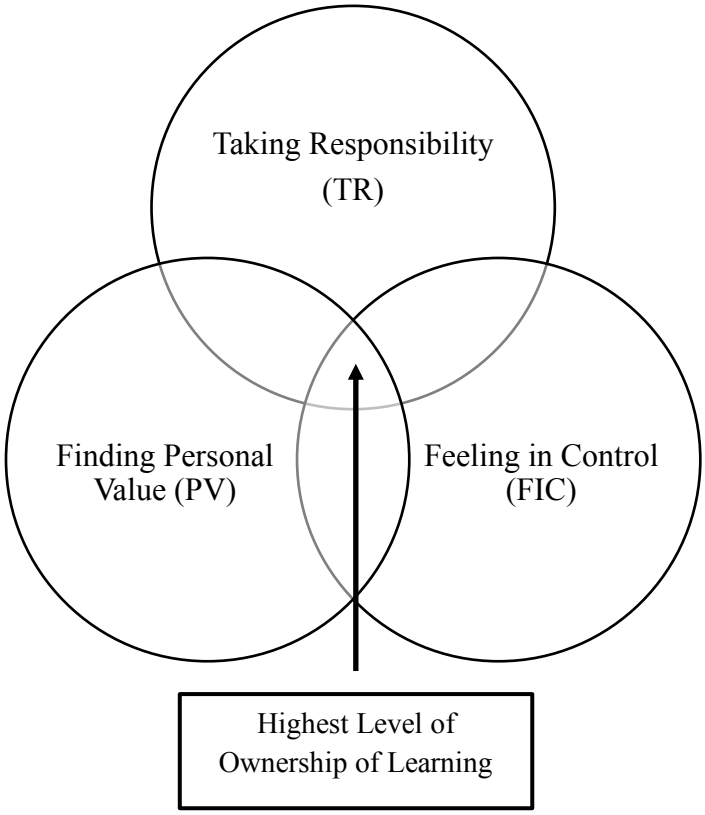

Figure 3. Student ownership of learning (Milner-Bolotin, 2001; Shroff et al., 2014).

2.5.1 Personal value.

Personal value comes from understanding how knowledge and skills developed during learning might be useful to the current learning context and how this learning will benefit the student in the future (Armitage, Wilson, & Sharp, 2004; Milner-Bolotin, 2001; Shroff et al., 2014). This is consistent with the expectancy-value theory, which describes a user's perception (or expectation) as based upon subjective task values – importance to self, high enjoyment, usefulness, and the weighing of cost versus reward (Emerson, 1976; Thibaut & Kelley, 1959). For instance, if the user expectations (the user-perceived benefits and importance) of an e-portfolio are positive, the student has understood the value of his/her e-portfolio as an educational tool to satisfy the required learning objectives. When the student (with teacher guidance) has arranged his/her e-portfolio as a self-marking portfolio and used his/her student e-portfolio to leverage employment, it is plausible that the student's personal value for the system is high. However, if the e-portfolio is difficult to use and/or the e-portfolio purpose does not connect to the core curriculum goals, the student will not

experience any learning connection to the current learning context and he/she will not see the benefits from continued and future use. In this instance, the student's personal value for the system is most likely low. Research has also shown that difficult-to-use ed-tech systems may negatively affect users, making them less motivated to use the system, and sometimes making them avoid the system altogether (Jafari, 2004; Redmond et al., 2014; San Jose & Kelleher, 2009).

According to Shroff et al. (2014), engaging in a process of reflection as a strategy to increase e-portfolio student engagement may be seen as essential to finding personal value with e-portfolios. Advantageously, e-portfolios accommodate both unstructured and structured reflective practices well, through the use of in-system CMC, which is easily and immediately retrievable, by push notifications, using any device, and at any time and in any place.

2.5.2 Feeling in control.

Feeling in control pertains to student involvement in their learning through the selection of topics relevant to them (Milner-Bolotin, 2001). With e-portfolios, students' internal sense of control occurs in the creation of their e-portfolios. In Mondi, Woods, and Rafi, (2008), students' ownership of their e-learning experiences was based upon heuristic and constructivist perspectives where students learned at their own pace, maintained control over what they wanted to learn, and experienced self-discovery. Mondi et al. (2008) added that students' motivation increased when e-learning systems promoted self-paced and self-regulated learning. According to Love et al. (2004), it is fundamental for students to generate descriptions of their achievements and accomplishments because the e-portfolio is, ultimately, about the story of their learning. Therefore, the feeling of being in control in e-portfolios comes from student personalization and selecting and showcasing works and achievements. Results of Shroff et al.'s (2014) study found that the process of personalization in e-portfolios increased a student's sense of feeling in control. They also added that feeling in control seemed to revolve around freedom and choice (Shroff et al., 2014).

2.5.3 Taking responsibility.

Responsibility in learning refers to students taking or becoming accountable in the process of their learning (Milner-Bolotin, 2001). Once more, in Shroff et al. (2014), students demonstrated strong and positive responses to taking responsibility in e-portfolios, which is linked to the concept of initiative. Students reported that they enjoyed the independence of

choosing what to post and how to satisfy the learning activities, by taking the initiative to "insert content and insert photos and design the layout based on [their] own creativity" (Shroff et al., 2014, p. 85). This initiative and acceptance of accountability has socio-affective and cognitive implications for positive attitudes towards learning and the capacity to reflect on the process of learning (Baeten et al., 2008; Brown & Ryan, 2004; DiBiase, 2002; Shroff et al., 2013).

2.5.4 The highest level of ownership of learning with e-portfolios.

Several e-portfolio literatures have pointed out the affordances and benefits of e-portfolio use (Abrami & Barret, 2005; Barrett, 2011; Barrett & Carney, 2005; Bartlett, 2009; Chau & Cheng, 2010; Jafari, 2004; Vlachopoulos & Wheeler, 2013). Similarly, this thesis has done the same. Nonetheless, success, or the highest level of ownership of learning, with e-portfolios in practice has continued to elude researchers and e-learning designers alike.

The next section will continue to examine the reward analysis of e-portfolio and focus on e-portfolios and assessment practices. Literature have underscored the importance of assessment practices within the e-portfolio domain (Bartlett, 2009; Chau & Cheng, 2010; Deneen, 2014; Deneen et al., 2017; Havelock 2009; Jafari, 2004; Swan, 2009) and the next section will delve into the importance of and the need for assessment practices in both the formative and summative evaluative practices that e-portfolios can facilitate.

2.6 E-Portfolios and Assessment Practices

According to Brown, Irving, Peterson, and Hirschfeld (2009), assessment is a difficult art because it links teaching with learning, which means teaching has to reflect student learning and learning needs to align to various forms of assessments, formative and summative. Fortunately, if they are built in and analytics are available, e-portfolios have the capacity to evaluate how students are using the system and what students are accomplishing when logged on (at least, they can measure levels of user activity). E-portfolios can also offer a final submission option, that is a tick or tab to submit to an evaluator, to show or share a student's e-portfolio to the public, and/or for summative evaluation. Regardless of whether assessment processes are built-in or the in-system quality merit-assessment systems are not available, external evaluative practices, such as a self-assessment rubric or activity, guided and unguided reflective practices, teacher communication and feedback, peer-to-peer feedback, rubrics for summative criteria, and so on, all have the potential to focus on quality, rather than simply quantity or compliance.

Deneen et al.'s (2017) analysis of areas of assessment and technology interaction around e-portfolios, found a causal (conceptual) relationship between e-portfolios as assessment and as technology. This means there is a relationship between user (i.e., teacher and student) acceptance of e-portfolios and the formative assessment function. Moreover, positive attitudes toward e-portfolios trigger increased confidence that teachers are using assessment formatively to modify their own instructions and, similarly, that students are tending to be self-regulated and showing a greater social interpersonal cooperation when being assessed (Deneen et al., 2017).

Deneen et al.'s (2017) study is also a positive direction for the improvement of student engagement with e-portfolios, specifically, with teachers' and students' positive acceptance of technology and technology-enabled assessment. They also added that the balancing of the formative and summative functions is still a priority, not only in the e-portfolio setting but also in the overall assessment framework (Deneen et al., 2017).

The following sub-sections discuss e-portfolios' assessment capabilities and their formative and summative-assessment particulars, highlighting the reflective practices, peer assessment (i.e., peer feedback rubric), teacher feedback, and the use of a rubric that can be made available (built in or externally) within the e-portfolio environment.

2.6.1 Reflective practices.

Reflective practices and self-assessments are crucial aspects of formative learning in e-portfolios (Barrett & Carney, 2005; Black & Wiliam, 1998). E-portfolios are often promoted as a reflective tool, as students are able to reflect on their learning through the process of collecting, selecting, self-scrutiny, and peer and mentor feedback (Bhattacharya & Hartnett, 2007; Love et al., 2004; Vlachopoulos & Wheeler, 2013). Learners using e-portfolios can either go through reflective practices abstractly, that is not following a framework of reflection to help them think reflectively, or with a more structured approach, in which teachers provide specific structures for reflection, which engages learners with self-evaluations of the quality of their reflection (Vlachopoulos & Cowan, 2010; Vlachopoulos & Wheeler, 2013).

According to Vlachopoulos and Wheeler (2013), there seems to be some scope in promoting the structured approach and, in particular, giving learners the template to help them connect the critical learning objectives required in their reflective journey (see Table 2 for assessment criteria for e-portfolio reflective assignments created by Vlachopoulos & Wheeler, 2013). In their comparison of two cohorts using e-portfolios for reflective practices,

one structured and the other unstructured, they showed that the structured cohort contributed almost three times more comments, expressed greater feelings, and more reflective self-questioning compared to the unstructured cohort (Vlachopoulos & Wheeler, 2013).

Table 2

Assessment Criteria for E-Portfolio Reflective Assignments (Vlachopoulos & Wheeler, 2013)

Criteria	Distinction	Pass	Fail
Self-scrutiny	Demonstrates an *open, non-defensive ability to self-appraise*, discussing both growth and frustrations as they related to learning in class and online. Risks asking probing questions about self and seeks to answer these.	Sometimes defensive or one-sided in the analysis. Asks some probing questions about self, but do not engage in seeking to answer these.	*Little or no self-scrutiny, minimal risk* in connecting concepts from class to personal experiences. Self-scrutiny tends to be superficial and factual, without self-reflection.
Connection to experiences	*In-depth synthesis* of thoughtfully selected aspects of past and current experiences (either as a learner or a teacher) related to your practice in your institution. Makes *clear* connections between what is learned from experiences and their own current practice.	Goes into *some detail* explaining some specific ideas or issues from experiences related to the practice. Makes *general* connections between what is learned from outside experiences and their current practice.	There is no attempt to connect *general ideas* or issues from experiences with the issue under scrutiny.
Connection to readings & other resources (assigned and ones you have sought on your own)	*In-depth synthesis* of thoughtfully selected aspects of readings and other resources related to the experience under scrutiny. Makes *clear* connections between what is learned from readings and the experience. Includes reference to at least four different readings other than those readings assigned for class.	Goes into more detail explaining some specific ideas or issues from readings related to the experience. Makes general connections between what is learned from readings and the experience. Includes reference to at least two readings other than those assigned for class.	There is no attempt to connect *general ideas* or issues from readings or other resources with the experience or issue under scrutiny.
Connection to class discussions & course learning outcomes and planning of active experimentation	Synthesize, analyze and evaluate thoughtfully selected aspects of ideas or issues from the class discussion as they relate to each experience under scrutiny. An excellent attempt to plan an action for improving learning and teaching in context.	Synthesize clearly some directly appropriate ideas or issues from the class discussion as they relate to the experiences discussed. Some attempt to plan an action for improving learning and teaching in context.	Restate some general ideas or issues from the class discussion as they relate to the experiences under scrutiny but there is no attempt to synthesize them or translate them into action.

Vlachopoulos and Wheeler's (2013) study showed that structured use of an electronic rubric can improve students' reflective practices with e-portfolios. In e-portfolios, these interactive feedback and reflective responses can also be in the form of message boxes, comments, direct messaging, public and private conversations such as "walls" or dialogue boxes, and other digital electronic messaging systems. Ideally, all of these student-teacher and peer-to-peer dialogues can be embedded into the student's "story of learning" or a student's journey to growth and development (Blackley et al., 2017; Chau & Cheng, 2010). Currently these processes cannot be automated by technology systems, so all of these reflective and formative practices require careful preparation and scaffolding (Oakley et al., 2013).

But reflective practices are a good way of shifting one's learning to the next level, the use of a well-considered e-portfolio structure and associated formative assessment criteria will allow a more positive student engagement with e-portfolios (Vlachopoulos & Wheeler, 2013).

2.6.2 Peer assessment.

Peer assessment, likewise, is an important formative assessment function in increasing student ownership of their learning and a collaborative approach to developing essential learning skills (Hartnell-Young & Morris, 2006; Oakley et al., 2013). Barrett and Carney (2005) professed that there is a great deal of difference between the use of e-portfolios in formative reflective learning and a summative high-stakes assessment of measures. As peer assessment or the reflective approach to learning is an integral part of learning with e-portfolios, students can independently and continuously assess their own and each other's learning (Bhattacharya & Hartnett, 2007; Hartnell-Young & Morriss, 2006). Peer evaluation can enhance the quality of student learning and the development of their e-portfolios through comparing relevant artifacts and in supporting each other in a collaborative approach (Barrett & Carney, 2005; Love et al., 2004). See Table 3 for a peer feedback rubric shared by the associate course director of the secondary GradDip teaching program, the University of Auckland.

Table 3

EDPRAC 608: Peer Feedback Sheet – Electronic Portfolio Artifact

EDPRAC 608: Peer Feedback Sheet – Portfolio Artefact

Student Teacher:_____ Peer:_____

(Highlight appropriate comments as they relate to the portfolio if it does not clearly sit in one of these categories).

A Portfolio in the A range will:

- link the Artefact clearly to the relevant Graduating Teacher Standard(s)
- articulate cogently and in depth the manner in which the Artefact attests to your practice as a Graduating Teacher
- integrate a wide range of appropriate artefacts
- cover Graduating Teacher Standards comprehensively and in detail
- structure material in a way appropriate to the purpose of the task, with clear and explicit links made
- use conventions of writing and presentation accurately and in a manner appropriate to the discipline and academic level

A Portfolio in the B range will:

- link the Artefact to the relevant Graduating Teacher Standard(s)
- articulate the manner in which the Artefact attests to your practice as a Graduating Teacher
- integrate a range of appropriate Artefact
- cover Graduating Teacher Standards thoroughly
- structure material in a way appropriate to the purpose of the task, with clear and explicit links made
- use conventions of writing and presentation in a manner appropriate to the discipline and academic level with few errors

A Portfolio may be judged unsatisfactory for a combination of the following factors.

- artefact not linked to the relevant Graduating Teacher Standard(s)
- no articulation of the manner in which the Artefact attests to practice as a Graduating Teacher
- insufficient range of appropriate Artefact
- Graduating Teacher Standards not covered
- material not adequately or appropriately structured
- links not made clear and/or explicit
- writing and presentation used in a manner not appropriate to the discipline and/ or academic level
- writing and presentation containing too many errors

Further Comments (Essential):

At the University of Auckland and in the GradDip secondary teaching program, a peer feedback rubric is used prior to the final submission and presentation of e-portfolios. According to Sheffield et al. (2016), when students control the process of reflection and communication involving multimedia messages it tends to cultivate independence and accountability in their learning.

2.6.3 Teacher feedback.

Teachers decide where the learners are in their learning, where they need to go and how best to get there (Oakley et al., 2013). Teacher feedback in e-portfolios is extremely important, as it is a way for students to understand what is required, and, if possible, make corrections and establish new learning goals and how to go about achieving the learning objectives and goals (Bartlett, 2009; Havelock, 2009). Bartlett (2009) also noted that the required instructor feedback needs to be consistent and arise early and often in the e-portfolio environment to avoid student confusion. In Bhattacharya and Hartnett (2007), student responses in the use of teacher feedback in e-portfolios was seen as a way to, "pull us back in line" (p. 22). It is without doubt that teacher feedback in e-portfolios is elemental to student success with the system.

2.6.4 Rubric.

Bartlett (2009) affirmed that using rubrics in e-portfolios can offer an effective and efficient way to inform students of what is expected and can lead to improved summative evaluation. Rubric development can be provided to students early in the program so they can help create and suggest changes; in this way, students will be able to understand and comprehend the learning expectations from the start (Bartlett, 2009; see Table 4 for an e-portfolio rubric example provided by Bartlett). In this way, students can easily be guided as to whether their uploads and artifacts are meeting expectations (Bartlett, 2009; Buzzetto-More & Alade, 2008). Rubrics can definitely serve to assist with consistency between markers (i.e., tutors and teachers) and student creation and submission of e-portfolios, as rubrics can be used as a guiding principle of what to select, what upload, and how these artifacts are satisfying and meeting learning expectations.

Table 4

Electronic Portfolio System External Rubric (Bartlett, 2009)

Electronic Portfolio Rubric					
Portfolio of: _____		Reviewed by:_____ Date: _____			
Section	**Meets expectations**	**Pts**	**Exceeds expectations**	**Pts**	**Score**
Welcome page	Attractive introduction to your portfolio. Identifying information and purpose clearly stated.	3	Eye-catching and original. Shows what is special about you. Effective use of images and/or movies.	4	
Resume	Education and work experience presented clearly.	3	N/A	3	
Teaching philosophy	Describes your ideas about how children learn and how you plan to teach. Clear format and grammatically correct.	9	Explains theories and philosophers related to your ideas and why you agree.	10	
Unit	Complete unit with Content/Performance. Standards and Teacher Standards, assessment and procedures. Evaluations of children and self for each lesson and unit overall. Samples of children's work.	9	Particularly detailed procedures and in-depth reflections. Effective use of images and/or movies.	10	
Self-evaluation	All 10 Teacher Standards with supporting examples from your teacher.	9	Effective use of images and/or movies.	10	
Research	All sections of your research proposal.	10	N/A	10	
Career goals	Attractive closing page that summarizes your portfolio.	2	Eye-catching and original. Effective use of images and/or movies.	3	
Strengths and suggestions for improvement:					

Regardless of whether rubrics are embedded internally within the e-portfolio mechanics, or external rubrics are used, adopting rubrics leads to better final projects and makes evaluation easier (Bartlett, 2009). Utilizing rubrics eliminates guesswork and lets students know if they are meeting or exceeding expectations (Bartlett, 2009).

The reward analysis presented in this chapter reviews the affordances and benefits from e-portfolios from the literature. However, despite what is presented in this chapter regarding the learning benefits from e-portfolios, there seems to be a barrier between the cost and rewards of e-portfolios that needs to be addressed.

The next section of the chapter presents the cost analysis of e-portfolios. It is important to re-iterate that there is an interplay between the cost-reward components and elements of e-portfolios in practice. The next section will delve into these cost components and elements and examine how these cost-like components may influence student engagement with e-portfolios.

2.7 The Cost-Reward Analysis of E-Portfolios: The Challenges with E-Portfolios in Practice

Previous studies have expressed that the cost or challenges with e-portfolios are the lack of user support (San Jose, 2017; Swan, 2009) and the confusion and competing paradigms during implementation and use (Blackley et al., 2017; Chau, 2007; Sheffield et al., 2016; Swan, 2009) In Lei (2010) and Blackley et al. (2017), the role of technology in student achievement was predicated on the quality of technology (its ease of use) and the how and what or the ways in which the e-portfolio is linked to the core curriculum design of the course.

Blackley et al. (2017) and Shepherd and Bolliger (2014) discussed the importance of the technical, functional requirements, and how the system is implemented to meet and satisfy user needs. Jafari (2004) identified seven factors that lead to successful e-portfolio projects and adoption: (1) ease of use, (2) sustainable business plan, (3) advanced features, (4) robust integrated technology architecture, (5) lifelong support, (6) transportability, and (7) unknown factors of the human aspect. The general query in educational technology software adoption and implementations are the general software performance, training, online and/or face-to-face support and tutorials, multimedia quality, learnability, and overall system functionality (Sheffield et al., 2016; Shepherd & Bolliger, 2014). In the case of e-portfolios, it is how the system functions as it is integrated into the curriculum, and how users can effectively and efficiently learn the system and learn from the system (Havelock, 2009; Sheffield et al., 2016; Zaharias & Poylymenakou, 2009). The success of e-portfolios hinges upon the alignment of the technology and the human aspect (Jafari, 2004), and how users can quickly achieve their learning needs and goals with the system (Hattie et al., 2006). Ideally, the user interface of the system is virtually invisible and the concentrated effort is applied in the learning content (Ardito et al., 2006; Hattie et al., 2006). Therefore, the focus is not in the learning of the e-portfolio but in the learning from the e-portfolio.

It could be that the challenges with e-portfolios in practice are the cost components, such as the technology and usability features, and how e-portfolios are being implemented in meeting and satisfying students' needs and goals while in the e-portfolio environment. Research has shown that different e-portfolios vary in terms of level of robustness, ease of control, flow of information, and user interface (Balaban & Bubas, 2010; Shepherd & Bolliger, 2014; Shroff et al., 2011; Swan, 2009). Further, the time and resources needed to learn the technical aspects, and the availability of training and support for users (Shepherd &

Bolliger, 2014); e-portfolio goals not being linked to curriculum goals (Barrett & Carney, 2005; Deneen et al., 2017; Havelock, 2009; Shroff et al., 2011); assessment practices and methods being undefined (Blackley et al., 2017; Shepherd & Bolliger, 2014; Deneen et al., 2017); and discrepancies in the user conception of assessments (Baeten et al., 2008; Beck et al., 2005; Brown, 2011; Deneen, 2014; Deneen et al., 2017) all contribute to lowering student engagement and compliance with the system.

The next and final section of the chapter revisits the gaps in literature that have been highlighted throughout the review, leading to the research questions supporting the research undertaking.

2.8 Research Questions

A number of gaps in e-portfolio literature have been identified and all revolve around the technical functionality, and the significant potential of e-portfolios as a productive form of technology for assessment. Balancing the formative and summative priorities is a key priority in assessment (Deneen et al., 2017). The balancing of assessment practices and making them a priority is no different in e-portfolios. Shepherd and Bolliger (2014) stated that integration and development can be difficult and time consuming for both instructors and students. These difficulties include both the learning of the technical issues around e-portfolios and the time and resources spent learning from it. They also recommended that future e-portfolio research undertakings should focus on the reasoning behind why students lose interest in maintaining and updating their e-portfolios after graduation (Shepherd & Bolliger, 2014). These gaps in the e-portfolio literature formed the basis for this doctoral research. These include the lack and under-representation of the critical turn in education technology research, which calls for more studies of the 'state-of-the-actual' (Selwyn, 2011), and the call for sociological theories and approaches (Bullock & Sator, 2018; Selwyn, 2011).

Tokenistic engagement or mere compliance seems to be the scourge of e-portfolios in practice. The use of social exchange theory is very appropriate to address these gaps, as the cost-reward analysis framework adopted by this study focuses on perception of learners, the impact of technology on usage and support in learning the system and learning from, and the assessment practices or the lack thereof, and how these factors will equate to students simply complying and getting the necessary items of their e-portfolio completed or students actually benefiting from use (Emerson, 1976; Thibaut & Kelley, 1959; Tyler, 2017; Van den Beemt et al., 2018). Therefore, the focus of the study is to isolate the primary cost or reward factors of

e-portfolios that would a) lead to student compliance or b) improved engagement with e-portfolios. The research questions, therefore, are:

1. What are the prevailing e-portfolios in use today and what are the essential technology features of each of them?
2. What user factors (i.e., user satisfaction and usability) of e-portfolios impact student experience?
3. What is the relationship of training and support, personalization, assessment practices, and students' understanding of e-portfolios to the educational goal of learning and ensuring professional certification?

The following chapter discusses the overall methodology and a mixed-methods approach that involves the sequential research design, evaluation, quantitative, and qualitative approach of this research study.

Chapter 3. Methodology

3.1 Methodology Overview

The methodology overview and research design presented in this chapter are the general overview of the overall study (i.e., Study 1, Study 2, and Study 3); detailed methods, data-analysis plans, relevant data-analysis procedures, and results are within the contents of the following chapters:

- see Chapter 4 Study 1 for mixed methods: software evaluation e-portfolios, ANOVA, and qualitative iterative data analysis
- see Chapter 5 Study 2 for CFA and SEM techniques
- see Chapter 6 Study 3 for qualitative iterative data analysis

Therefore, this chapter presents the methods overture for achieving the study's research aim and research questions. The research methodology of the study includes principles of research design and procedures for data collecting, data analysis, and interpretation of data collected through a case study (Creswell & Plano Clark, 2011). This thesis utilized three studies using a multiphase design and combining the sequential analysis of the quantitative and qualitative data sets over multiphase to form a constructed overview of e-portfolio usage in two faculties, EDSW and FMHS, of the University of Auckland, New Zealand.

This thesis takes a realist view of physical and psychological phenomena and attempts to examine e-portfolios from multiple perspectives in order to understand their real-world existence and functions. This goal requires using multiple methods, each selected to maximize understanding of different aspects of both physical and social uses of e-portfolios. To describe the current status quo, interviews, surveys, and observations are conducted. To explore the inter-relationship between a variety of e-portfolio facets and outcomes, sophisticated causal-correlational statistical techniques are used. To test hypotheses generated by statistical analyses, interview data are subjected to thematic analyses using both deductive and inductive methods. Interpretation across studies and methods has led to an integrated understanding of the status quo and aspects of e-portfolio that need revision to achieve intended purposes and goals.

The multiphase design, by definition, is the concurrent and/or sequential collection of quantitative and qualitative data sets over multiple phases of a program of study (Creswell & Plano Clark, 2011). Fundamentally, it offers a design structure that combines the differing

strengths and generalizability of quantitative methods (large sample size and trends) with the specific and detailed scheme of qualitative methods (small *N* and in depth; Creswell & Plano Clark, 2007; Patton, 1990). Working with quantitative and qualitative approaches, in tandem, provides a more comprehensive and extensive procedural archetype of successful implementation of e-portfolios and usage factors that may lead to quality engagement with the system. This design is employed when the researcher wants to compare and contrast quantitative statistical results with quantitative findings for corroboration and validation purposes (Creswell & Plano Clark, 2007). Moreover, this methodological approach can be less vulnerable to errors and biases and enables a robust schematic analysis to best explain the research questions and investigative the goals of the research undertaking, as compared to a single-method approach (Creswell, 2014).

3.2 Research Design and Research Methods

The multiphase and sequential-analysis design structure consists of a series of quantitative measures of one-way analysis of variance (ANOVA), CFA, and SEM techniques, and a qualitative iterative data-analysis scheme to validate factors of e-portfolios in a cost-reward analysis framework. The multiphase design was employed due to the flexibility, intuitive sense, and effectiveness of having each type of data collected and analyzed independently (Creswell, 2014), and then compared and contrasted in the results section of the study and merged with one another to obtain an overall understanding of the research questions and goals (Creswell & Plano Clark, 2011). Figure 4 visually layers the three levels of the study and the processes of data collection, analysis, results, and the overall interpretation of the data.

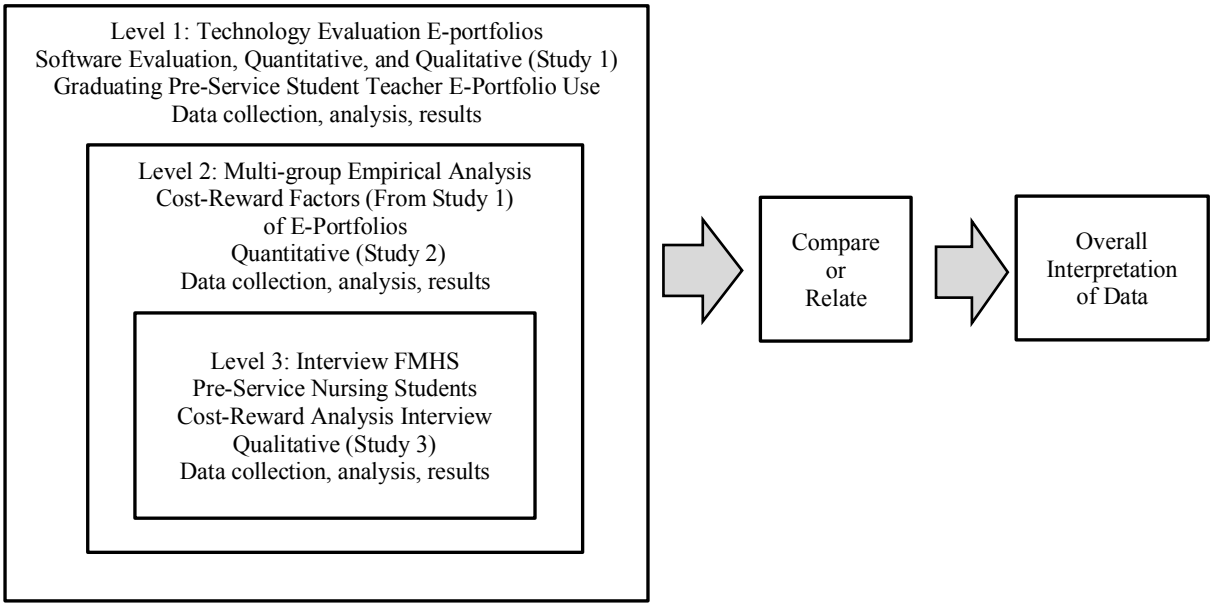

Figure 4. The multiphase and sequential-analysis design structure of the thesis.
(Design model taken from Creswell & Plano Clark, 2007, p. 64)

3.2.1 Design purpose.

The design of the study is multiphase structure, which positions it to address the research questions of taking an evaluative approach to technology systems (i.e., e-portfolios) and developing a framework to identify the cost-reward factors of e-portfolios. The mixing of methods is an inquiry that combines both qualitative and quantitative data, integrates the forms of data, and uses distinct designs that may involve philosophical assumptions and a theoretical framework (Creswell, 2014). The design purpose of the study is based on identifying observable components of e-portfolios that would lead users to comply versus facilitating factors that would improve engagement with the system.

Therefore, Study 1 data collection begins with an evaluation of the technology and software features of prevailing e-portfolios (as identified by the associate course directors of the ECE, primary, and secondary GradDip teaching programs). Next, a standardized self-reported survey questionnaire, evaluating student satisfaction with, and the usability of, e-portfolios such as MyPortfolio (Mahara) and Google Sites, was completed by pre-service student teachers in the GradDip ECE and secondary teaching programs. This is then followed by qualitative interviews within the framework of the cost-reward analysis (i.e., likes, dislikes, and recommendations). Study 2 follows up in terms of empirically evaluating factors identified in Study 1 and the cost-reward analysis utilizing the Multigroup evaluative processes of CFA and SEM techniques to 1) validate survey measurement items of student

perspectives such as perceived benefits, and importance and usefulness, and 2) identify factors of e-portfolios such as training and support, assessment practices, and long-term benefits, and their relationships to compliance and quality engagement with the system.

Study 3 interviews nursing students and centers around the cost-reward analysis and on the framework of student ownership of their learning with e-portfolios (Milner-Bolotin, 2001; Shroff et al., 2014). Study 3, using the qualitative iterative approach, examines students' sense of personal value, feeling in control, and taking responsibility (Shroff et al., 2014) when using e-portfolios to satisfy nursing competencies.

The level of interaction between the phases of the study is organized sequentially with the results of each individual level of the study influencing the next level of the study. Ultimately, the design purpose of the study is to identify specific observable components of e-portfolios that would lead to compliance versus learning. The design purpose is also structured to create an evaluative analysis of the relationship of technology systems and how systems impact the educational goal of learning and the administrative goal of ensuring professional external standards. Table 5 shows the mixed-methods sequential research design of the study.

Table 5

Classification of the Study's Mixed-Methods Sequential Design

Sequential
(explanatory)
SOFTWARE EVALUATION → QUAN → QUAL → QUAN → QUAL

According to Johnson and Onwuegbuzie (2004), the explanatory sequential design collects either quantitative or qualitative data first and uses the data and results to inform the sequences of the research undertaking. The mixed-methods sequential design of the study was initiated and informed by the software evaluation of the prevailing e-portfolios. This was followed by a quantitative ANOVA analysis of user satisfaction and usability comparison of MyPortfolio (Mahara) and Google Sites e-portfolios, along with a qualitative, iterative data-analysis approach, interview of pre-service student teachers to identify factors of e-portfolios that will increase student engagement with the system. These factors were then analyzed using quantitative CFA and SEM techniques. The final method was a qualitative, iterative data-analysis approach, interview of pre-service Bachelor of Nursing (BNurs) students, under the same purpose of using an e-portfolio to satisfy a professional external standard.

This thesis reports a Phase-1 Software Evaluation, QUAN (ANOVA comparative analysis) + QUAL (student interview); Phase-2 QUAN (Factor Analysis); and, Phase-3 QUAL (student interview). This sequential explanatory approach was structured to generate a synthetic view of a cost-reward analysis of e-portfolio usage in a single academic institution, within two faculties, and to determine factors which increase students' quality engagement with the system.

3.2.2 Sampling strategy.

A convenience sampling design was carried out to enlist participants for the research study. Participants were recruited with assistance of the associate dean, associate director, director of the Learning Technology Unit, and course coordinators. Participants were also identified based on their required use of e-portfolios to satisfy New Zealand teacher standards and New Zealand nursing competencies. Therefore, convenience sampling was adopted based on convenience and availability (Cresswell, 2014). On the other hand, this method of sampling strategy can be a major disadvantage, as it is prone to producing an inaccurate and unrepresentative sample of the population (Cresswell, 2014; Keyton, 2014). Further, this method also exposes potential biases due to the availability of volunteers who may differ in motivation, interest, and inclination compared to those who decline to participate. The Human Participants Ethics Committee (HPEC) does allow convenience sampling strategy as this design is sometimes a necessary option, or the only option for researchers, as long as ethical constraints are addressed and participants are protected, with confidentiality and anonymity and the right to withdraw their data based on an agreed timeframe (see Appendices A, B, and C for HPEC approved items).

In light of the purpose of the study and to provide an initial understanding of e-portfolio software platforms adopted at the University of Auckland, a convenience sampling design was deemed appropriate for the research undertaking. To adhere to HPEC and to protect the study's participants, the researcher opted to create the surveys for Study 1 and Study 2 anonymously, which means participants' names were omitted or not necessary anywhere on the survey questionnaire. For the interview protocol, participants were identified using their email but names or other pieces of information were removed from the interview data sheet. Without exception, all items were considered and informed by the voluntary response rate, total sample size, and limitations in light of sampling strategy from a case study and at a single site.

3.3 Quantitative Analysis Overview

Two quantitative data procedures were adopted for Study 1 and Study 2. Study 1 employed a one-way ANOVA, which was performed to compare the MyPortfolio (Mahara) and Google Sites e-portfolio software platforms in terms of user information satisfaction (UIS) and usability evaluation method (UEM) of these e-portfolios.

Study 2 utilized CFA and SEM techniques and used student perspectives on perceived benefits and importance and usefulness. The primary focus of the Study 2 data-analysis plan was to confirm the structure of the latent variables used, by evaluating the reliability of the measurement models prior to proceeding with exploration of the relations among the variables. Next, SEM was used to incorporate the concept of observed or manifest variables and latent variables. This is particularly useful in this study, as the key constructs or factors are understood as latent or implicit causal variables that cannot be directly measured but can be assumed through observable indicator items (Byrne, 2016). The aim of Study 2 revolves around confirming factors arising from Study 1 and the facilitating factors that will improve student engagement with e-portfolios. (see Chapter 5 for the detailed description and procedures of the quantitative data techniques and results of Study 2).

3.4 Qualitative Data-Analysis Framework Overview

A qualitative iterative data-analysis approach has been adopted (Srivastava & Hopwood, 2009) (see Chapter 6 for the detailed description and procedures of the quantitative data techniques and results of Study 3). Study 3 has also utilized the framework of student ownership of learning with e-portfolios to explore the cost-reward analysis of the system in the BNurs program (Milner-Bolotin, 2001; Shroff et al., 2014).

Iterative data analysis is the process in which patterns and themes emerge from the data but not on their own (Srivastava & Hopwood, 2009). Data are driven based on useful sets of triangulated inquiry: (1) self-reflexivity, for example what the researcher knows and wants to know; (2) reflexivity about those studied, for example how those studied know what they know; and (3) reflexivity about the audience, for example how those who receive my findings make sense of what I give them (Patton, 2002; Srivastava & Hopwood, 2009).

3.5 Data Collection Procedures

The teachers were asked to arrange venues and time for the administration of the paper-based survey questionnaire. All participants were briefed and allowed to ask questions after the researcher went over the participant information sheet (PIS). The survey was anonymous and a consent form (CF) was deemed not necessary, as per the instruction of HPEC (reference number 011928). Participants were also informed of their rights and ethical considerations (see Appendices A, B, C, F, H, I, and J for all approved CF, PIS, and Amendments).

3.6 Ethical Considerations

The study followed strict adherence to ethical standards during the planning and execution of both the quantitative and qualitative research study undertaking. The ethical issues and considerations were submitted to the University of Auckland HPEC for approval. The ethical issues involved in this study are informed consent and participants' privacy, confidentiality, and anonymity. The researcher and the research team also guaranteed that students' decision to participate, not participate, or withdraw at any time without giving any reason would not impact their evaluations and grades.

All participants had the right to withdraw at any time and have their data excluded, but a particular deadline was stipulated due to data analysis being conducted by the researcher normally within 4 weeks of completion of data gathering. All participants were also given a PIS informing them of the survey and interview process. Lastly, a CF was not necessary for the survey portion of the study, as it was anonymous; CFs were employed for the interview portion of the study but participants' names were replaced with their email address and an alpha-numeric code only known to the researcher.

3.6.1 Data storage/retention/destruction/future use.

The paper data (hard copy) was stored and secured in a locked cabinet at the University of Auckland, EDSW office facility. Only the researcher and the research team had access to the office and storage facility. All electronic data were stored in a password-protected desktop computer. The data are to be destroyed after period of 6 years. The paper data (hard copy) will be disposed via shredding, which will be conducted by the school's facilities coordinator. The electronic data will be expunged by the school's IT support and technician.

3.6.2 Rights to withdraw.

Participants were informed that they had the right to withdraw and have their data removed from the analysis up to 4 weeks after they had completed either the self-reported survey and/or the retrospective interview of their e-portfolio use. The 4-week period was given to all participants to have their data removed from the analysis, as the researcher needed a deadline so that the results of the study could be published or presented at a conference.

3.6.3 Control over participants' data and publishing options.

In research, it is important that all participants are informed, made aware of their options, and have their privacy maintained. Considering the potential threat to students' information and privacy, it was imperative that the researcher protected the participants by the following provisions:

- Alpha-numeric codes were given to survey questionnaires, interview recordings, and interview transcriptions to protect the privacy of participants.
- All participant names were deleted from any paper or electronic document. It was not possible to match survey serial numbers to interview recordings or transcriptions.
- No names were used in any reports arising from the study.
- No personal information was collected or stored.

All participants were also informed that all collected data would only be used for the completion of the researcher's Doctor of Philosophy in Education thesis requirements, academic publications, and conference proceedings. All participants were also informed that they could obtain a copy of the published work by emailing the researcher.

Chapter 4. Evaluating, Comparing, and Best Practice in Electronic Portfolio System Use

Chapter 4 consists entirely of a manuscript published in the *Journal of Educational Technology Systems*: San Jose, D. L. (2017). Evaluating, comparing, and best practice in electronic portfolio system use. *Journal of Educational Technology Systems, 45*(4), 455–477. doi:10.1177 /0047239516672049

The published manuscript acknowledged and satisfied the following research questions (RQ's):

> RQ1: Identify the prevailing e-portfolio software systems and the essential technology features of each system.
>
> RQ2: Determine the impact of e-portfolio technology features (i.e., usability) that impact upon student experience with the system.

If the goal with e-portfolios is to improve and allow quality engagement with the system whereby affordances from the system are observed, then an evaluation of the prevailing e-portfolios using the essential technology features is the first step. The evaluation of the prevailing e-portfolios' software platforms and the effectiveness of these platforms in meeting and satisfying user needs (i.e., learning from e-portfolios) are positioned to assist teachers and digital learning (IT) support in minimizing the cost or time in testing and selecting a fitting e-portfolio software platform to demonstrate the curriculum objectives and goals of a course or program.

The manuscript also presented the usability comparison of the MyPortfolio (Mahara) and Google Sites systems and the impact of the technology features upon student experience with e-portfolios. Study 1 also determined the cost-reward analysis and recommendations to improve student engagement with e-portfolios through the analysis of the graduating pre-service student teacher interview responses in their year-long use of the system. The salient recommendations from this study (i.e., Study 1) were then applied to Study 2, using CFA and SEM techniques, to empirically test factors in improving student engagement with e-portfolios.

4.1 Abstract

Electronic portfolios are commonly positioned to show evidence of student learning with formative and summative-assessment benefits. At the University of Auckland teacher education program, two e-portfolios were adopted and for pre-service teachers attest to the Graduating Teacher Standards. This paper seeks to: (1) evaluate e-portfolios, (2) compare the MyPortfolio (Mahara) and Google Sites systems, and (3) provide recommendations for best practice in-system use. The software system comparison between the MyPortfolio (Mahara) and Google Sites system was based on the essential technology features for system use. User satisfaction and usability data were obtained through self-reported surveys (N = 192). Open-ended questions (N = 192) and semi-structured interviews with a sample of course participants (N = 12) ascertained the best practice approach for system use. Mean scores were higher for the MyPortfolio (Mahara) system. One-way analysis of variance indicated that the differences were statistically significant.

Keywords

Electronic portfolio system; higher education; teacher education; e-portfolio comparison; educational technology evaluation

4.3 Evaluating, Comparing, and Best Practice in Electronic Portfolio System Use

Rapid advances in ICTs over the last two decades have contributed to the increasing use of technology in education. Educational technologies, such as e-portfolios, have brought innovative and creative ways for educators to think, re-think, and reconstitute their pedagogical designs to enhance student learning in the 21st century. The purpose of an e-portfolio, similar to its paper counterpart, is for learners to collect, document, and reflect on their progress, self-development, coursework, and assessment results (Abrami & Barret, 2005; Barret, 2011; Beck et al., 2005; Jafari, 2004). An e-portfolio is a web-based software system with digital storage capabilities, accessible through the World Wide Web. Conventional e-portfolios in education include: Google Applications, Mahara Systems, WordPress, Blogger, LiveBinders, Weebly, PebblePad, and Canvas. Two of the most important technology features of an e-portfolio are the showcasing of achievements and artifacts, and the ability of the e-portfolio learner to easily modify collected contents to meet differing objectives. These technological features are arguably imperative components of any e-portfolio as they help the learner document and share personal and professional growth (San Jose, 2014).

In effect, within an e-portfolio, learners can upload digital items such as course work, assignments, curriculum vitae, syllabus, program activities, program assessments, evaluations, achievements, certifications, recommendations, references, and any electronic materials for storage or showcasing (Abrami & Barret, 2005; Bartlett, 2009; Chau & Cheng, 2010; Gaide, 2006; Jafari, 2004; Shroff et al., 2011). The success of an e-portfolio is centered in its ability to allow the learner to flexibly organize or re-organize the contents for differing purposes, which requires reflection upon and transparency in personal and professional growth. Further, e-portfolios enable learners to be the author of their learning (Chau & Cheng, 2010).

The productivity of an e-portfolio revolves around the learner's active participation in the learning process, as can be seen in collection and selection of materials to store and presentation to the public (Baeten et al., 2008). When building and developing an e-portfolio, students need to be self-regulated, goal-oriented, and develop knowledge and skills to create their own e-portfolio. Leading researchers and advocates of e-portfolios have pointed out that learners accrue immense learning and technological skills as they compile, include, self-

assess, and think critically through the use of the software system (Beck et al., 2005; Hartnell-Young & Morriss, 2006; Lorenzo & Ittelson, 2005).

Despite enthusiasm for and claims of learning benefits, e-portfolios in practice have remained less than overwhelmingly successful. Oftentimes, e-portfolio use has resulted in mere compliance with requirements without substantial reflection or been regarded with unwelcomed sentiment (Chau, 2007; Oliver & Whelan, 2011; Swan, 2009). According to Chau and Cheng (2010), e-portfolios in practice often lead to confusion and frustration, especially if the conceptual purpose of the system is not clearly defined, assessment practices are not established, and there is limited technical support. Oliver and Whelan (2011) have also indicated that the introduction of educational technologies sometimes results in educators questioning their own abilities; especially, if they lack the knowledge and associated skills to successfully and easily operate the system, let alone overcoming the challenges of incorporating a software system into their regular curriculum. More often than not, utilizing educational technologies requires several underpinning tasks upfront and prior to its deployment in a course or program. Such underpinning tasks are the technical and functional dimensions of the software system, manageability of the system, and the building of the online interface to reflect the formative and summative goals of the program (Edward, 2015). Likewise, there are issues with the implementation cost of an e-portfolio, such as the need for new or better IT hardware, system server maintenance, and server hosting support (Chau & Cheng, 2010; Edward, 2015; Lambert & Corrin, 2007).

Issues with e-portfolio use and the difficulties with successful practice may reside in the usability of the software system and how the system is implemented pedagogically. Shroff et al. (2011) suggested that user friendliness and user acceptance of educational technologies are two of the most problematic areas when exploring students' behavioral intention to use this type of educational technology. Research has also identified that different e-portfolios vary in terms of level of robustness, ease of control, flow of information, and user interface (Balaban & Bubas, 2010; Buzzetto-More & Sweat-Guy, 2007; Shroff et al., 2011; Swan, 2009;). In addition, users can be easily frustrated and discouraged when faced with a problematic user interface or ineffective technology system (Redmond et al., 2014; San Jose & Kelleher, 2009). Student perspectives are often left out in higher education change management (Deneen, Brown, Bond, & Shroff, 2013). Therefore, it is imperative to delve into students' interviews and user feedbacks to determine the best practice approach for e-portfolio use.

4.4 Essential Technology Features of E-portfolios

Successful implementation of an e-portfolio is often subverted by technology characteristics (Chau, 2007; Imhof & Picard, 2009; Jafari, 2004; Love et al., 2004; Shroff et al., 2014; Swan, 2009; Vlachopoulos & Wheeler, 2013). For that reason, five key technological features have been identified: (1) electronic storage capabilities to store user information and artifacts, (2) personalization and customization of the system, (3) the ability to showcase selected artifacts and achievements, (4) communication for reflection and feedback, and (5) evaluation and assessment processes.

1. *Electronic Storage*. E-portfolios permit upload, storage, and retrieval of documents and digital objects. Capacity must align with expected user requirements and permit a variety of file formats for text, image, audio, video, and common office application document types (e.g., spreadsheets, presentations, etc.). Systems, which offer hyperlink or linking to web pages and other social media sites, permit additional personalization, customization, and presentation of work and achievements.
2. *Personalization*. User control (e.g., personalization of formatting) over the system reduces the learning curve, increases responsibility, and ownership of the system (Shroff et al., 2014). Higher education students, in particular, want to have control of what to include, exclude, and showcase to best meet the purpose of an e-portfolio application (Baeten et al., 2008).
3. *Showcasing*. Another important requirement of an e-portfolio is the ability of flexibility and purposively selecting artifacts and achievements to showcase or highlight for different kinds of purpose. For example, the content used to gain a new job will probably differ from career advancement. Having control of this dimension of the technology system is important to learners (Shroff et al., 2014). Flexibility in this aspect of the technology adds utility to the user in that different 'virtual identities' and individual stories can be created and communicated (Hartnell-Young & Morriss, 2006).
4. *Reflection and Feedback*. Since selection and communication are integral components of e-portfolios, the technology must allow reflection and feedback processes. The reflective process involves creating an object within the e-portfolio that communicates a reflection on work, progress, development, and relevance to the e-portfolio purposes. Such a reflection requires self-scrutiny in light of experiences, learning resources, and learning objectives of the curriculum (Hartnell-Young &

Morriss, 2006; Imhof & Picard, 2009; Vlachopoulos & Wheeler, 2013). Systems that permit both confidential and public feedback from peers and instructors are likely to enhance the learning effects of selection and communication of reflection. Exposing an e-portfolio to constructive criticism is likely to result in much better quality, and so feedback mechanisms are necessary.

5. *Assessment*. E-portfolios are often positioned as either formative or summative evaluation mechanisms. Unlike paper-based assessments, in which there is only one way to read a product (i.e., linearly), e-portfolios permit multiple paths and starting points, which change the way in which the showcase is experienced or understood by the rater or evaluator. Furthermore, e-portfolios may be supplemented with assessment tools such as rubrics, digital assessment measurements, or built-in system evaluations showing completion of tasks and assignments. Whatever mechanisms used, it is imperative that instructors provide a clear and responsive support for learners that illustrates precisely how the student learning will be evaluated (Bartlett, 2009; Havelock, 2009).

These five technology features are the core technology characteristics that allow an e-portfolio to achieve its learning goals.

4.5 The Usability Evaluation of E-portfolios

It is probably a sine qua non that no e-portfolio meets all technological and learning requirements simultaneously. Hence, evaluation of an e-portfolio depends on the experience intended end-users have with the system. This approach involves usability evaluation to determine the degree to which the system is effective and efficient in helping the user complete intended tasks (Dzida, 1996; Laxman, 2010). Usability evaluation normally focuses on the user experience of the technology features of the educational technology system. For example, the user interface must be easy to use; the navigation menus and dashboards need to be easily accessible and intuitive, the system must be free from technical and operational problems, so that users are able to learn the system quickly and efficiently, and to move on to their intended learning task. A highly usable technology is likely to be invisible to users so that their attention is spent on using the software for its intended purpose (Hattie et al., 2006).

Unfortunately, education is littered with technology systems that do not enhance teaching and learning, despite their promise (Cuban et al., 2001). Unreliable and difficult-to-use software systems often overwhelm even the most experienced educator and may frustrate

any user (Cuban et al., 2001; Mishra & Koehler, 2006; Redmond et al., 2014; San Jose & Kelleher, 2009). Frustration often leads to users disengaging from or abandoning a system. Previous research has concluded that any educational technology (a) is easy to use, (b) produces a beneficial user experience, and (c) does not distract or prevent users from achieving their objectives (Hattie et al., 2006). Although an e-portfolio technology system might have the potential to meet various personal, professional, program, and institutional goals, if the system is overly complex and too difficult, the learning benefits are unlikely to occur.

4.6 Aim and Objectives

This study sought to evaluate e-portfolios with respect to the five essential technology features. The study also culls key dimensions of user satisfaction and usability from prior literatures (Ives, Olson, & Baroudi, 1983; Zaharias & Poylymenakou, 2009) for the purpose of comparing the MyPortfolio (Mahara) and Google Site e-portfolios adopted at the University of Auckland, teacher education program. Based on student feedback, the study aims to add to best practice knowledge around e-portfolio usage. Thereupon, the study seeks to:

1. Evaluate e-portfolios, MyPortfolio (Mahara), Google Sites, WordPress, Blogger, LiveBinders, Weebly, PebblePad, and Canvas and in light of the five essential technology features.
2. Evaluate MyPortfolio (Mahara) and Google Sites e-portfolios for user satisfaction.
3. Evaluate MyPortfolio (Mahara) and Google Sites e-portfolios for usability.
4. Make recommendations for best practice in e-portfolio use.

4.7 Methodology

At the University of Auckland teacher education program, two e-portfolios have been adopted to document pre-service teacher's course work, achievements, and to attest to the GTS. The GTS consists of 29 competencies considered essential for successful entry to the teaching profession as a beginning teacher with a GradDip in teaching. Teacher education programs are required to sign off that each graduating teacher has met the 29 standards by inspection and student presentation of their e-portfolio, which provides evidence of attainment of the standards.

The secondary teaching program adopted the MyPortfolio (Mahara) system, which was developed by New Zealand's Tertiary Education Commission on E-learning Collaborative Development Fund (Lee & Pohio, 2012; NZTC, 2010). In contrast, the ECE teaching program adopted Google Sites, which is an open-source web system created by Google Incorporated for the promotion of e-portfolio use and a software-learning platform for users. Pre-service student teachers are required to use the e-portfolio assigned to their program for the purpose of demonstrating fulfillment of the GTS standards by inclusion of curricular objects, lesson plans, teaching events, mentor-teacher evaluations, and critical-reflection statements.

4.7.1 Participants and procedures.

Participants were drawn from the 2014 cohort in the one-year ECE and secondary graduate diploma programs. Surveys and interviews were conducted at the end of the year-long program.

Of the initial volunteer pool of 45 pre-service student teachers from the ECE graduate diploma teacher program, 37 (82% response rate) completed the survey and answered the open-ended questions. Of the initial volunteer pool of 171 (from a program population of 192) secondary GradDip teacher education program students, 155 (effective response rate = 81%) completed the survey and answered the open-ended questions. Retrospective interviews concerning the e-portfolios were conducted with four ECE and eight secondary graduate diploma program teacher education students.

4.7.2 The survey inventory items.

A standardized self-report survey focused on student satisfaction with the e-portfolio using items from the UIS and the UEM inventories. Four UIS items were taken from Ives et al.'s (1983) UIS instrument. To adapt the UIS to e-portfolio evaluation, reference to information systems (IS) was replaced with e-portfolio (e.g., "I am confident in using the information system" to "I am confident in using the e-portfolio"). The 12 UEM e-portfolio measurement items were taken from Zaharias and Poylymenakou's (2009) UEM, which was created to measure online LMSs and web learning environments. The UEM items were adjusted to refer to e-portfolios (e.g., "The web course was free from technical problems" to "The e-portfolio was free from technical problems").

Both inventories adopted a six-point positively-packed agreement-rating scale; "strongly disagree," "usually disagree," "slightly agree," "moderately agree," "usually

agree," and "strongly agree." Positive packing is valid when participants are expected to have a bias toward positive attitude (Brown, 2004; Lam & Klockars, 1982).

4.7.3 Survey analysis.

The aim of the data analysis is to examine the user satisfaction and usability, in terms of technology features of systems, and ascertain how these technology features of e-portfolios impact student experience (San Jose, 2014). A one-way analysis of variance and parametric measures were employed; as it provides a more accurate and robust analysis (Norman, 2010) even though a six-point positively-packed agreement-rating scale data are merely ordinal in nature (e.g., Jamieson, 2004). The measured scale itself may not be continuous, however the variable derived from the scale can be treated as continuous for parametric analysis (Norman, 2010).

4.7.4 Open-ended and interview questions.

The survey was supplemented by open-ended questions examining students' opinions concerning specific aspects of the e-portfolio software technical features they liked, disliked, and any recommendations they had for improved implementation of the e-portfolio. A semi-structured interview protocol was developed to obtain insights based on their year-long use of the e-portfolio. The interview protocols were based on Chau and Cheng's (2010) e-portfolio framework and the usability of the system in terms of ease of use, efficiency, inclusion and exclusion of course work, showcasing of work, achieving program objectives, and overall software technology features of the system.

4.8 Results

4.8.1 Objective 1.

Evaluations of the eight e-portfolios MyPortfolio (Mahara), Google Sites, WordPress, Blogger, LiveBinders, Weebly, PebblePad, and Canvas were rendered (See Tables 6 to 9).

Table 6

Features of the MyPortfolio (Mahara) and Google Sites Systems

Essential Technology Features	MyPortfolio (Mahara) System	Google Sites System
Technology **Electronic Storage Capacity (Max)**	1000 MB/ 1 GB Maximum Upload File Size: 50 MB	100 MB Maximum Upload File Size: 20 MB
Upload and download directly to the system	✓	✓
Compatibility	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls). Video upload too large and not compatible.	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls). Video upload too large and not compatible.
Personalization & Customization	✓	✓
Layout options	Several	Several
Compatibility	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls).	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls).
Showcasing	✓	✓
Privacy	✓	✓
Direct text and private messaging	✓	✓
Linkage to external email systems (e.g., school)	✓	✓
Communication	Compatible with text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf) as a form of a message or electronic mail.	Compatible with text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf).
Dissemination control	Messages can be made public or private using a "Wall" feature where peers, mentors, and other users can populate the "Wall" page.	Available under the comments section and limited characters only.
Assessment and Evaluation **Direct evaluation or assessment features**	✕	✕
Demonstration of Task Completion	Share e-portfolio web page	Share e-portfolio web page
Evaluation processes	External	External

Table 7

Features of WordPress and Blogger Web Blog Systems

Essential Technology Features	WordPress	Blogger
Technology Electronic Storage Capacity (Max)	3000 MB/ 3 GB (Free Plan) Maximum Upload File Size: 8 MB	1000 MB/ 1 GB (Free Plan) Maximum Upload File Size: 100 MB
Upload and download directly to the system	Upload Only – No Folder Storage	Upload Only – No Folder Storage
Compatibility	Text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf). Video and Audio upload too large and not compatible.	Text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf). Video and Audio upload too large and not compatible.
Personalization & Customization	✓	✓
Layout options	Several	Several
Compatibility	Text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf).	Text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf).
Showcasing	✓	✓
Privacy	No Privacy Settings	No Privacy Settings
Direct text and private messaging	Not Capable	Not Capable
Linkage to external email systems (e.g., school)	✓	✓
Communication	Available under the comments section and limited characters only.	Available under the comments section and limited characters only.
Dissemination control	Available under the comments section and limited characters only.	Available under the comments section and limited characters only.
Assessment and Evaluation Direct evaluation or assessment features	✕	✕
Demonstration of Task Completion	Share e-portfolio blog page (Public)	Share e-portfolio blog page (Public)
Evaluation processes	External	External

Table 8

Features of Weebly and LiveBinders

Essential Technology Features	Weebly	LiveBinders
Technology **Electronic Storage Capacity (Max)**	Unlimited (Free Plan) Maximum Upload File Size: 10 MB	100 MB (Free Plan) Maximum Upload File Size: 5 MB
Upload and download directly to the system	Upload Only – No Folder Storage	✓
Compatibility	Text, image (jpeg, tif, png, gif), Word Document (doc), PowerPoint (ptt), and Portable Document Format (pdf). Video and Audio upload too large and not compatible.	Text, image (jpeg, tif, png, gif), Word Document (doc), PowerPoint (ptt), and Portable Document Format (pdf). Video and Audio upload too large and not compatible.
Personalization & Customization	✓	✓
Layout options	Several	Several
Compatibility	Text, image (jpeg, tif, png, gif), Word Document (doc), PowerPoint (ptt), and Portable Document Format (pdf).	Text, image (jpeg, tif, png, gif), Word Document (doc), PowerPoint (ptt), Excel (xls), and Portable Document Format (pdf).
Showcasing	✓	✓
Privacy	No Privacy Settings	Privacy Setting Available
Direct text and private messaging	No Direct Messaging	✓
Linkage to external email systems (e.g., school)	✓	✓
Communication	No direct messaging available.	Compatible with text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf) as a form of a message or electronic mail.
Dissemination control	No direct messaging available.	Available under the comments section and limited characters only.
Assessment and Evaluation **Direct evaluation or assessment features**	✕	✕
Demonstration of Task Completion	Share e-portfolio web page (Public)	Share e-portfolio page (Public)
Evaluation processes	External	External

Table 9

Features of PebblePad and Canvas

Essential Technology Features	PebblePad	Canvas
Technology **Electronic Storage Capacity (Max)**	2000 MB / 2 GB Maximum Upload File Size: 500 MB *The school can assign the file size/limit based on student needs.	2000 MB / 2 GB Maximum Upload File Size: 50 MB *The school can assign the file size/limit based on student needs.
Upload and download directly to the system	✓	✓
Compatibility	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls). Video upload too large and not compatible.	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls). Video upload too large and not compatible.
Personalization & Customization	✓	✓
Layout options	Several	Basic – White Space
Compatibility	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls).	Text, image (jpeg, tif, png, gif), audio (wav, mp3, mp4), PowerPoint (ptt), Word Document (doc), Portable Document Format (pdf), and Excel (xls).
Showcasing	✓	✓
Privacy	Privacy Setting Available	Privacy Setting Available
Direct text and private messaging	✓	✓
Linkage to external email systems (e.g., school)	✓	✓
Communication	Compatible with text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf) as a form of a message or electronic mail.	Compatible with text, image (jpeg, tif, png, gif), Word Document (doc), and Portable Document Format (pdf) as a form of a message or electronic mail.
Dissemination control	Available under the comments section.	Available under the comments section.
Assessment and Evaluation **Direct evaluation or assessment features**	✓	✕
Demonstration of Task Completion	Share e-portfolio page (Public)	Share e-portfolio page (Public)
Evaluation processes	Built in with the system and with analytics capabilities	External

4.8.2 Objective 2 and Objective 3.

Scale reliability for the 4-item UIS e-portfolio measurement scale (α = .93) and the 12-item UEM e-portfolio measurement scale (α = .96) supported aggregation of item responses into a single scale. Mean scores were higher for both scales for the MyPortfolio (Mahara) system. One-way analysis of variance indicated that the differences were statistically significant and effect sizes (Cohen, 1992) were borderline moderate to large (see Table 10).

Table 10

Student Evaluation Scores of the MyPortfolio (Mahara) and Google Sites E-portfolios

	MyPortfolio (Mahara)		**Google Sites**		**Difference statistics**			
	M	*SD*	*M*	*SD*	*F*	*df*	*p*	*d*
User Information Satisfaction (UIS)	4.14	1.04	3.62	1.05	5.70	1	.018	.49
Usability Evaluation Method (UEM)	4.16	1.00	3.55	1.18	10.22	1	.002	.66

4.8.3 Objective 4.

The results of the open-ended questions and interviews were aggregated according to the five essential technology features introduced earlier. Note that points identified may actually apply to both systems, but participants may not have mentioned these features in either the survey or interviews. Responses (see Table 11) indicated a generally positive evaluation of both systems identifying many of the design features intentionally built in to the systems. Students indicated that they understood the benefits and importance of using an e-portfolio and some indicated that they would possibly continue to use their e-portfolios after graduation. One MyPortfolio (Mahara) user stated, “I liked the electronic version as it made it accessible anywhere.” He added, “I may continue to use the system,” “Actually, I created my own personal e-portfolio but I got a job… So, I didn’t finish it.” Another pre-service graduated student teacher and from the ECE program also shared similar positive comments with respect to the accessibility and continued use of the system beyond the program. The she stated, “the platform was easy to use and no layout problems for me but I’ve used one before.” She also added, “I enjoyed the personal reflections and may use the system in the future.”

Table 11

Positive Features of the MyPortfolio (Mahara) and Google Sites E-portfolios

Positive Features	MyPortfolio	Google Sites
Technology		
Uploading	Anything, any time, easy	Anything, any time, easy
Safety	✓	✓
Object handling & organisation	Easy	Easy
Storage	Automatic	Automatic
Navigation	Dashboard	Pages
File types	incl. photographs & text	incl. photographs & text
Personalization		
Page creation	Easy	Easy
Layout	Simple, clear	Simple, clear
Editing	Easy	Easy
Template copying	✓	✓
Simplicity	✓	✓
Gallery	✓	✓
Media inclusion	All	All
Set up of appearance	Easy	Easy
Showcasing		
Artefact display	Easy	Easy
Shareable	✓	✓
Privacy options	✓	✓
Adding people to share	Easy	Easy
Google Docs compatibility	✓	✓
Communication		
Journaling	✓	✓
Sharing	Easy	Easy
Editing	✓	✓

However, significant technical issues and limitations were identified across both systems (see Table 12). A student from the secondary GradDip program and user of the MyPortfolio (Mahara) system stated, "I had to crop my picture several times… So frustrating." For instance, the MyPortfolio (Mahara) system login procedures at the University of Auckland teacher education program requires an initial login to a LMS, Moodle, before students can access their student e-portfolio. While a student from the ECE program and user of Google Sites system stated, "I couldn't' upload the images I want because the system was so limited." The system's layout and personalization also caused several problematic issues with students. Another student from the secondary graduate

diploma program expressed, “I had to use the basic layout because the other layout options where too difficult to format… I also tried embedding videos from YouTube but that didn’t work.” Further comments from another ECE student stated, “Creating the pages for my artefacts were too difficult. I didn’t know how to add or delete the pages. It took forever to figure out.” Lastly, the storage limitations and upload restrictions are important technology features that students have to anticipate, as potentially useful images and artifacts may be out of scope for the system and their inclusion will require added digital manipulation that may be beyond student skill sets and which take considerable time.

Table 12

Negative Features of the MyPortfolio (Mahara) and Google Sites E-portfolios

Negative Features	MyPortfolio	Google Sites
Technology		
Per file uploading	Max upload 50 megabytes	Max upload 20 megabytes
Peak time upload speed	Slow	Instant
Off peak upload speed	Instant	Instant
Embedding of files	Some HTML understanding required	Some HTML understanding required
Browser Compatibility	Google Chrome & Firefox	Google Chrome & Firefox
Personalization		
Page customization	Limited design option	Several design options
Web page deletion	Easy	Difficult
File deletion	Difficult	Easy
Organization of pages	Easy	Difficult
Photo display	Resizing required not automatic	Resizing required not automatic
Showcasing		
Flash plug-ins	✕	✕
Page order	Simple	Moderate
Image & text integration	Difficult	Easy
Adjustable display	Easy	Difficult
PDF display	✓	✕
Communication		
Peer feedback	✓ Wall page	✓ Comment page
Teacher feedback	No assessment feedback page	No assessment feedback page
Assessment	External	External

4.9 Discussion and Best Practice in E-portfolio Use

4.9.1 Discussion.

The paper identified eight e-portfolios and presented a taxonomy prospectus of the prevailing e-portfolios availability for instructors, course coordinators, institutions, and e-learning designers.

In terms of the convenient sampling and evaluation of the MyPortfolio (Mahara) and Google Sites in the University of Auckland, Faculty of Education and Social Work, there appears to be very little difference between the two systems. Despite the mean differences between user satisfaction and usability, as reported by students, there were no notable difference between the systems. The larger storage capacity of the MyPortfolio relative to the Google Sites can be mitigated if users connect their Google Drive accounts to the Google Sites system, which then becomes, much less restricted. Otherwise, the two e-portfolios had similar technology, personalization and customization, showcasing, and communication features. Both systems lacked internal assessment capabilities, meaning that not even automated summarization of the e-portfolio contents to ensure completion of all 29 standards was available to teachers or learners.

The best practice and recommendations seem especially important, in light of plans to continue to use e-portfolios in New Zealand and throughout international higher education institutions (Chau, 2007; Hamp-Lyons & Condon, 2000; Teoh, 2011). While technology and environment systems can continue to be improved, the major challenge of e-portfolios remains its evaluative role in education.

Arising from the open-ended and interview questions, three recommendations appear salient for all future use of e-portfolios (i.e., training, evaluation, and long-term benefits).

4.9.2 Best practice in e-portfolio use.

4.8.2.1 Training and support. We cannot assume that all users will have the same technological abilities and we cannot assume that all software systems are built the same way. Although young people have substantial experience of hardware and software, if an e-portfolio is used for a high-stake purpose (e.g., attest to meeting professional entry standards), then the institution must provide preparation and training that includes introduction to the features of the system and ongoing support for making use of the facilities built into the e-portfolio (Challis, 2005). Such support includes e-portfolio examples and an open discussion to answer any problems with the system (Buzzetto-More & Alade, 2008). It

is mandatory that teachers, course coordinators and learners are aware of the basic technological features and the confluence of technology skills required for system use. Basic technology features and usage procedures cannot be underestimated, because these tedious and banal processes can cause disruption in the creation, development, and learning outcomes.

4.8.2.2 Assessment processes. Evaluations and assessments carried out through e-portfolios must articulate learning objectives, goals, assessment data, and allow complex and subjective skills to be measured (Bartlett, 2009; Buzzetto-More & Alade, 2008; Havelock, 2009). E-portfolio assessments, if built-in analytics are available, have the capability to evaluate how students are using the system and what students are accomplishing when logged onto the system. Nevertheless, it would be unfortunate if summary counts of items inserted into an e-portfolio were seen as sufficient basis for evaluation quality of work. Thus, if in-system quality merit-assessment systems are not available, external rubric assessments have the potential to focus on quality, rather than just quantity or compliance. If rubrics are built in to the e-portfolio students can easily be guided as to whether their uploads and selections are meeting expectations (Bartlett, 2009; Buzzetto-More & Alade, 2008). Nonetheless, the litmus test is the consistency between markers and students in which assessment rubrics are used to assign grades and the alignment of graded e-portfolios with demonstrated professional competence in the field.

4.8.2.3 Long-term benefits of e-portfolios. A key objective in using e-portfolios is the development of authentic, deep learning which appears to happen when students modify, customize, and personalize their e-portfolios from the standard template (Love et al., 2004). Such behavior is more likely when students see the benefit in a system beyond course completion or compliance resulting in greater personal and professional value invested in the e-portfolio (Shroff et al., 2014). In this way, an e-portfolio becomes more than just an educational technology but rather a representation of the student's identity and a narrative of the journey to growth and development (Hecht, 2002). Making students aware of personal and professional benefits of an e-portfolio beyond the course is essential for high-quality engagement.

4.10 Limitation and Conclusion

4.10.1 Limitations.

Case studies, by nature, are limited so the generalizability of these students' experiences of just two e-portfolios within a teacher education context to other systems or professional applications is uncertain but plausible.

Further, student participants in this study were selected through a convenience sampling process that relied on student teachers that were enrolled in a teacher education program and in a single university and in a single year. Broad conclusions from data from this group must be tested and replicated with other groups in other contexts.

Lastly, it is significant to point out the relative unequal sample size between the ECE pre-service student teachers of n = 37 and secondary pre-service student teachers of n = 155, even though the N = 192 sample size is an acceptable sample size, the homogeneity of variance assumption were not affected (Reaves, 1992). The unequal sample size was due to the convenience sampling of the two-in-house e-portfolios adopted by ECE and the secondary teacher education program at the University of Auckland.

4.10.2 Conclusion.

A detailed taxonomy of the technology features of predominant e-portfolios was presented in this study and a user satisfaction and usability evaluation of the MyPortfolio (Mahara) and Google Sites e-portfolios conclude that there is little substantive difference in-system capacities. Both systems meet minimum essential technology features. Nonetheless, students reported many and substantial challenges interacting with the e-portfolios due to limitations in the information technology environments in which the e-portfolios were deployed. These problems are not inherent to the e-portfolios but are rather significant system challenges that need to be addressed before introduction of e-portfolios for assessment. Training workshops, robust IT systems with rapid and stable Internet connections, and personalization and customization of the system with the ability to integrate moving images and high-resolution image files are essential prerequisites.

Likewise, Bartlett (2009) underscored the need to integrate the complex technological tools of an e-portfolio with evaluative practices into a carefully crafted course design. The key factor in evaluating e-portfolios against the Graduating Teacher Standards is whether the evaluation system will focus on ensuring compliance (i.e., all standards have material) or evaluating quality (i.e., how well has the student demonstrated acquisition of the standards).

Further, there are decisions around the extent to which students' e-portfolios are made public, which may generate a tendency to focus on appearance and presentation rather than substance. Challis (2005) stressed the importance of assessment processes as these guide students' overall growth and connection with the portfolio. Currently, students in the GradDip in teaching program are required to present their student e-portfolios in a formal presentation to their peers and an instructor to show their achievements, learning journey, and fulfillment of the teacher standard requirements.

In spite of all, students must embody e-portfolios beyond the course or program to allow authentic learning, personal growth, and leverage their educational experience for enhanced career prospects (Shroff et al., 2014). Benefits beyond the system transform learning and shift responsibility of learning to the learner.

The complexity of learning the e-portfolio at the same time as the complexity of learning to teach, as well as the complexity of metacognitively reflecting in the e-portfolio about meeting the standards, all conspire to raise an interesting challenge to the validity of e-portfolios. Could a high-quality e-portfolio actually mask a less than high-quality learning and, conversely, could a high-quality learning be masked by a low-quality e-portfolio or presentation? If the answer to either question is probably or possibly, then better evaluative practices and better technology is required to ensure that e-portfolios, teaching, and learning quality align.

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4.11 The Cost-Reward Analysis of E-Portfolios: Study 1

Study 1 utilized a mixed-methods approach to create an initial overview of the cost-reward analysis for e-portfolios. Study 1 employed a software evaluative analysis using the essential technology features and generated an evaluative cross-comparison of the prevailing e-portfolios available to teachers and course coordinators. This was followed by a quantitative analysis, one-way ANOVA, and the result indicates that students were more satisfied (i.e., user satisfaction) with the MyPortfolio (Mahara) system and evaluated it higher in terms of usability features than the Google Sites system. Emerging from the interview questions, student recommendations included increasing training and support, and assessment practices, and more emphasis of the long-term benefits of e-portfolios.

4.11.1 The software evaluation analysis of e-portfolios.

The software evaluative analysis of the eight-prevailing e-portfolios was generated to provide teachers and course coordinators a convenient method of surveying e-portfolios. Of course, it would be impossible to sample all current and upcoming e-portfolios but the essential technology features and their distinguishing particulars will assist in the expediency of testing and evaluation of these e-portfolios.

The essential technology features of e-portfolios with their distinguishing particulars include:

- Technology – Electronic storage capacity, upload and download, and compatibility.
- Personalization – Layout options and compatibility with documents (e.g., jpeg, wav, document files, etc.).
- Showcasing – Privacy and showcasing to the public.
- Communication – Forms of internal/in-system communication and dissemination control, direct and private messaging, linkage to email.
- Assessment – Direct and in-system evaluation, demonstration of task completion, and evaluation procedure.

See Table 13 for the comparison overview of the eight prevailing e-portfolios with their essential technology features, as highlighted above.

Table 13

The Essential Technology Features and the Eight Sample of E-Portfolios

Essential Technology Features	MyPortfolio (Mahara) System	Google Sites System	WordPress	Blogger	Weebly	LiveBinders	PebblePad	Chalk & Wire***
Technology								
Maximum Storage	1 GB	100 MB	3 GB*	1 GB*	Unlimited*	100 MB*	2 GB	2 GB
Max Upload File Size	50 MB	20 MB	8 MB	100 MB	10 MB	5 MB	500 MB**	500 MB****
Electronic Folder Compatibility	Yes Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Yes Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	No Folder Text, doc/docx, PDF; jpeg, tif, png, gif	No Folder Text, doc/docx, PDF; jpeg, tif, png, gif	No Folder Text, doc/docx, PDF; jpeg, tif, png, gif	Yes Text, doc/docx, PDF; jpeg, tif, png, gif	Yes Text, doc/docx, PDF; jpeg, tif, png, gif	Yes Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4
Personalization	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No – White Space
Layout Options	Several	Several	Several	Several	Several	Several	Several	None****
Compatibility	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Text, doc/docx, PDF; jpeg, tif, png, gif	Text, doc/docx, PDF; jpeg, tif, png, gif	Text, doc/docx, PDF; jpeg, tif, png, gif	Text, doc/docx, PDF; jpeg, tif, png, gif	Text, doc/docx, PDF; jpeg, tif, png, gif	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4
Video Upload	No	No	No	No	No	No	No	No
Showcasing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Privacy	Yes	Yes	No	No	No	Yes	Yes	Yes
Communication	Yes – via 'Wall'	Yes – via 'Comment Section'	Yes – via 'Comment Section'	Yes – via 'Comment Section'	No	Yes – via 'Comment Section'	Yes – via 'Comment Section'	Yes – via 'Comment Section'
Direct Messaging	Yes	Yes	No	No	No	Yes	Yes	Yes
Linkage to Email	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Assessment	No – External Only	No – External Only	No – External Only	No – External Only	No – External Only	No – External Only	Yes	No – External Only
Demonstration of Completion	Share e-portfolios web page for public evaluation (i.e., make public)	Share e-portfolios web page for public evaluation (i.e., make public)	Share e-portfolios web page for public evaluation (i.e., make public)	Share e-portfolios web page for public evaluation (i.e., make public)	Share e-portfolios web page for public evaluation (i.e., make public)	Share e-portfolios web page for public evaluation (i.e., make public)	Built-in and analytics capabilities	Share e-portfolios web page for public evaluation (i.e., make public)

* Available on free plan. **The school can assign the file size/limit based on student needs. ***Chalk & Wire system evaluation was created after the publication and during Study 3.

****Chalk & Wire is also highly customizable under the University of Auckland's Learning Technology Unit and threshold listed can be changed to fit user needs.

4.11.2 The comparative analysis of MyPortfolio (Mahara) and Google Sites systems.

The user satisfaction and usability analysis of the MyPortfolio (Mahara) and Google Sites systems were based upon the technology (i.e., user satisfaction and usability) and the impact on student experience with the system. The result from the comparative analysis shows MyPortfolio (Mahara) system was rated higher compared to the Google Sites system. The differences between the two systems were also statistically significant and effect sizes (Cohen, 1992) were borderline moderate to large, which means that there was moderate to large practical significance between students' usage satisfaction and the usability (i.e., easier to use and helpful in meeting and satisfying user the GTS) of the MyPortfolio (Mahara) system compared to the Google Sites system. Therefore, this satisfied Objective 2 of the study: Determine the impact of e-portfolio technology features that impact upon student experience with the system.

As for the cost-reward analysis, the technology features and usability of e-portfolios did impact students' experience with e-portfolios. This is consistent with the literature that states ed-tech systems require several underpinning tasks upfront. Such underpinning tasks are the technical and functional aspects of the software system, manageability, and the basic to advanced user technology skills needed to operate the system (Edwards, 2015; Redmond et al., 2014; San Jose & Kelleher, 2009). The essential technology features of the MyPortfolio (Mahara) system does not necessarily mean that it was a superior system compared to the Google Sites system, as both systems were helpful in satisfying the required standards of the GTS. There were several items that needs to be considered and these include:

- a technical issue (i.e., storage capacity issue) experienced by ECE students with Google Sites at the mid-point of the semester, and
- relative unequal sample size between the MyPortfolio (Mahara) users (N = 192) compared to Googles Sites users (N = 37).

4.10.2.1 Storage capacity issue with Google Sites at the mid-point of the semester.

The ECE pre-service student teachers were burdened with a storage capacity issue at the mid-point of the semester. There was a software upgrade and this caused a disruption. Students experienced an error message when uploading artifacts to their Google Sites e-portfolio. A solution was provided by Google Services and students were instructed to upload to their Google Drive first and then link the files to Google Sites. Nonetheless, this may have decreased students' perceived satisfaction and usability of the Google Sites system.

4.10.2.2 Unequal sample size between the MyPortfolio (Mahara) users (N = 192) compared to Googles Sites users (N = 37). The relative unequal sample size between the ECE and secondary pre-service student teachers was due to the convenience sampling of the two in-house e-portfolios. More discussion will be presented in the limitations section of the thesis (see Chapter 7).

4.11.3 The interview and the aim for Study 2.

Ascertained from the interview of the graduating pre-service student teachers (N = 12), was a degree of difficulty in either using or learning from both the MyPortfolio (Mahara) and Google Sites e-portfolios. Nonetheless, there were meaningful and positive reward outcomes, as reported by the interview participants. The thematic analysis is presented below in the framework of reward analysis of e-portfolios (see Table 14).

Table 14

Reward Analysis of E-Portfolios at the GradDip in Teaching Program and EDSW

The Reward Components of E-Portfolios	Number of Student Responses Out of N = 12
Liked the electronic portfolio, as it can be accessed with any device	7
Will continue to use it	2
Found it easy to use	2
Personalization and customization	9
Reflective practice	6
Peer feedback	5
Transparency (i.e., able to share and showcasing of student works)	7
Usefulness in satisfying the required GTS	10

Several students expressed that they liked the electronic version and they reported that they will continue to use it. Personalization and customization were also reported by students as positive or rewarding factors of e-portfolios. Students stated that they enjoyed the posting of their professional and teaching philosophy, and the posting of the images as personalization.

On the contrary, even though students reported that they enjoyed the personal reflective practices accessible within the e-portfolio environment, they wanted more time to engage in reflective processes (i.e., formative learning), possibly during class time. This is because students wanted to know if the artifacts they were posting were satisfactory in meeting the required standards. Students wanted more feedback from their lecturers and

teacher supervisors regarding the posting and justification of these artifacts. The thematic analysis is presented below in the framework of cost analysis of e-portfolios (see Table 15).

Table 15

Cost Analysis of E-Portfolios at the GradDip in Teaching Program and EDSW

The Cost Components of E-Portfolios	Number of Student Responses Out of N = 12
Difficult to use (i.e., steep learning curve)	9*
More training and support sessions needed (includes teachers, as some are not very good with computers)	5
More reflective practice – in class if possible	6
More option for personalization (i.e., skins and use of videos)	4
More teacher feedback	8
More communication from teacher and especially, when we satisfy each standard – want to know if I am doing this correctly	4
I wish it was graded (i.e., final submission graded and with feedback)	7

* n = 4 from ECE and Google Sites e-portfolio

Other challenges and cost components with the e-portfolios were underscored in the publication of Study 1:

- no training and support,
- underutilization of assessment processes, and
- no emphasis of the long-term benefits of e-portfolios.

This means much more is needed with e-portfolios to improve students' quality engagement with the system. These salient recommendations from graduating pre-service student teachers are consistent with the literature and with the importance of training and support, assessment practices, and embodiment of e-portfolios to improve engagement and students' connection with their e-portfolios (Bartlett, 2009; Buzzetto-Moore & Alade, 2008; Challis, 2005; Deneen et al., 2017; Havelock, 2009; Love et al., 2004; Shroff et al., 2014).

Study 2 empirically examines the relationships of training and support and the personalization of e-portfolios in increasing students' personal value and long-term benefits of e-portfolios.

Chapter 5. Study 2

Arising from the interview questions from Study 1 (i.e., training and support, assessment processes, and long-term benefits), Study 2 addressed these recommendations and the research question (RQ3): Do factors of training and support, and personalization of e-portfolios improve student engagement in terms of students' understanding of the required items for summative assessment and their showcasing of their e-portfolios to potential employers? The aim of Study 2 revolves around confirming factors of training and support, and the personalization of e-portfolios in increasing students' personal value and long-term benefits of e-portfolios in improving student engagement with the system. Study 2 delved into pre-service student teachers' year-long use of the MyPortfolio (Mahara) system and surveyed them on two different occasions, beginning (Time 1) and graduating (Time 2). It examined students' perceived benefits, and importance and usefulness of e-portfolios and their understanding of the outcome from their year-long use of the MyPortfolio (Mahara) e-portfolio.

This chapter presents the conceptual model, data-analysis plan, relevant data-analysis procedures (i.e., factor analysis and invariance testing), results, and discussion.

5.1 Study 2: Conceptual Model

Given the literature review and the objective related to this study (see Chapter 1, Chapter 2, and information provided above), a conceptual model was proposed. Study 2 proposes that attending training and support sessions (see training and support workshop description Section 5.8.2), and students' personalization (i.e., the creation of an introduction page, and inclusion of a personal and teaching philosophy) of e-portfolios will increase the quality of student engagement with the system (i.e., potentially show my e-portfolio to employers and understand the required items for the end-of-the-year summative assessment).

Several studies have found significant connection between training and support (Buzzetto-More & Alade, 2008; Challis, 2005; San Jose, 2017) and the personalization of e-portfolios in increasing students' personal value and the long-term benefits of e-portfolios (Baeten et al., 2008; Love et al., 2004; Shroff et al., 2014; Shroff et al., 2013; San Jose, 2017). However, they are without empirical evidence. Therefore, Study 2 sought to confirm a model of perceived benefits (An & Wilder, 2010), and importance and usefulness (Imhof & Picard, 2009) of e-portfolios as predictors of e-portfolio behavior.

After confirmation of perceived benefits (An & Wilder, 2010), and importance and usefulness (Imhof & Picard, 2009), structural equation modelling (SEM) technique is used. SEM affords social science researchers a powerful tool to detect their hypothesized and theoretical relationship model. It incorporates the concept of observed variables and latent variables, and provides specific observable factors in satisfying research objectives and hypothesis. SEM is particularly useful in education research, as key constructs involved are understood as latent or implicit causal variables that cannot be measured and are mostly assumed to be explained by responses to multiple observable indicators items (Byrne, 2016; Tabachnick & Fidell, 2012).

SEM directly accommodates measurement errors in the estimation of a series of relationships and tests for model fit. It also takes a confirmatory approach in analyzing data in which a priori theoretical models about relationships among manifests and latent variables are specified, and then tested for model fit to the data under scrutiny. Therefore, SEM allows researchers to test models containing complex relationships and various data types (e.g., categorical, ordinal, and continuous), compare multiple groups, and test whether models are invariant between different groups and times, and whether the mean differences in latent variables are statistically significant.

5.2 Data-Analysis Plan

With respect to the CFA and SEM techniques, the study followed procedures laid out by Byrne (2016) and guidelines presented in literature by Schreiber, Nora, Stage, Barlow, and King (2016) and Peterson, Brown, and Jun (2015). The primary focus in the Study 2 data-analysis plan is confirming the model structure of the latent factors (i.e., evaluating the reliability of the measurement models) used, prior to proceeding with exploring the relations among the variables. When CFA is conducted at the outset, the researcher is using a hypothesized model to estimate a population covariance matrix that is compared with the observed covariance matrix (Schreiber et al., 2016). The process is based on minimizing the difference between the estimated and observed structures and relations. Therefore, it is important to confirm the model exhibits good model fit, and represents the data well prior to the multigroup and invariance testing.

Testing structural models has been described as a combination of exploratory factor analysis and multiple regression (Byrne, 2016). This is because SEM conveys two important procedures where (1) the causal processes under study are represented by a series of

structural (i.e., regression) equations, and (2) the aggregation of items into coherent pools of shared covariance can be robustly evaluated. SEM incorporates the concept of observed or manifest variables and latent variables. This is particularly useful in this study, as the key constructs or factors are understood as latent or implicit causal variables that cannot be directly measured but can be assumed through observable indicator items (Byrne, 2016). SEM directly accommodates measurement errors in the estimation of a series of relationships and test for model fit. It then takes a confirmatory scheme to analyzing data in testing the hypothesized theoretical relationships among manifest and latent variables (i.e., testing for model of fit). Therefore, it has been acknowledged as the most robust multivariate analysis technique for testing hypothesized relationships among latent variables measured by multiple indicators (Byrne, 2016; Schreiber et al., 2016; Tabachnick & Fidell, 2012).

5.2.1 Sample size requirement.

According to Schreiber et al. (2016), sample size is important because it relates to the stability of the parameter estimates. For any statistical analysis, a recommendation of large sample sizes (i.e., $N > 500$) is essential in the measurement of adequate power and determining whether the model reflects the true relationships within the sample data (Pohlmann, 2004). This is especially true for SEM, as SEM and parameters (estimated through SEM) are based upon a sample covariance matrix rather than individual observations (Bollen, 1990). Therefore, a small sample size (e.g., $N < 100$) may pose a problem in SEM, as the probability of getting an inadmissible solution by chance increases and the lack of the statistical power to discriminate between good and poor fitting models (Kenny & McCoach, 2003). Nevertheless, studies have shown if conditions are favorable, for instance the model itself is simple or the residual variance is small, then small sample size ($N < 100$) may be adequate (Hooper, Coughlan, & Mullen, 2008; Pohlmann, 2004). Ideally, one could try to collect enough data to randomly split the data in half, estimate the model twice, and then compare the results (Pohlmann, 2004), but this would require an immense amount of time, costs, and resources.

There is, however, no exact rule for the number of participants needed; but 10 cases per estimated parameter appears to be a general consensus (Schreiber et al., 2016). Another approach to obtaining an acceptable sample size is to achieve a sufficient statistical power (i.e., $1\text{-}\beta \geq .80$; Fabrigar, Porter, & Norris, 2010). In this research, the minimum sample size requirement was determined on the basis of statistical power consideration. Using the computation tool developed by Soper (2015), with an anticipated effect size of $d = .20$,

statistical power (1-β) level set as .80, and probability set as .05, the minimum sample size for model structure was calculated as N = 200.

5.2.2 Handling of missing data.

In surveys, missing data can be caused by several random possibilities (i.e., fatigue, randomly skipped, time constraints, etc.) and are usually beyond the researcher's control (Byrne, 2016). Nonetheless, missing data is an almost inevitable occurrence in social science research (Byrne, 2016). Thus, a data-analysis plan should always include a discussion of the handling of missing data (i.e., listwise, pairwise, single imputation, or estimated; Byrne, 2010; Schreiber et al., 2016).

Issues with missing data revolve around how it may affect the results and the potential for biased conclusions drawn from it. There are also issues of not having enough data to perform the analysis (i.e., certain missing data procedures omit missing data from the analysis) or being able to run the data but having results not statistically significant because of the small amount of input data (Popham & Sirotnik, 1992). Lastly, results may be misleading if the cases analyzed are not a random sample of all cases (Field, 2009). Therefore, a careful consideration and an analysis conducted by the research is always required in handling of incomplete and missing data.

However, it is not always obvious when missing data will cause a problem and only a thorough analysis of data can determine whether missing data are problematic (Field, 2009). To address this, Tabachnick and Fidell (2012) stated that the pattern of missing data is more important than the amount missing and, therefore, it is important to identify if the missing data are scattered randomly. Little and Rubin (1987) distinguished between three primary patterns of missing data: those missing completely at random (MCAR), those missing at random (MAR), and those considered to be nonignorable (NMAR).

5.2.2.1 Handling of Study 2's missing data Time 1 data. There are several procedural options in the handling of missing data. Firstly, it is important to identify the pattern of the missing data. Using IBM SPSS version 23 and Frequencies, it was determined that 90% of cases had no missing data and only 20 cases had >2 missing responses (Table 16).

According to Byrne (2016), there are no clear guidelines regarding what constitutes a "large" amount of missing data, but Kline (1998) has suggested that missing data should constitute less than 10% of the data. Upon this information and based on the frequencies of missing data analysis, cases not meeting this criterion were omitted from the analysis.

Table 16

Frequencies Missing Data Study 2 (Time 1) Data

Status	Amount Missing	Number	Percent	Valid Percent	Cumulative Percent
Complete	none	220	90.2	90.2	90.2
MVA	1.00	3	1.2	1.2	91.4
MVA	2.00	1	.4	.4	91.8
Delete	9.00	1	.4	.4	92.2
Delete	10.00	3	1.2	1.2	93.4
Delete	14.00	16	6.6	6.6	100.0
	Total	244	100.0	100.0	

Secondly, the missing value analysis (MVA) and expectation-maximization (EM) (i.e., estimated statistics) were employed to determine the value analysis of the missing data and its impact to the results. The MVA begins by investigating the extent of missing data (i.e., if the remaining missing data warrants further investigation). Such cases that warrant further investigation are data that consists of: a) large percentage still missing, b) possible missing combination of data that may bias results, and c) under-representation of categorical groups in the data (Field, 2009). Using face-validity checks, none of these instances as listed by Field (2009) were applicable to the remaining cases of Study 2 (Time 1) data. Little's MCAR statistic was not statistically significant (X^2 = 80.92, df = 64, p=.075), indicating that the distribution of missing values was completely at random.

Moreover (and before proceeding to the mean imputation of the missing data), EM was also run to analyze the summary of estimated means. It is noteworthy that the EM algorithm is an iterative algorithm that can provide estimates of statistical quantities such as correlations, or imputed values for missing values, in the presence of a general pattern of missingness (Field, 2009). EM, in SPSS, also handles the estimated value of the missing data and it inputs the estimated value onto the data file. After EM is conducted, M and SD values for each variable are examined to ensure that the imputation process did not change the parameters of the variables. Likewise, if the mean imputation of missing value is substantial the frequency distribution of the imputed variable may be misleading (Byrne, 2010). Because the amount of missing data was small, imputation had very little impact on the mean and standard deviation of the items (i.e., with an estimated value change of .0001 to .0037).

5.2.2.2 Handling of Study 2's missing data Time 2 data. The handling of Study 2's missing data Time 2 were set up similarly to Study 2 Time 1 data (see Table 17).

Table 17

Frequencies Missing Data Study 2 (Time 2) Data

Status	Missing	Frequency	Percent	Valid Percent	Cumulative Percent
Complete	none	196	92.9	92.9	92.9
MVA	1.00	9	4.3	4.3	97.2
MVA	3.00	4	1.4	1.4	98.6
Delete	4.00	1	.5	.5	99.1
Delete	6.00	1	.5	.5	99.5
Delete	14.00	1	.5	.5	100.0
	Total	212	100.0	100.0	

Time 2, MVA and EM were also employed to determine the value analysis of the missing data and its impact on the results. Once again, using face-validity checks, none of these instances as listed by Field (2009) were applicable to the remaining cases of Study 2 (Time 2) data. Little's MCAR statistic was not statistically significant (X^2 = 114.67, df = 78, p=.060), indicating that the distribution of missing values was completely at random.

5.2.3 Repeated measures.

According to McArdle and Nesselroade (2014), a big problem with repeated measures is attrition, in that some participants do not provide data at all occasions. Another problem with repeated measures, and especially with SEM techniques, is that it does not always work or the model is not always guaranteed to "converge" (McArdle & Nesselroade, 2014). The issue with repeated measures with SEM scheme is that the complexity of the model increases as it is repeated (i.e., Time 1, Time 2, etc.) and as it is repeated the model becomes unstable. However, if the structural model is moderately stable (or exhibits good model fit) and the mean and covariances are appropriate for the scores (Byrne, 2016; McArdle & Nesselroade, 2014), then SEM techniques offer a level of precision not readily available to other empirical techniques. This is the reason why SEM is so widely used in social sciences empirical studies (Byrne, 2016; Field, 2009; McArdle & Nesselroade, 2014; Schreiber et al., 2016; Tabachnick & Fidell, 2012).

The repeated measure procedure for Study 2 was for the purpose of confirming (i.e., using CFA) the student perspective measurement items (i.e., perceived benefits, and importance and usefulness) and the stability of the model to appropriately measure student perspectives on e-portfolios and the outcome from their year-long use of the system. More

information is discussed in terms of the CFA and the outcome of the final model of the student perspective measurement items used in Study 2 in the instrument section of this chapter (see Section 5.5 Instruments).

5.2.4 Invariance testing.

Invariance testing is a statistical technique that determines whether model parameters differ by more than chance when tested across some specified groups (e.g., different group or different time; Byrne, 2016; Tabachnick & Fidell, 2012). According to Byrne (2016) and Schoot, Lugtig, and Hox (2012), invariance testing or measurement invariance (MI) guidelines or sets of models need to be estimated:

1. Run a model where only the paths are equal across groups, but the factor loadings and intercepts are allowed to differ between groups (i.e., configural invariance). This tests whether the arrangement of items and factors is equivalent in both groups.
2. Run a model where the factor loadings are equal across groups but the intercepts are allowed to differ between groups (i.e., metric invariance). This tests whether the strength of association between the latent factor and contributing items is equivalent.
3. Run a model where the loadings and intercepts are constrained to be equal (i.e., scalar invariance). This tests whether the participants have a statistically equivalent start value for the items belonging to each factor.

If the models are configurally invariant, it can be assumed that the same factorial structure holds across groups because the same factors and paths exist across groups (Schoot et al., 2012). If the models are metrically invariant, it can be assumed that the same strengths of the relations between factors and specific items exist across groups (Bialosiewicz, Murphy, & Berry, 2013). Lastly, if the models are scalar invariant, it can be assumed that the start values for each item within each factor are equivalent across groups. Thus, participants who have the same value on the latent construct should have equal values on the items on which the construct is based (Bialosiewicz et al., 2013).

According to McArdle and Nesselroade (2014), metric (equivalent regression weights) and scalar invariances are needed, firstly, to proceed with comparisons across groups. However, when the same people are studied in a repeated measures treatment, scalar equivalence may not be required because it is expected that events or treatments between measures may cause a change in the starting values participants have (McArdle, 2007).

Invariance is determined through comparisons of fit indices between increasingly constrained models. If the changes in fit are within chance, given the change in degrees of

freedom in the model, then invariance is established. Accordingly, a difference in comparative fit index (CFI) less than .01 (ΔCFI < .01) was adopted to determine that there was not a statistically significant drop in fit between models, while the root mean square error of approximation (RMSEA) ≤ 0.08 was used to detect the presence of configural invariance (Cheung & Rensvold, 2002; Schoot et al., 2012).

5.2.5 Model fit indices.

The general consensus in the literature is that studies should report a range of fit indices such that the limitation or biases of one index can be converged or supported by another index (Hu & Bentler, 1999; Fan & Sivo, 2005). However, it has been shown that not all fit indices are equally robust when models become large or complex, when sample sizes are large, or if models are incorrectly specified (Fan & Sivo, 2007). For example, the chi-square statistic is overly sensitive to sample size because it tends to reject models when large samples are used (Bentler & Bonnet, 1980; Hooper et al., 2008). Thus, the chi-squared (X^2/df) ratio can be used to evaluate overall model fit, with values < 3.80 yielding a $p > .05$. The RMSEA reveals how well the model, with unknown but optimally chosen parameter estimates, would fit the population covariance matrix (Byrne, 2016; Hooper et al., 2008). However, the RMSEA falsely rewards complicated models (i.e., >3 factors), while the CFI falsely tends to punish such complex models (Fan & Sivo, 2007). The Tucker-Lewis index is also affected by sample size (i.e., small sample size) and degrees of freedom but prefers simpler models (Byrne, 2010; Hooper et al., 2008; Tabachnick & Fidell, 2012). The gamma hat is unaffected by model complexity or misspecification and it directly measures how well the research model reproduces the observed data (Fan & Sivo, 2007). Lastly, the SRMR is the square root of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model (Hooper et al., 2008). Values for the SRMR range from zero to 1.0 with well-fitting models obtaining values close to .06; however, values as high as 0.08 are deemed acceptable (Hooper et al., 2008; Hu & Bentler, 1999).

Given the item discussion above, the model fit indices and criteria for acceptable levels of fit for Study 2 are: $X^2/\mathrm{df} < 3.80$; CFI and Gamma Hat ≥ .90; SRMR and RMSEA ≤ .08.

5.3 The GradDip in Teaching

Study 2 utilized a convenience sampling strategy and participants were drawn from the GradDip in teaching program. The GradDip in teaching is a year-long intensive program that

focuses on advance qualification in education and teaching career advancement. The program requires a bachelor's degree in any discipline and an earned GPA of 2.4 or higher. Completion of the program allows pre-service teachers to either teach at an ECE, primary (and intermediate), or secondary level. One of several summative evaluations of the GradDip in Teaching program is to satisfy the GTS, which consist of 29 teaching standards that exemplify the critical role teachers play in enabling the educational achievement of all learners. The GTS are divided into three parts: professional knowledge, professional practice, and professional values and relationships. Pre-service student teachers are required to satisfy all 29 standards using an e-portfolio software platform. For Study 2, participants were the 2015 cohort from the primary and secondary GradDip in Teaching utilizing the MyPortfolio (Mahara) e-portfolio. The ECE pre-service student teachers were excluded from Study 2, as they were using the Google Sites system.

5.3.1 E-portfolio training and support workshops.

Workshops were conducted by the course coordinators and with the help of a teacher assistant. The training and support workshops procedures are listed below. The primary focus of the training and support workshops was to assist students in the technical functionality of the MyPortfolio (Mahara) e-portfolio software system. Training and support workshop procedures and set-up include how to:

- Access the MyPortfolio (Mahara) through the EDSW faculty webpage.
- Login through Moodle (LMS) system.
- Identify and gain familiarity with the "front" page or profile page.
- Edit and populate the profile page and other pages (i.e., GTS page).
- Populate the front page with an introductory and teaching philosophy (optional). This includes cutting and pasting of information from a Word document or PDF.
- Create pages for the GTS.
- Upload artifacts to satisfy the GTS.
- Create justification (i.e., text boxes) to satisfy the GTS.
- Organize artifacts and other uploaded electronic files in folders.
- Access folders, and make changes to these folders and also change/update artifacts and justifications that have already been linked to the standards of the GTS.

The procedures listed above were the structural procedures set up by the teacher assistant who was the sole principal training and support workshop facilitator. The training and support workshops were available four times in the academic year 2015. The first workshop was at the first month of the program (i.e., early February, 2015), another mid-year (i.e., July, 2015), and two during the last month of the program (i.e., November, 2015). The only difference between the primary and secondary e-portfolio set-up procedure was the presentation of the GTS on the e-portfolio web page.

The primary GradDip in teaching GTS set-up procedure was to separate the GTS based on standard categories of *professional knowledge*, *professional practice*, and *professional values and relationships*. This meant students had to learn how to create three pages and label the pages based on these GTS categories. Then they uploaded their artifacts and wrote an appropriate justification that showed how the artifacts attested to the standards.

The secondary e-portfolio set-up procedure was based on a template created by the associate course director and all standards of the GTS were populated onto a single e-portfolio page. Students then copied the template onto their own page and then wrote an appropriate justification that showed how the artifacts attested to the standards.

It is important to note that the importance and demonstration of these standards of the GTS were the responsibility of the associate course director and course coordinators, rather than the trainer. The training and support workshops did not delve into the standards of the GTS or seek to influence what should be uploaded and/or how to justify each artifact. Both programs provided templates, peer-to-peer feedback rubrics, and examples from former students to their students. It is also important to note that "skin" personalization and customization was not available in the MyPortfolio (Mahara) version 16 because the skin template was not available until software update version 17.1.

During Study 2, personalization of student e-portfolios consisted of students populating their profile page, and creating and designing learning window pages (i.e., categories of the GTS). Personalization could include:

- personal information,
- teaching philosophy,
- personal images (i.e., picture of themselves, including selfies) and images of professional teaching practices (i.e., picture of activities they created, themselves teaching, etc.),
- other images created in software programs such as Photoshop, paint, etc., and

- embedding of videos from YouTube provided they were familiar with HTML.

5.4 Participants

The academic year for the University of Auckland and the GradDip in Teaching starts in January (Semester 1) and concludes late in November (Semester 2). Surveys responses were collected from pre-service student teachers on two different occasions, at the beginning (Time 1; February) and near the finish of their 1-year program (Time 2; November).

Participants consisted of males and females with an age range of under 18- to 59-years old (i.e., as indicated on the demographic information of participants; see also Table 18 for the complete demographic information of participants). Female participants dominated the volunteer pool. GradDip in Teaching (Primary) female participants at Time 1 (79.12%) and Time 2 (68%), compared to male participants at Time 1 (20.88%) and Time 2 (32.03%). Likewise, the GradDip in Teaching (Secondary) female participants at Time 1 (70.20%) and Time 2 (77.1%), compared to male participants at Time 1 (29.80%) and Time 2 (22.9%) respectively. The age group of 20-29 dominated the volunteer pool consistent with the GradDip in Teaching being a post-bachelor's degree program. It is safe to assume that most of the 20-29 age-group participants directly entered the GradDip program immediately after their bachelor degree completion. Further, it is also a teaching and professional setting graduate degree and therefore it is not uncommon to observe returning students in the age range of 30-39, 40-49, and up to 59 years of age.

Table 18

Demographic Information the Pre-service Student Teachers for Time 1 and Time 2

GradDip in Teaching		Sex and Percentage		Age Range and Percentage					
	N	Male	Female	Under 18	18-19	20-29	30-39	40-49	50-59
GradDip Primary (Time1)	91	19 (20.88%)	72 (79.12%)	0 (0.00%)	1 (1.09%)	58 (63.73)	16 (17.58%)	13 (14.28)	3 (3.29%)
GradDip Primary (Time2)	128	41 (32.03%)	87 (68%)	0 (0.00%)	2 (1.56%)	86 (67.18%)	27 (21.09%)	10 (7.81%)	3 (2.34%)
GradDip Secondary (Time 1)	151	45 (29.80%)	106 (70.20%)	1 (0.6%)	1 (0.6%)	103 (68.24%)	27 (17.88%)	15 (9.93%)	4 (2.64%)
GradDip Secondary (Time 2)	83	19 (22.9%)	64 (77.1%)	0 (0.00%)	1 (1.20%)	52 (62.65%)	14 (16.86%)	15 (18.07%)	1 (1.20%)

5.4.1 Survey response rate.

Table 19 shows the obtained sample size and response rate relative to the cohort size for primary and secondary GradDip programs. Unsurprisingly, the response rate for secondary dropped from 82% at Time 1 to 53% at Time 2. However, the response rate rose from 69% to 95% among the GradDip in Teaching (Primary) group. At Time 1, data collection was restricted to the day and time approved by the course coordinators and thus, if students were absent, truant, or tardy, the surveys were not completed. However, at Time 2 pre-service student teachers were required (i.e., mandatory) to attend a course meeting with the associate director of the program to discuss any end-of-the-year required items and to also provide details about the presentation of their e-portfolios. Time 2 survey was administered during this time thus the explanation for the increase of response rate. The increased participation rate at Time 2 may affect the final analysis. Nonetheless, the volunteer and anonymous nature of the study can cause unequal and unbalanced participation.

Table 19

Time 1 and Time 2 Response Rate and Volunteer Pool (No Missing Data)

		Participants	
Group	Cohort	Time 1	Time 2
Primary GradDip in Teaching	132	91 (69%)	126 (95%)
Secondary GradDip in Teaching	157	129 (82%)	83 (53%)

5.5 Instruments

The survey measurement items were drawn from two sources. The eight perceived benefits and value were from An and Wilder (2010) and the four importance and usefulness of e-portfolios measures were from Imhof and Picard (2009). An and Wilder's (2010) items were taken from their analysis of elementary teacher candidates' perceptions of e-portfolio benefits ($\alpha = 0.91$). The perceived benefits (pbfit) items were adapted to focus on the study content:

Creating my e-portfolio helped me to:

- improve my computer/technology skills.
- develop a better understanding of alternative forms of assessment.
- develop critical thinking skills.
- develop organizational skills.
- critically reflect on projects I have worked on.

- evaluate my career goals.
- show my creativity.
- demonstrate my technology skills.

Likewise, the items from Imhof and Picard (2009) were designed to measure the acceptance of the components of the e-portfolio structure and to assess the practical usage ratings of the importance and usefulness of the system ($\alpha = 0.89$). The importance and usefulness (iu) item content were:

The e-portfolio in the teacher education program was:

- important.
- useful.
- well structured.
- clearly laid out.

All items and inventories adopted by Study 2 utilized a six-point positively packed agreement-rating scale: *strongly disagree*, *usually disagree*, *slightly agree*, *moderately agree*, *usually agree*, and *strongly agree*. A six-point positively packed rating scale (Lam & Klockars, 1982) was adopted to increase the variation and discrimination of the participants' responses (Masimo & Lam, 2014). Positive packing is valid when participants are expected to have a bias toward positive attitude (Brown, 2004; Lam & Klockars, 1982). The rating scale had four positive-agreement response points and two negative-response points indicating the participants' agreement level for each survey item. The scale responses were 1 = *strongly disagree*, 2 = *disagree*, 3 = *slightly agree*, 4 = *moderately agree*, 5 = *mostly agree*, and 6 = *strongly agree*. This type of scale-response format has been reported to effectively mitigate the potential ceiling effect caused by participants' tendency or disposition to agree with all statements (Brown, 2004).

Results

5.6 Descriptive Statistics: Training and Support Workshops Attended and Personalization of E-Portfolios.

Table 20 shows the frequency of response of workshops attended and degree of personalization, at Time 1 and Time 2. There was an increase in the number of students who attended two or more training and support sessions at Time 2 compared to Time 1, with a large effect size (*d*=.70; Cohen, 1992). The large effect size may indicate the importance of the training and support workshop sessions and in how students required more technical support with their e-portfolio usage and development. There is more discussion of the training and support sessions, along with the personalization of e-portfolios, in the results and discussion section of this chapter (see Section 5.8). Personalization of e-portfolios was determined based on students indicating (i.e., on the self-reported survey) that they created an introduction page and if they also included a teaching philosophy.

Table 20

Workshops and Personalization (Time 1 and Time 2)

	Time 1	Time 2
Number of e-portfolio training and support workshops		
0	108	62
1	92	63
2	15	66
3	5	15
4	0	2
≥5	0	1
M	1.63	2.22
SD	0.72	1.01
	Time 1	Time 2
Personalization of e-portfolio		
Yes	85	101
No	135	108
M	1.62	1.52
SD	0.49	0.5

Those who did not attend or only attended one workshop were classified as low attendees, while those who attended two or more workshops were classed as high attendees (Table 21). Similarly, the distribution of those who personalized and who did not personalize their e-portfolios is shown. The difference in distributions is statistically significant

(χ^2=27.01, *p*=<.001), indicating that greater attendance at workshops resulted in greater probability that the e-portfolio showed personalization.

Table 21

Workshops Attended and Personalization

Personalization	0-1 Attended	≥ 2	Total
YES	42	59	101
NO	83	25	108
Total	125	84	209

5.7 Validating the Perceived Benefits, and Importance and Usefulness of E-Portfolios

The two factors, perceived benefits, and importance and usefulness of e-portfolios, were validated with a total of 12 items, and an output of two items: continued use of e-portfolios (OUT1) and summative evaluation (OUT2). All items were initially examined using Cronbach's (1970) alpha using IBM SPSS version 23. Perceived benefits (8 items, α=.92) and importance and usefulness (4 items, α=.87) at Time 1 exceeded the reliability estimate threshold (α = 0.70) recommended by Nunnally (1967). While Time 2 perceived benefits (8 items, α=.91) and importance and usefulness (4 items, α=.89), likewise, exceeded the reliability estimate threshold (α = 0.70) recommended by Nunnally (1967).

5.7.1 Descriptive statistics.

Descriptive statistics for the questionnaire items are presented in Table 22. All means for Time 1 were above 2.90, ranging from 2.90 to 4.00 (Note: 1 = strongly disagree, 2 = mostly disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, and 6 = strongly agree). The standard deviations ranged from 0.91 to 1.36, which indicates a large spread around the mean. Additionally, all means for Time 2 were above 2.81, ranging from 2.81 to 3.85. The standard deviations ranged from 0.33 to 1.36, which also indicates a large spread around the mean.

Cohen's *d* indicates a small to moderate effect size for mean differences between Time 1 and Time 2. This indicates a small to moderate practical significance with students' responses from Time 1 to Time 2. Moderate effects are especially noted with the items of pbfit5 (i.e., critically reflected on projects I worked on), pbfit7 (i.e., showed my creativity), iu1 (i.e., e-portfolio was important), and OUT1 (i.e., someday I would like to show my e-

portfolio to potential employers). Initial analysis of these items seems to focus on the reflective practices of e-portfolios and the system's capabilities of showcasing students' creative works. Students also indicated the importance of the system in procuring future employment. This seems to be in alignment with the general purposes and benefits from e-portfolio use, especially in a professional-practice context.

Table 22

Descriptive Statistics from the Survey: Perceived Benefits, Importance and Usefulness, and Output (Time 1 and Time 2)

	Time 1		Time 2		
Factor and Items	*M*	*SD*	*M*	*SD*	*d*
Perceived Benefits (pbfit)					
1. Improved my computer/technology skills.	2.90	0.95	2.91	1.02	.01
2. Developed a better understanding of alternative forms of assessments.	3.33	0.93	3.20	0.96	-.13
3. Developed critical thinking skills.	3.00	0.91	3.00	1.03	0.0
4. Developed organizational skills.	3.30	0.96	3.25	1.02	-.05
5. Critically reflected on projects I worked on.	3.20	0.91	3.62	0.94	**.45**
6. Evaluated my career goals.	3.06	0.94	3.10	1.05	.04
7. Showed my creativity.	3.10	0.95	2.81	1.07	**.29**
8. Demonstrated my technology skills.	3.21	0.93	3.22	1.01	.17
Importance and Usefulness (iu)					
1. In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was important.	4.00	1.36	3.56	1.34	**.32**
2. In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was useful.	3.67	1.32	3.57	1.28	.08
3. The electronic portfolio (e-portfolio) system was well structured.	3.30	1.23	3.39	0.33	.09
4. The procedures for the e-portfolio usage were clearly laid out.	3.23	1.22	3.42	1.36	.14
OUTPUT					
OUT1. Someday I would like to show my e-portfolio to potential employers.	3.40	1.00	3.02	1.16	**.35**
OUT2. Understood the required items for my end of the semester evaluations or assessments (e.g., course and programme goals/standards or the GTS).	3.80	1.02	3.85	0.88	.05

Note. Items in bold have effect size greater than trivial.

5.8 Factor Analysis and Invariance Testing

5.8.1 Factor analysis.

Prior to testing the models of e-portfolios in this study, the validity of the measurement model for all constructs was assessed. An inter-correlated model consisting of two factors and 12 items was tested in Amos. The schematic figure for this Time 1 e-portfolio model is presented in Figure 5.

The model fit indices of the initial measurement of the e-portfolio model (Time 1) revealed a marginal fit, thereby suggesting that the fit of the data to the hypothesized model was not entirely adequate. (see Table 23 for accepted values and Time 1 model fit indices).

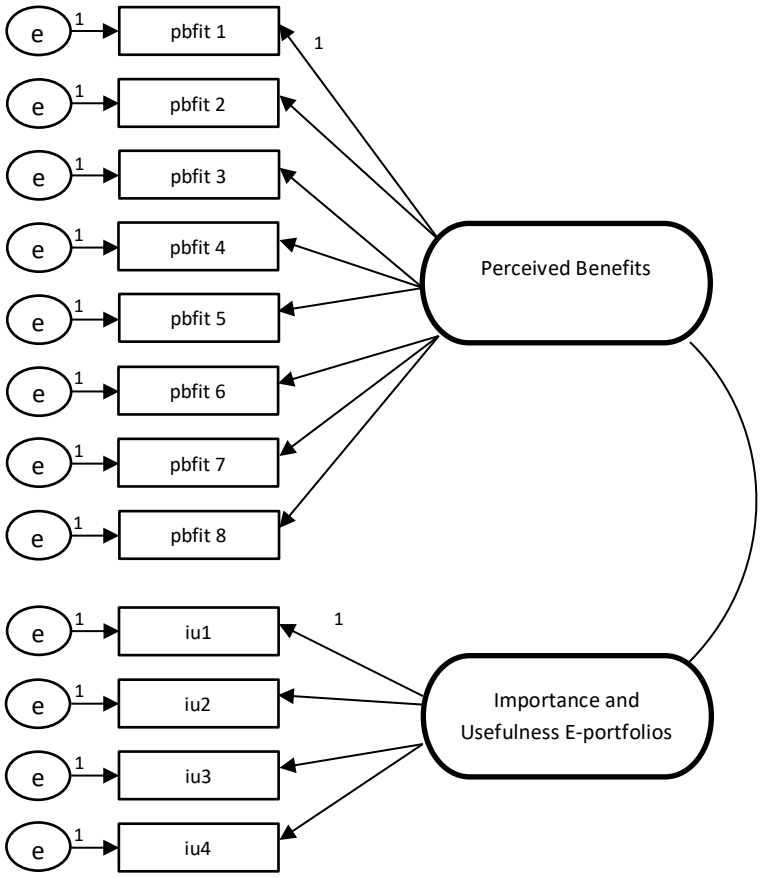

Figure 5. The measurement model structure of e-portfolio in Time 1.

Table 23

Study 2 Time 1 Initial E-Portfolio Model

	N	X^2 (df)	X^2/df	CFI	Gamma Hat	SRMR	RMSEA
Accepted Values			< 3.80	≥ 0.90	≥ 0.90	≤ 0.08	≤ 0.08
Time 1 Model 1	220	350.12 (74)	4.73	.865	.93	.06	.13
Time 1 Model 1A (Trimmed)	220	211.54 (62)	3.41	.912	.90	.05	.10

This required revision and trimming to obtain a well-fitting model (Field, 2009; Sauro & Lewis, 2011). Inspection and consideration of the item loadings (Table 24) suggested that strength of loading was not a significant factor because only one item (pbfit1) had a loading < .70; Tabachnick & Fidell, 2012).

Table 24

Constructs, Items, and Loading Statistics

Item Code	Factor & Items	Factor Loading Time 1
	Perceived Benefits (pbfit)	
pbfit1	Improved my computer/technology skills.	0.69
pbfit2	Developed a better understanding of alternative forms of assessments.	0.71
pbfit3	Developed critical thinking skills.	0.82
pbfit4	Developed organizational skills.	0.83
pbfit5	Critically reflected on projects I worked on.	0.71
pbfit6	Evaluated my career goals.	0.82
pbfit7	Showed my creativity.	0.78
pbfit8	Demonstrated my technology skills.	0.80
	Importance and Usefulness (iu)	
iu1	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was important.	0.76
iu2	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was useful.	0.95
iu3	The electronic portfolio (e-portfolio) system was well structured.	0.76
iu4	The procedures for the e-portfolio usage were clearly laid out.	0.70

However, inspection of modification indices suggested that pbfit1 (i.e., improved my computer/technology skills), iu3 (i.e., the electronic portfolio (e-portfolio) system was well structured), and iu4 (i.e., the procedures for the e-portfolio usage were clearly laid out) were strongly inter-correlated. Because iu4 and iu3 referred to the e-portfolio in terms of its structure (i.e., iu3) and how it was laid out (i.e., iu4) and because iu4 had a lower loading than iu3, it was decided to drop item iu4 from further analysis.

The trimmed Model 1A had generally acceptable fit. Although the RMSEA was higher than usual, this may be due to the very simple nature of the model being tested. The balance of fit indices was acceptable and thus this model was used for testing the Time 2 responses.

Model 1A was tested with the Time 2 data to determine whether it was statistically equivalent. Multigroup CFA (Cheung & Rensvold, 2002) was used to determine the stability of Model 1A at Time 2. Furthermore, it was tested for equivalence between low- and high-workshop-attendance groups and no-personalization vs personalized e-portfolios (see Table 25).

Table 25

E-Portfolio Model 1A Multigroup Fit Indices for Three Conditions

Condition	N	X^2 (df)	X^2/df	CFI	Gamma Hat	SRMR	RMSEA
Time 1 v. Time 2	T1 =220 T2 =209	412.50 (124)	3.32	.912	.90	.05	.07
Workshops Attended (0-1 v. high ≥ 2)	0-1 = 125 High =84	293.65 (126)	2.33	.892	.90	.07	.08
Personalization (No Personalization v. Personalization)	No =108 Yes =101	250.27 (124)	2.02	.918	.90	.06	.07

The fit of the 2-group version of Model 1A for each of the three comparative conditions ranged from acceptable to good. Hence, the models were then tested for invariance.

5.8.2 Invariance testing.

In accordance with the discussion of the data-analysis plan, an MI test was performed to test the factor validity of Model 1A across three conditions. This would determine whether the same factorial structure held across each condition. For each factor, a sequence of increasingly constrained models was tested. Starting on the basis of the established configural invariance, subsequent invariance tests were carried out by: 1) imposing equal factor loading constraints across both groups to test metric invariance, and 2) imposing equal factor loading and equal intercept constraints to test scalar invariance. Table 26 presents the results of these invariance tests.

Table 26

E-Portfolio Model 1 to Model 4 Multigroup Invariance Testing

Condition	N	X^2	*df*	X^2/df	RMSEA	CFI	ΔCFI	Invariant?
Time 1 v. Time 2	T1 N=220 T2 N=209							
Configural		412.50	124	3.32	.07	.912	--	--
Metric		425.18	134	3.17	.07	.911	--	Yes**
Scalar		531.98	147	3.61	.08	.887	.03	No**
Workshops Attended (0-1 v. high ≥ 2 Attendees)	0-1 =125 vs. High =84							
Configural		293.65	126	2.33	.08	.892	--	--
Metric		300.18	136	2.20	.08	.895	--	Yes**
Scalar		340.57	149	2.28	.08	.877	.01	No**
Personalization (No Personalization v. Personalization)	No =108 vs. Yes =101							
Configural		250.27	124	2.02	.07	.918	--	--
Metric		263.53	134	1.97	.06	.916	.01	Yes**
Scalar		322.85	147	2.19	.07	.887	.02	No**

Results showed that in all three conditions both configural and metric invariance were supported. However, the models failed the stricter scalar invariance, indicating that by the end of the year, participants had different starting values. It can be concluded that the compared samples were not from the same population since they responded differently to the questionnaire items, with 0-1 versus high training and support attendees and no personalization and personalization all having different start values.

Given that only metric equivalence for the measurement was established, it was likely that the structural models might function differently across groups (Brown, Harris, O'Quin, & Lane, 2015). According to Cheung and Rensvold (2002), metric and scalar invariances are essential prerequisites before comparisons across groups are made, although metric equivalence is enough to allow between-time comparisons. Therefore, failing scalar equivalence prevents the comparison of latent means across groups. In the absence of strong factorial invariance, the comparison of latent means is ambiguous and the effects of a between-group difference in the latent means are confounded with differences in the scale (Cheung & Rensvold, 2002). In this case, instead of comparing groups at the path coefficient level (Byrne, 2016; Gaskin, 2016), the differences at the intercept of the item were examined (Cheung & Rensvold, 2002).

5.8.3 Time 1 vs Time 2 intercept comparison.

Only three items in Model 1A had effect size differences *d* >.20 (Table 27).

Table 27

Items and Intercept Comparison Time 1 Versus Time 2

		Time 1		Time 2			
Item	Factor and Items	Intercept	S. E.	Intercept	S.E.	ΔIntercept	*d*
	Perceived Benefits						
pbfit1	Improved my computer/technology skills.	2.90	0.064	2.91	0.071	.01	.00
pbfit2	Developed a better understanding of alternative forms of assessments.	3.33	0.063	3.20	0.067	-.13	-.08
pbfit3	Developed critical thinking skills.	2.98	0.061	2.99	0.072	.01	.00
pbfit4	Developed organizational skills.	3.30	0.065	3.25	0.071	-.05	-.03
pbfit5	Critically reflected on projects I worked on.	3.20	0.062	3.62	0.065	.42	**.28**
pbfit6	Evaluated my career goals.	3.06	0.064	3.10	0.073	.04	.02
pbfit7	Showed my creativity.	3.10	0.064	2.81	0.074	-.29	-.19
pbfit8	Demonstrated my technology skills.	3.21	0.063	3.22	0.07	.01	.00
	Importance and Usefulness						
iu1	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was important.	3.97	0.091	3.56	0.093	-.41	**-.28**
iu2	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was useful.	3.67	0.089	3.57	0.089	-.10	-.07
iu3	The electronic portfolio (e-portfolio) system was well structured.	3.30	0.083	3.39	0.092	.09	.06
	OUTPUT						
OUT1	Someday I would like to show my e-portfolio to potential employers.	3.39	0.089	3.02	0.08	-.37	**-.25**
OUT2	Understand the required items for my end of the semester evaluations or assessments (e.g., course and programme goals/standards or the GTS).	3.80	0.083	3.85	0.06	.05	.03

The small difference in pbfit5 (i.e., critically reflected on projects I worked on) underscores the reflective nature of e-portfolios within the GradDip in Teaching and professional-practice context. In contrast, a decrease in mean starting point was observed for iu1 (i.e., in the context of the teacher-training program, the electronic portfolio (e-portfolio) system was important) and OUT1 (i.e., someday I would like to show my e-portfolio to potential employers). This suggests that the challenges and cost components of MyPortfolio (Mahara) e-portfolio in the context of the teacher-training program worked against enthusiasm for these notions.

However, given the metric equivalence and the small size of difference in the intercepts of just three items, it would seem that changes over time for this group of participants do little to provide insight into Objective 3 (i.e., determine factors [e.g., training and support, assessment practices, and long-term benefits] and student perspectives [i.e.,

perceived benefits, and importance and usefulness] that lead to compliance versus quality engagement with the system). It could be then that insights can be gained by examining differences in the other conditions (i.e., level of training and support and degree of personalization).

5.8.4 Level of workshop attendance intercept comparison.

Table 28 provides the intercept comparisons for the low (i.e., ≤ 1 workshops attended) versus high (i.e., ≥ 2 workshops attended) training and support conditions.

Table 28

Items and Intercept Comparison (Time 2) 0-1 (i.e., ≤ 1 Workshops Attended) Versus High (i.e., ≥ 2 Workshops Attended)

		Low		High			
Item	Factor and Items	Intercept	S. E.	Intercept	S.E.	ΔIntercept	*d*
	Perceived Benefits						
pbfit1	Improved my computer/technology skills.	2.85	0.093	3.02	0.1	.17	.17
pbfit2	Developed a better understanding of alternative forms of assessments.	3.16	0.089	3.26	0.107	.10	.11
pbfit3	Developed critical thinking skills.	2.96	0.096	3.05	0.109	.09	-.10
pbfit4	Developed organizational skills.	3.32	0.093	3.14	0.096	-.18	-.17
pbfit5	Critically reflected on projects I worked on.	3.64	0.088	3.60	0.108	-.04	-.03
pbfit6	Evaluated my career goals.	3.05	0.098	3.15	0.115	.10	.10
pbfit7	Showed my creativity.	2.76	0.097	2.90	0.108	.14	.16
pbfit8	Demonstrated my technology skills.	3.19	0.092	3.27	0.124	.08	.07
	Importance and Usefulness						
iu1	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was important.	3.73	0.12	3.30	0.141	-.43	**-.40**
iu2	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was useful.	3.78	0.114	3.24	0.135	-.54	**-.51**
iu3	The electronic portfolio (e-portfolio) system was well structured.	3.68	0.116	2.95	0.139	-.73	**-.70**
	OUTPUT						
OUT1	Someday I would like to show my e-portfolio to potential employers.	2.97	0.10	3.09	0.124	.12	.11
OUT2	Understand the required items for my end of the semester evaluations or assessments (e.g., course and programme goals/standards or the GTS).	3.93	0.08	3.75	0.093	-.18	-.17

Estimates of the intercept comparison between 0-1 versus high training and support workshop groups indicated small effect sizes, except for the three importance and usefulness items which had moderate to large decreases in the starting value. This indicates that participants who attended more workshops had lower starting values for the importance and

usefulness of the e-portfolio. It could be that the effort needed to learn the system (i.e., taking extra time to learn how to operate the technology of the e-portfolio) and learning from the system were additional pressures and generated relatively more negative attitudes. Time, resources, and energy that could be directed elsewhere, such as teaching, were required simply to fulfill the e-portfolio component. Therefore, it may be that students who need more technology assistance will produce lower quality documentation in the e-portfolio as to their teaching qualities.

Nonetheless, the distinguishing differences between pre-service student teachers who attended two or more (≥ 2) training and support workshops indicate higher estimates (with small effect size ranging from .10 to .17; Cohen, 1992) for pbfit1 (i.e., improved my computer/technology skills), pbfit2 (i.e., developed a better understanding of alternative forms of assessments), pbfit3 (i.e., developed my critical thinking skills), pbfit6 (i.e., evaluate my career goals), pbfit7 (i.e., show my creativity), and OUT1 (i.e., someday I would like to show my e-portfolio to a potential employer). This is consistent with the notion that active training and support for users contribute to user understanding and the purposes of e-portfolios (Bartlett, 2009; Buzzetto-More & Alade, 2008; Challis, 2005; Havelock, 2009; San Jose, 2017). Training and support sessions reinforce the overall purposes and differing objectives (i.e., improve computer skills, develop critical thinking, and show creativity) (Barrett & Carney, 2005; Chau & Cheng, 2010), along with the leveraging of e-portfolios for future employment. Nonetheless, these effects are small.

For this reason, a comprehensive training and support session to help mitigate against such pressures or to simply ease the tension of learning, learning with, and operating an e-portfolio must be implemented when e-portfolios are adopted. Training and support sessions deal with the persistent challenges of technology in education (i.e., Dede, 1998; Dzida, 1996; Cuban, 1998; Cuban et al., 2001) and likewise, assist in the reduction of stressors and aid phobic users (Fontaine, 2000; 2002; Redmond et al., 2014; San Jose & Kelleher, 2009). The overall purposes of training and support sessions can capture opportunities, as observed in this study, for further enhancement and improvement of student engagement with e-portfolios, these include: 1) improvement of technology skills, 2) better understanding of assessment practices, and 3) greater acceptance and user buy-ins of the affordances from e-portfolios as they help develop critical thinking skills and benefits from one's personal and professional vocation.

5.8.5 Level of personalization intercept comparison.

Table 29 provides the comparison of intercept scores for no personalization vs. personalized groups.

Table 29

Items and Intercept Comparison (Time 2) Model 4 (Time 2) No Personalization versus Personalization

		No Personalization		Yes Personalization			
Item	Factor and Items	Intercept	S. E.	Intercept	S.E.	ΔIntercept	*d*
	Perceived Benefits						
pbfit1	Improved my computer/technology skills.	2.88	0.109	2.95	0.089	.07	.07
pbfit2	Developed a better understanding of alternative forms of assessments.	3.16	0.099	3.24	0.089	.08	.08
pbfit3	Developed critical thinking skills.	2.9	0.106	3.04	0.096	.14	.14
pbfit4	Developed organizational skills.	3.32	0.103	3.18	0.096	-.14	-.14
pbfit5	Critically reflected on projects I worked on.	3.53	0.099	3.72	0.083	.19	**.20**
pbfit6	Evaluated my career goals.	2.97	0.11	3.24	0.092	.27	**.27**
pbfit7	Showed my creativity.	2.48	0.1	3.17	0.1	.69	**.70**
pbfit8	Demonstrated my technology skills.	3.04	0.101	3.40	0.094	.36	**.36**
	Importance and Usefulness						
iu1	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was important.	3.70	0.125	3.41	0.137	-.29	**-.28**
iu2	In the context of the teacher-training program, the electronic portfolio (e-portfolio) system was useful.	3.63	0.125	3.50	0.126	-.13	-.12
iu3	The electronic portfolio (e-portfolio) system was well structured.	3.48	0.128	3.31	0.133	-.17	-.16
	OUTPUT						
OUT1	Someday I would like to show my e-portfolio to potential employers.	2.92	0.113	3.13	0.08	.21	**.22**
OUT2	Understand the required items for my end of the semester evaluations or assessments (e.g., course and programme goals/standards or the GTS).	3.88	0.089	3.83	0.06	-.05	-.06

Altogether, six items had differences equal to or greater than $d = .20$. Five items had higher intercepts for the personalized group, except for iu1 to do with the importance of the e-portfolio, which was lower. Four higher values were in the perceived benefit (pbfit5-8), with one having a large effect (pbfit7: showed my creativity). Graduating pre-service student teachers who personalized their e-portfolios seemed to have positioned their e-portfolios as "self-marketing portfolios" (Barrett & Carney, 2005), in which they showed notably greater reflection on their projects, evaluation of their career goals, exhibition of their creativity, and demonstrated their technology skills and willingness to show the e-portfolio to a potential

employer. Thus, personalization seems to be associated with greater demonstration of skills, creativity, and showcasing of e-portfolios to potential employers.

Personalizing one's e-portfolio in such manner of marketing and leveraging the system for employment or career advancement contributes to the greater personal value (i.e., finding personal value) and ownership of e-portfolios (Buzzetto-More & Alade, 2008; Love et al., 2004; Shroff et al., 2014; Shroff et al., 2013). There is, in a sense, a greater ownership of the system as to showcasing of students' technology skills (i.e., personalization, customization, and professional layouts), transparency of exemplar works and creativity, and all seem to be for the purposes of employment and career advancement. This makes practical sense, as the next stage for any student is to procure employment.

5.9 Summary

Study 2 addressed the recommendations from Study 1 (i.e., training and support) and explored personalization of e-portfolios (i.e., continued and long-term benefits from e-portfolio) as facilitating factors in improving students' engagement with e-portfolios. It is evident that training and support, and personalization of e-portfolios, improve student engagement with the e-portfolio. Clearly, students who used more of the training also had greater personalization of their e-portfolios (Table 21). Together these results suggest that despite the training being focused on technical aspects, it supported a greater ability to customize the e-portfolio itself.

Results are consistent with current literature and in accordance to Shroff et al.'s (2013) findings on the positioning of e-portfolios for increasing personal value, feelings of control, and taking responsibility of his or her own learning. Thus, there seems to be a cost in mastering the e-portfolio technology, but, when that cost is paid through further training, it would appear that students are rewarded with greater personal benefits through personalized e-portfolios. Study 3 further extends the cost-reward analysis and the tension between compliance and learning for nursing students in the BNurs program.

Chapter 6. Study 3

The general purpose of Study 3 was to obtain evaluative user feedback from the BNurs program in FMHS – a different faculty but with similar e-portfolio usage that is meeting healthcare and nursing competencies – while deploying the cost-reward analysis (Emerson, 1976; Thibaut & Kelley, 1959) and the student ownership of learning with an e-portfolios framework (Shroff et al., 2014; Shroff et al., 2013). These dimensions of student ownership of learning with e-portfolios replicated Study 1's analysis of positive/liked and negative/disliked aspects, and recommendations for improving student engagement with the system. This study replicated the exploration of the tension between compliance and learning, in a cost analysis, of difficulty of use, lack of personalization, assessment processes, and articulation of the long-term and continued benefits, and likewise, a reward analysis, of the convenience, portability, and the satisfaction of the nursing competencies, of e-portfolios. This chapter presents the data-analysis plan, procedures, results, and discussion.

6.1 Qualitative Data-Analysis Plan

Study 3's qualitative data-analysis plan was based on Srivastava and Hopwood's (2009) qualitative iterative data-analysis model. The iterative process is not just a repetitive mechanical task where the researcher reads the text, divides the text into segments of information, codes segments, refines the codes, interprets the results, and then repeats the process until a pattern or a theme emerges. The process is more of a reflective systematic scheme and the aim or purpose is to spark understanding and develop meaning (Srivastava & Hopwood, 2009). The insight is then associated with what the researcher knows, what he or she wants to know (based on the research questions), and the logical relationship between what is emerging from the data (Srivastava & Hopwood, 2009).

The objective of Study 3 was to examine nursing students' feedback on their use of the Chalk & Wire e-portfolio, and explore factors of student ownership of learning, in connection to the cost-reward analysis, as the overarching objective. Therefore, the Study 3 analysis was a semi-structured interview protocol guided by the constructs of *finding personal value* (FPV), *feeling in control* (FIC), and *taking responsibility* (TR; Milner-Bolotin, 2001; Shroff et al., 2014). The interview protocols were based on Spradley's (1979) ethnographic interview processes and questions were developed to directly ask participants about core constructs of ownership of learning with e-portfolios. The interview data were also coded (aggregated into) with positive and negative responses by nursing students. Lastly,

nursing students openly provided feedback and recommendations to increase ownership of e-portfolios in the context of healthcare services and in satisfaction of the nursing competencies.

Figure 6 shows the iterative analytic procedure used in this study. This is an identical process to that described in Chapter 4 in which data were positively and negatively coded and then formulated into cost-reward analysis (see Section 4.10). The process involves first grouping responses to questions into the three content categories: FPV, FIC, TR, and according to whether the comments were positive, negative, or recommendations. Subsequent re-examination was deployed to search for possible new insights. The summarized data was then synthesized for an interpretation of user opinions about e-portfolios for improved engagement, that is assessment practices, and long-term and continued use.

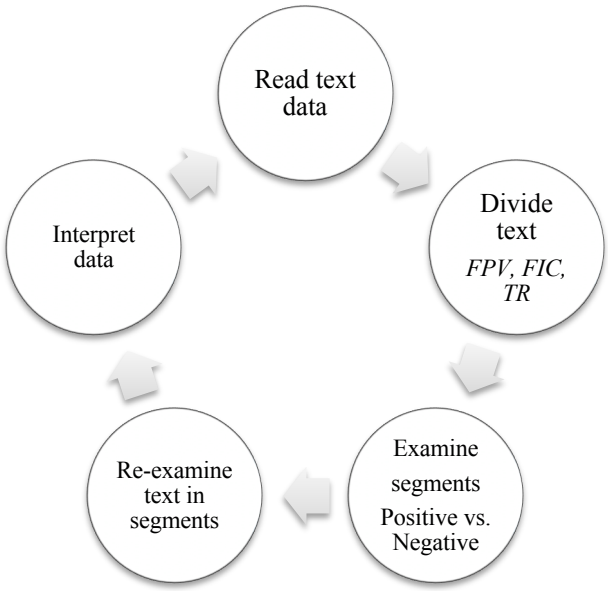

Figure 6. Study 3 iteration analysis.

6.2 Bachelor of Nursing (BNurs) Program and the Chalk & Wire System

The BNurs program and the FMHS adopted the Chalk & Wire e-portfolio to provide pre-registered nursing students the means to capture their skills during clinical placements and to attest to the 24 nursing competencies. The system was adopted to provide a software system for students to store, collate, and demonstrate their nursing competencies gained from a series of problem-based scenarios and other hypothetical situational circumstances nurses may encounter in their day-to-day work. Nursing students were all recruited from the course Nursing 201, Nursing Clients with a Pathophysiological Problem. The key factor in

evaluating the Chalk & Wire e-portfolio was whether the nursing students would focus on ensuring compliance, ticking off all nursing competencies, or whether they would demonstrate the relevant problem-solving skills and as well as meeting and ensuring professional certification using the system. As presented in Study 1, the technology features of user satisfaction and usability, or the lack thereof, impact students' engagement with the system. For that reason, Table 30 shows the essential technology features of Chalk & Wire and the system's capabilities for capturing these nursing competencies.

Table 30

Essential Technology Features of Chalk & Wire

Chalk & Wire*	Technology	Personalization	Showcasing	Communication	Assessment
	2 GB max storage 500 MB max upload	No – white space	Make public and privacy option available	Direct messaging and can be linked to email	Not available – external only
File Compatibility	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4	Text, PPT, doc/docx, PDF; XLS; jpeg, tif, png, gif; wav, mp3, mp4

*The Chalk & Wire system is a paid service from Chalk & Wire Learning Assessment Inc. It is customizable by the University of Auckland's Learning Technology Unit and the threshold listed can be changed to fit user needs and goals.

Chalk & Wire was not part of Study 1 and the essential technology feature evaluation was generated to provide a parallel analysis of how Chalk & Wire matches up with other systems (see also Chapter 4, Section 4.10 and Table 14 for the complete comparison of eight samples of e-portfolios). As seen and clearly visible on this table, personalization and the assessment features of Chalk & Wire are not available and this can be problematic, especially with regard to improving the quality of student engagement, satisfying the nursing competencies, and developing the e-portfolio for future employment as a nurse. With this information in hand, nursing students' perspectives regarding their use of Chalk & Wire were then included in this thesis.

6.3 Participants

Study 3 participants were drawn from the 2017 cohort of nursing students (N = 11) in the BNurs program, in the nursing course NURSING 201, at the University of Auckland. Study 3 interviewed nursing students in June of 2017. Four were male and seven were female. They were all in their second year and Stage 2 of the nursing program. To protect the identity of

the nursing students' identity, they were coded and identified with an alpha-numeric code, e.g., S3P1, S3P2, etc., short for Study 3 and the participant number (see Appendices H and I).

Table 31 presents the profiles of the interviewees. The researcher opted to gather some basic demographic information such as the year of study, the e-portfolio software and the sex of the participants.

Table 31

Profiles of the Interviewees

Code	Sex	Year of Study	E-Portfolio
S3P1	Female	Stage 2/Year 2	Chalk & Wire
S3P2	Female	Stage 2/Year 2	Chalk & Wire
S3P3	Male	Stage 2/Year 2	Chalk & Wire
S3P4	Male	Stage 2/Year 2	Chalk & Wire
S3P5	Female	Stage 2/Year 2	Chalk & Wire
S3P6	Female	Stage 2/Year 2	Chalk & Wire
S3P7	Female	Stage 2/Year 2	Chalk & Wire
S3P8	Male	Stage 2/Year 2	Chalk & Wire
S3P9	Male	Stage 2/Year 2	Chalk & Wire
S3P10	Female	Stage 2/Year 2	Chalk & Wire
S3P11	Female	Stage 2/Year 2	Chalk & Wire

6.4 Data Collection Procedures

The researcher gained access to the nursing students through the director of the Learning Technology Unit and this opened the way to the dean of the FMHS. The dean then instructed the director of the BNurs program to allow the researcher interview access to the nursing students. The recruiting method was posted on the Canvas LMS and the participants were instructed to click on a hyperlink (if they are willing to volunteer and participate) that directed them to the electronic sign-up sheet. Other than the sign-up processes and information, the sign-up page also gave students information regarding their rights and ethical considerations such as being able to withdraw themselves and their data from the research, up until a set date, without reason.

Next, the participants directed the day and time to conduct the interview. The interview location was mutually selected for convenience and it was confirmed that the interview process was separate from their course and participation or non-participation would not affect course evaluations and grades. The researcher also informed the participants that the information gathered would be strictly anonymous and all interview analysis was for the

purpose of this thesis. The researcher also indicated that the interview analysis and results would most likely be published in a manuscript and that the participants had the right to withhold any or all information from the publication (see Appendix J for Study 3 PIS).

6.5 Study 3 Interview Results

Taken together, the qualitative interview analysis of nursing students' responses regarding their use of Chalk & Wire, extends and adds to the objective of this study. The results add to the cost-reward analysis of e-portfolios and provide a richer and deeper understanding of the tension between compliance and improved engagement with the system, especially as Study 3 explored some aspects of training and support, personalization, and assessment practices in a different faculty and population. Table 32 presents nursing students' responses regarding the training and support offered to them, the total (approximate) hours spent learning how to operate the Chalk & Wire system, and whether or not they personalized their Chalk & Wire e-portfolio.

Table 32

Interview Responses Regarding: Training and Support, Hours Spent, and Personalization of Chalk & Wire

Code	Training and Support Type Opted to Use	Total Hours Spent Chalk & Wire	Personalized?
S3P1	Basic computer-use workshop	1-2 Hours	No
S3P2	Basic computer-use workshop	1-2 Hours	Yes
S3P3	Did not attend any workshop	1-2 Hours	No
S3P4	Basic computer-use workshop	1-2 Hours	No
S3P5	Basic computer-use workshop	1-2 Hours	No
S3P6	Basic computer-use workshop	1-2 Hours	No
S3P7	Did not attend any workshop	1-2 Hours	No
S3P8	Basic computer-use workshop	1-2 Hours	No
S3P9	Basic computer-use workshop	1-2 Hours	No
S3P10	Basic computer-use workshop	1-2 Hours	No
S3P11	Basic computer-use workshop	7+ hours	No

The interview analysis shows that nursing students were offered a basic training and support workshop that provided them with entry-level operational-usage support for Chalk & Wire. Students also stated that operating instructions for Chalk & Wire were sent via electronic mail in PDF form, including a step-by-step guide to operating, editing, and uploading files to the system. They also expressed that the system was (somewhat) easy to use and it only took 1-2 hours (on average) to become familiar with the system, although one stated that it "took forever" to learn (i.e., 7 or more hours). Most of the nursing students stated that they opted not to personalize their Chalk & Wire, as there were no other layout options or customization features available other than basic white. However, student S3P3

stated that he/she populated his/her Chalk & Wire profile page by uploading a picture and some text information, and created an introduction.

6.5.1 Finding personal value (FPV).

Finding personal value is based upon subjective tasks and students' perception of the usefulness of Chalk & Wire to his or her learning. Students expressed their agreement as to the benefits from and usefulness of Chalk & Wire to the nursing program. The FPV analysis revealed that students found personal value in terms of the system providing them some opportunity to reflect, which led to improvements in healthcare delivery. Each aspect is further explained below with relevant remarks from the interviewees.

> *The e-portfolio provides an opportunity to reflect on both personal and observed clinical practice, which may help improve the future delivery of healthcare... Critically reflecting on particular situations with the integration of relevant literature, helps to enlighten the correct procedures, with the intention of increasing patients' overall health outcomes.* (S3P9)

> *Functionality of the system - Able to export my completed competencies in a professional format.* (S3P10)

> *It helped me understand the requirements for nursing competencies better*. (S3P4)

> *E-portfolio as meaningful and rewarding - Agree, the task of reflection itself was extremely important to my role. It ensured adequate reflection and multiple occasions I learnt something new (about either the situation or myself). Plus, loved receiving individual feedback on each scenario.* (S3P5)

> *I enjoyed the process of reflection and what I could learn as a result.* (S3P2)

> *When I thought about my past experiences that is when I effectively reflected. And writing them down helped with this*. (S3P7)

Nursing students also reported several issues with Chalk & Wire and with the usability and functionality of the system. There seemed to be issues with the system in terms of editing pages; how it functions when the "edit" button was clicked, and ease of use of the Chalk & Wire system were reported as a concern for nursing students.

> *The system requires the ability to re-answer the questions at a different time point without removing or editing the original answer*. (S3P11)

The ease of use is a huge factor in my willingness to use it and that probably impacts more on whether I'd use it again. Chalk & Wire was not easy to use. (S3P3)

The website was quite bitty, with lots of things going on, lots of text, if there was more negative space this would make it less stressful to use and probably increase reflective and meaningful work. Also, it needs a pop out window so each question could be made into a new big screen. Every time you clicked add or moved the mouse the wrong way (or touch screen) it scrolled up the start of the webpage. (S3P8)

The system does not appear well-organized, and issues with navigating the webpage/system (e.g., when accessing a competency and click on edit the system goes back to the beginning/start of the page). (S3P1)

If I'm being honest, I didn't like completing the e-portfolio. I would create my work word and then paste them into Chalk & Wire as I had heard that sometimes it doesn't save my work. (S3P10)

When I wanted to add something into my portfolio it sent me to the top of the page and I had to find the place where I wanted to stick the text or picture again. Made the experience every jarring. (S3P6)

For S3P9, S3P5, S3P2, and S3P7, the reflective aspect of the e-portfolio played a vital role in their clinical practice, understanding of nursing competencies, and their role as a nurse. This has a strong resonance with findings from existing research suggesting that the reflective and feedback workings of the system are important aspects of e-portfolios, because they provide clear and responsive technical and conceptual support for the formative learning processes of learners (Bartlett, 2009; Havelock, 2009). There was also the value of the outcome and completion of the nursing competencies; S3P10 and S3P4 stated they were able to export their completed competencies in a professional format, which helped them better understand the requirements for nursing competencies. Thus, FPV seems to gravitate more towards more tangible outcomes such as completion and summative evaluation.

The negative aspects of FPV draw on the technical-usability features of the system in terms of editing, navigating, and uploading of text and artifacts to satisfy the nursing competencies. As S3P1 stated, the system does not appear well-organized, and there are issues with navigating the system. The cost component of Chalk & Wire and the technical issues do create substantial difficulties in using the system, as S3P6 commented, they "made the experience very jarring."

6.5.2 Feeling in control (FIC).

Feeling in control refers to students' internal sense of control in their learning. In e-portfolios, the sense of control is in the creation and development of the system. According to Shroff et al. (2014), FIC revolves around freedom and choice. Nursing students' sense of FIC revolved around how they want to present and satisfy the competencies. FIC responses of nursing students are further explained below with relevant remarks from the interviewees.

> *I was able to pick and choose my own experiences to share to meet the competencies and while each required a reference, this could be from anywhere so really supported own research*. (S3P7)

> *It will show both my theoretical knowledge and application in the clinical setting which I believed is an essential component, particularly in delivery of healthcare*. (S3P2)

> *I will want to use it post-graduation as it is a good record of experiences I have had on placement and how this fits in with nursing competencies*. (S3P9)

> *I completed the e-portfolio as a requirement of my course and future career*. (S3P3)

In terms of the technical aspect of the system, students expressed that they appreciated the Chalk & Wire system because it was easily accessible and highly compatible with other software.

> *Easy upload to the system, e.g., scanning of the evaluation from clinical placement and upload via pdf*. (S3P9)

> *I saw that Chalk & Wire could be used as a stand-alone from university system. I hope to gain and copy and paste my answers for a record*. (S3P10)

FIC refers to student involvement and engagement. FIC is extremely valuable, as it assists in increasing a student's sense of ownership and learning independence. As S3P7 suggests, users were able to pick and choose their own experiences. Further, as S3P2 states, the system allows users to show both their theoretical knowledge and how they apply it in the clinical setting. Part of this control and the increased student involvement comes from the personalization and articulation of ownership of the system. Students expressed their concerns and offered ways to increase FIC.

> *I felt like it was my portfolio although I would have liked more opportunities to change it and personalize the portfolio for how I work*. (*S3P1)*

I can only access all the functions through my course's page on Canvas and I don't know when I will lose access to this. (*S3P8)*

Easier access outside of Canvas and being able to use on my phone and just bring up one question would have helped answer the questions (competencies) while on break at the hospital would have made life easier. (*S3P11)*

Also, there was no progress bar so I had to go into the system and individually count how many I had already done versus how many left to complete. (*S3P6)*

If there was a way to keep the position on the website after. Clicking that you wanted to insert something that would make it a lot easier to use and give control back to be user. (S3P3)

It is important to discuss the fact that the Chalk & Wire e-portfolio was set up to work alongside Canvas, the university's LMS. An initial login to Canvas is required prior to students gaining access to Chalk & Wire; this caused several disruptions with usage or staying logged onto the system, as sometimes students are kicked out or booted off the Chalk & Wire while working on their competencies. Also, when students are working on Chalk & Wire, and while on Canvas, the window or web page for Chalk & Wire is extremely small and the visibility of the web content is poor.

Writing in the system can be a bit small and hard to read. I can't think of specifics but some text could be enlarged. (S3P11)

It needs a pop out window so each question could be made into a new big screen. Every time you clicked add or moved the mouse the wrong way (or touch screen) it scrolled up the start of the webpage. (S3P8)

6.5.3 Taking responsibility (TR).

Taking responsibility relies on students developing and becoming accountable in their learning (Milner-Bolotin, 2001). It was clear that nursing students developed their responsibility and accountability in meeting the nursing competencies.

It made me think critically about my nursing practice and take accountability for my actions…. I discussed scenarios that were observed and how it could be improved referencing recent relevant literature. I, therefore, believe that I take ownership of my work in my e-portfolio, as it provides detailed reflection for particular clinical scenarios to improve personal clinical practice. (S3P7)

I felt accountable for my entries into the Chalk & Wire system as the reflective tasks involved personal experiences that occurred whilst on clinical placement. (S3P9)

There are a number of entries that are not directly related to me, however I discussed scenarios that were observed and how it could be improved referencing recent relevant literature. I therefore believe that I take ownership of my work in my e-portfolio, as it provides detailed reflection for particular clinical scenarios to improve personal clinical practice. (S3P5)

The e-portfolio has provided me with a critical insight toward my personal practice which is an aim of the university course (to create a healthcare professional that is keenly analytical and provides reflective practice). (S3P3)

Accountability I did feel at times as I wanted to make sure what I was writing was accurate. I also thought about the times I worked within my scope. (S3P2)

I understand that the entries into the e-portfolio reflect personal experience during clinical placement in the health care setting… The e-portfolio has also helped consolidate the gap between both practical and theoretical knowledge. (S3P10)

Thinking critically and taking accountability, of course, is a very important character pre-requisite for any healthcare and patient-care provider. S3P7, S3P5, S3P2, and S3P10 all expressed their accountability and their critical thinking about their nursing practice and actions. Baeten et al. (2008) and DiBiase (2002) pointed out that this acceptance of accountability and ownership of learning has socio-affective and cognitive implications for the capacity to reflect and foster learning autonomy. However, students did express that they wanted more ownership of the system and offered strategies for improving this.

This is something I will need to use throughout my career and course. I need to take ownership rather than passively following the course requirements. I do feel that having access through Canvas reduces my ownership as it is reliant on access through my course pages and continuation of lecturer involvement. (S3P8)

To increase the accountability and ownership of the e-portfolio, I believe that improved access to the website is necessary… Increasing openness of the website, more negative space, bigger text, not having to find the spot you want to insert text every time you ask to insert something. (S3P11)

Feeling a sense of accountability in taking ownership - Disagree. The portfolio itself is very scripted and formatted already so in terms of producing a portfolio, I had no

input. I just filled the gaps with scenarios… Maybe, emphasizing the fact that the e-portfolio is theirs e.g., you've completed your e-portfolio. (S3P1)

There is a fairly complex process involved to collaborate between both the student and lecturer for marking purposes, often leading to a decreased sense of reliability in the design of the portfolio system. (S3P6)

I believe a sense of ownership is lost when some learning objectives created do not satisfy characteristics of the clinical setting, resulting in the creation of a hypothetical scenario rather than critically reflecting on a legitimate incident. Also, produce something tangible at the end… Something to make it feel less like "just another assignment." Something, I can use and attach to a CV. (S3P2)

Students' comments about Chalk & Wire seemed to articulate issues with ownership and the lack of emphasis of their ownership of Chalk & Wire. Nursing students felt that the e-portfolio was adopted to simply satisfy the 24 nursing competencies and that the long-term benefits of the system, such as being able to use it after the program and potentially use it to show future employers, were not clearly emphasized.

6.6 Cost-Reward Analysis and Recommendations

Overall, students expressed that the process of capturing the nursing competencies can only be done conveniently through Chalk & Wire, as it is accessible and in an electronic format. Students also shared the strong personal value of the reflective processes, even though they wanted more time and opportunities to engage in the reflective practices (see student recommendations Table 35). The showcasing of theoretical and applied skills from lectures and clinical placements, the FIC of what to showcase and how to satisfy the competencies, and the taking of responsibility and accountability, which connect to the opportunity to think critically about nursing scenarios and clinical practice, all add to the increased ownership of, and benefits from, e-portfolios. Further, the ability to discuss and showcase, and the usefulness of Chalk & Wire in demonstrating and satisfying nursing competencies, were reported by students as the reward components of the e-portfolio. Table 33 shows the thematic analysis in the framework of reward analysis of Chalk & Wire in the FMHS.

Table 33

Reward Analysis of Chalk & Wire E-Portfolios in the BNurs and FMHS

The Reward Components of E-Portfolios	Number of Student Responses Out of N = 11
Personal value as opportunity to reflect and understand the competencies	4
Thinking critically, as to show theoretical knowledge and applying them	8
Feeling in control	9
Taking responsibility and accountability	6
Ability to discuss and showcase skills based on the competencies	6
Usefulness in satisfying the nursing competencies	9

The strong resonance with findings of this study suggests that students were interested in the reflective and the formative learning that can be captured in Chalk & Wire. This is an interesting finding, in that it suggests that e-portfolios may be valued for their enhancement of learning engagement with the system. These findings are consistent with Ayala's (2006) that e-portfolios should be meaningful to students and should be built on a constructivist knowledge paradigm, not a top-down mandate. The process of students being able to connect with the competencies and the ability to express or "discuss scenarios that were observed (during clinical practice) and how it could be improved" (S3P7) evidently represent the usefulness of e-portfolios in this professional practice context. Further, students also discussed the summative understanding of how the e-portfolio was a useful tool to satisfy the competencies. Shroff et al. (2014) suggested that instructions around e-portfolios may sometimes focus on the summative assessment. It could be that e-portfolios and the convenience of the system in storing, collating, and as a repository of student works, make it easy to comply or tick the summative goals. The key in this sense (i.e., going forward with e-portfolios) is the balancing of the formative and summative priorities (Brown, 2013; Deneen et al., 2017).

Chalk & Wire's system layout, usability, and personalization caused several problems. San Jose (2017) identified technical issues and limitations of e-portfolios as issues with the essential technology features of the current e-portfolio platforms, which often act as a barrier to continued use. Issues with compatibility and uploading of files, personalization, communication, and assessment mechanisms were highlighted. These types of usability issues tend to disrupt students learning from the system (Redmond et al., 2014; San Jose &

Kelleher, 2009; Shroff et al., 2013). Table 34 shows the thematic analysis of the framework of cost analysis of Chalk & Wire in the FMHS.

Table 34

Cost Analysis of Chalk & Wire E-Portfolios in the BNurs and FMHS

The Cost Components of E-Portfolios	Number of Student Responses Out of N = 11
Difficult to use (i.e., steep learning curve)	8
Limited training and support	4
Limited time to engage in the reflective processes of e-portfolios	9
No personalization	2
Limited feedback from teachers and supervisors	8

Additionally, other cost components were students requiring and wanting more reflective practice and feedback from lecturers and supervisors. If structured appropriately, the reflective mechanism of e-portfolios adequately synthesizes users' thoughts and engages learners in a greater number of feelings and more reflective self-questioning (Vlachopoulos & Wheeler, 2013). The reflective process is a way for students to learn how to self-assess and self-scrutinize, especially in the high-stakes and high-pressure profession of nursing. Further, teacher and supervisor feedback are ways for students to understand what is required, and, if possible, make corrections in their learning. Bartlett (2009) also stated that both reflective and feedback processes in e-portfolios allow learners to understand their objectives and goals.

The reflective and feedback processes, or the lack thereof, have been a recurring concern of students in this study. Students expressed that if we are to increase the personal value (i.e., student ownership of learning with e-portfolios), then more emphasis is needed for the reflective process and more feedback from lecturers and supervisors, in a timely manner, is required. Each aspect is further explained below with relevant remarks and recommendations from the interviewees.

> *I believe that we are not provided the opportunity to critically reflect, due to the time limit set by the university course. Allow a greater search of the relevant literature, to ensure personal reflection has closer correlation with the relevant literature. Also, when providing a written entry, feedback from clinical lecturers is often non-existent or the feedback is minimal*. (S3P11)

In order to increase the personal value of the e-portfolio it would be beneficial to have more feedback from clinical lecturers, as they are more experienced and have a broader theoretical knowledge that may apply to the particular situation. (S3P6)

I would feel that the time spent synthesizing the entry would be well spend if the feedback provided more in-depth information. Plus, issues with my supervisor, as she is not trained to use the system. So, we exchanged word documents as my feedback and I cut and paste our reflective process to the system. (S3P8)

E-portfolio should have been used in the first year and could view progression of learning and maturity. (S3P5)

These findings and recommendations strongly align with the conceptualization of student ownership of their learning with e-portfolios (Milner-Bolotin, 2001; Shroff et al., 2014), the understanding of training and support (Buzzetto-More & Alade, 2008; Challis, 2005; San Jose, 2017), and the balance between the formative and summative priorities (Brown, 2013; Deneen et al., 2017), all key aspects in technology-enabled assessment. According to San Jose (2017), we cannot assume that all users will have the same technology abilities and we cannot assume that all software systems are built the same way and that the training and support will allow us to overcome the tedious and banal process of learning how to operate the system and proceed to the overall purpose of the system: learning. The assessment aspect and, seemingly, the reflective and feedback functionalities (i.e., formative assessment) of e-portfolios provide evidence for implementation and improved student engagement with the system. Table 35 shows the thematic analysis and nursing students' recommendations to improve student engagement with e-portfolios.

Table 35

Recommendations to Improve Student Engagement with E-Portfolios in the BNurs and FMHS

Recommendations to Improve Student Engagement with E-Portfolios	Number of Student Responses Out of N = 11
More training and support for all users	4
More time for reflective practice	9
More feedback from teachers, lecturers, and supervisors	8

6.7 Summary

The research in this Study 3 focused on exploring aspects of e-portfolios from a different faculty, a different population, and using a different e-portfolio software system. Usage of the

Chalk & Wire system in the BNurs program gave nursing students the opportunity to engage in a somewhat reflective practice and a platform to discuss aspects of their clinical practice. This study used a framework of cost-reward analysis and the ownership of learning to critically examine the use of e-portfolios as an enhancement to student engagement with the system. These findings reinforce the impact of technology in engagement and learning and the formative practices (i.e., reflective and teacher feedback) often absent in e-portfolio implementation (Ayala, 2006; Deneen, 2013; Deneen et al., 2017; Jafari, 2004; San Jose, 2017). Participants expressed ownership with e-portfolios and across all three factors of the Milner-Bolotin (2001) and Shroff et al. (2014) framework. Likewise, the cost-reward analysis showed clear cost and reward components of e-portfolios as to implications for further research into the tensions between compliance and learning with the system.

The cost-reward analysis presented in this chapter reflects the ongoing approach in improving student engagement with e-portfolios. The overarching factors that were observed in Study 3 are consistent with the results from the previous phases of the study, Study 1 and Study 2. These overarching factors are:

- the lack of training and support, and
- the underutilization of the assessment functions (i.e., reflective practices, teacher feedback, and formative assessment).

Various contributions and implications arise from this study in the bridging of the gap between the theoretical benefits from e-portfolio usage and the practical implications of the e-portfolio factors that facilitate the rewards and affordances from the system. The next chapter discusses the overall findings from all phases of the study, theoretical and practical implications, limitations, future considerations, and the final conclusion of this multiphase e-portfolio research undertaking.

Chapter 7. Discussion & Conclusion

7.1 Summary of Findings

This thesis has utilized three studies using a multiphase design and combining the sequential analysis of the qualitative and quantitative data sets over multiple phases to form a synthetic view of e-portfolio usage in a single academic institution, the University of Auckland, New Zealand. The multiphase study employed a mixed-methods approach which consists of a qualitative iterative data-analysis scheme and quantitative, ANOVA, CFA, and SEM techniques to validate factors of e-portfolios and to identify factors that advance student engagement with e-portfolios. The results and findings of the study demonstrate technology and usability factors that impact e-portfolio usage and further explore the tension between compliance and learning from the perspective of a cost-reward analysis. This analysis illustrates that the cost component of use and learning with e-portfolios may conspire against the quality of student engagement with the system if usage of the system is not aided by the facilitated-learning factors of training and support and personalization of e-portfolios, and the guiding principles of assessment, that is a facilitated-learning perspective towards improved student engagement with e-portfolios. These facilitated-learning factors of e-portfolios, when embedded and promoted during use, indicate a conceptual relationship between technology use, assessment (i.e., understanding the required end-of-the-year summative evaluation), and improved quality engagement with the system as a career procurement tool. As a result, all three research questions of the study were satisfied.

When training and support are inclusive, and include internal and external facilitators, i.e., tutors, facilitators, and supervisors; when personalization of the system is promoted; and when comprehensive assessment processes, both formative and summative, are emphasized, the reward factors and improved student engagement with e-portfolios can be observed.

7.1.1 Study 1.

Study 1 examined e-portfolio software platforms and their impact on student experience. The results of the study (see Chapter 4) indicated that students were more satisfied with the MyPortfolio (Mahara) system and evaluated it higher in terms of usability features than the Google Sites system. Despite the higher user-rating preferences of the MyPortfolio (Mahara) system, both systems were helpful in satisfying the required GTS, as a check list or repository of artifacts meeting the teacher standards. The technology features and usability of e-port-

folios impacted students' experience with e-portfolios. However, the technology features and usability of the system did not act in isolation. Noteworthy was the degree of difficulty in either using or learning the system, both of which nullify learning outcomes. Thus, while the e-portfolio has to comply with summative evaluation requirements, much more is needed in terms of training and support for users, articulating the assessment processes, and developing an emphasis on the continued use and long-term benefits of e-portfolios, to ensure successful engagement. Without such support, compliance approaches and outcomes seem inevitable, with low levels of learning engagement.

7.1.2 Study 2.

Study 2 delved into the salient and necessary elements of training and support, understanding of assessments, and the long-term benefits of e-portfolios. It was proposed that personalization of e-portfolios assists in the long-term benefits and continued use of the system (Baeten et al., 2008; Love et al., 2004; San Jose, 2017; Shroff et al., 2014; Shroff et al., 2013). For this reason, it was included as one of the facilitating factors, along with training and support, to improve student engagement with e-portfolios. A survey of user perspectives on the perceived benefits, and importance and usefulness, was analyzed with CFA and SEM techniques. Results indicate that training and support sessions, and the personalization of e-portfolios, increased the quality of student engagement with the system. Compared to students who did not attend or only attended one training and support session, students who attended two or more training and support workshops indicated higher estimates (of the intercept comparison) for the items:

- *improved my computer/technology skills*,
- *developed a better understanding of alternate forms of assessment*,
- *developed my critical thinking skills*,
- *evaluate my career goals,*
- *show my creativity,* and
- *someday I would like to show my e-portfolio to a potential employer.*

Likewise, students who personalized their e-portfolio indicated higher estimates (of the intercept comparison) for the items:

- *critically reflected on projects I have worked on*,
- *evaluation of career goals*,
- *showed my creativity*,

- *demonstration of technology skills*, and
- *someday, I would like to show my e-portfolios to potential employers.*

All of these items reflect a facilitated-learning perspective toward e-portfolios. In this circumstance, graduating pre-service student teachers who attended two or more training and support sessions, or who personalized their e-portfolios, leveraged their e-portfolios to improve their technology skills; show better understanding of alternate forms of assessment, and, notably, greater reflection on their projects; increase evaluation of their career goals and exhibition of their creativity; and demonstrate their technology skills, and willingness to show their e-portfolios to potential employers, to procure employment.

7.1.3 Study 3.

Study 3 extends the e-portfolio study to the BNurs program, in the FMHS, and to the use of Chalk & Wire for a similar overall summative purpose (i.e., satisfaction of professional external standards). The dimensions of student ownership of learning with e-portfolios replicated the tension between compliance and learning (e.g., lack of personalization; the system was too difficult to use; or, on the contrary, the system provided an opportunity to reflect on the student's nursing and patient-care skills) noted in the EDSW.

Using a qualitative iterative approach, the overarching factors that were observed in Study 3 were:

- the lack of training and support, and
- the underutilization of the assessment functions such as reflective practices, teacher feedback, and formative assessment.

Various contributions and implications arise from these three studies. Significantly, the true value of this research undertaking lies in the bridging of the gap between the theoretical benefits from e-portfolio usage and the observable practical impact seen in these two higher education contexts. The contribution of this thesis is in its detailed examination of the relationship of technology systems and software to the educational goal of learning and the administrative goal of ensuring professional certification.

7.2 Theoretical and Practical Implications

A cost-reward analysis framework was employed to identify specific observable components of e-portfolios that would facilitate or contribute to deep engagement with the requirements as a means of leading to improvement rather than simple accountability evaluation.

Throughout the studies, aspects of e-portfolio use and the facilitated-learning factors of e-portfolios (i.e., training and support, personalization of e-portfolios, and assessment practices) are discovered. If the goal of an e-portfolio is to enhance learning and prove professional certification, then these factors, which can promote and improve the quality of student engagement, need attention.

7.2.1 E-Portfolio cost components.

The cost components of e-portfolios are the difficulties of use or the steep learning curve of the system, limited to no training and support, lack of personalization, utilization of the e-portfolio not being connected or linked to the curriculum goals, ownership of the system not being emphasized, and the underutilization of the assessment mechanism or evaluative practices of the e-portfolio.

The results indicate that there are several factors within e-portfolios that can constitute a cost (Emerson, 1976; Thibaut & Kelley, 1959). The existence of cost is not strictly causal of compliance behavior but does raise the probability of a rational, strategic choice to do the minimum necessary to demonstrate fulfillment of requirements. The more cost components a student experiences, for example an e-portfolio software platform that has no personalization and customization options, limited storage file capabilities, no privacy settings, and limited file uploads, the more likely they are to exhibit compliance behavior.

This is because certain cost components do carry more weight and can lead to greater compliance behavior (i.e., minimal engagement with the e-portfolio). This seems to arise most often when cost components in e-portfolios create substantial difficulties in using them. Factors such as a steep learning curve (Chau, 2007; Havelock, 2009; Oliver & Whelan, 2011), ill-defined or differing purposes (Barrett, 2009; Barrett & Carney, 2005), unguided reflective practices with little or no feedback (Bartlett, 2009; Swan, 2009), time constraints such as objectives and activities needing to be completed in a finite amount of time, and the underutilization of formative assessment practices (Bartlett, 2009; Chau & Cheng, 2010; Oliver & Whelan, 2011), all tend to elicit compliance from students. Table 36 shows the cost components of e-portfolios that were experienced by pre-service student teachers and nursing students.

Table 36

Results from the Thematic Analysis from All Three Phases of the Study: The Cost Components of E-Portfolios

The Cost Components of E-Portfolios	EDSW		FMHS
	Study 1	Study 2	Study 3
Difficult to use (i.e., steep learning curve)	✓	✓	✓
Limited to no training and support available	✓	✓	✓
No personalization or customization features or it was not emphasized		✓	✓
Ownership of the system is not emphasized (i.e., no personal value, feel in control, and taking of responsibility of learning with e-portfolios)	✓	✓	✓
No assessment features (Formative, i.e., reflection, feedback, and dialogues; Summative, i.e., final submission or a tick-mark, and/or assigned a final grade)	✓	✓	✓

There are other cost or cost-like components of e-portfolios but they were not experienced or reported by the participants of the thesis. For example, the cost of use might include actual monetary cost such as the need for a new desktop or smart device or Internet access off-campus. It could also be the cost of purchasing software to create and convert student artifacts into compatible electronic files. The monetary cost of use may be a significant and contributing factor in the compliance and learning with e-portfolios. However, this issue focuses more on the digital divide and the civil engagement of the inequality of ICTs worldwide (Norris, 2001). Nevertheless, the cost components in this thesis isolate specific elements of e-portfolios that lead to lower engagement, such as not leveraging e-portfolios for employment or understanding the required items for assessments.

7.2.2 E-Portfolio reward components.

The reward components of e-portfolios are the portability, ease of use and speed of learners getting onto the learning task, personalization to increase the personal value, having the communication mechanism for direct and visible feedback, reflective practices, and the fulfillment of the summative evaluation. Table 37 shows the reward components of e-portfolios as expressed by pre-service student teachers and nursing students.

Table 37

Results from the Thematic Analysis from All Three Phases of the Study: The Reward Components Expressed by Pre-Service Student Teachers and Nursing Students

The Reward Components of E-Portfolios	EDSW		FMHS
	Study 1	Study 2	Study 3
Liked the electronic portfolio, as it can be accessed with any device	✓		✓
Will continue to use it	✓		✓
Found it easy to use	✓		✓
Reflective practice	✓	✓	✓
Peer feedback	✓		
Transparency (i.e., able to share and showcasing of student works)	✓	✓	✓
Leveraging of e-portfolio for employment		✓	
Usefulness in satisfying the required professional external standards	✓	✓	✓

Good quality e-portfolio environments are accessible; easy to use; provide robust communication solutions, such as the pervasiveness of web "wall" posting or comment sections, direct messaging, SMS messaging, HTML coding, and other forms of CMC like electronic mail, voice over Internet protocol, etc.; have showcasing capabilities; and can be developed as a self-marketing/self-promoting e-portfolio; and as a software platform for student works to sufficiently meet formative and summative evaluation requirements. As observed from all three phases of the study, the e-portfolios were sufficient in the fulfillment of the end-of-year summative teacher standards and nursing competences.

The research questions of the study, nonetheless, have led to the identification of the facilitating factors of training and support and personalization, and have shown observable practical impact on students' ability to go beyond compliance to demonstrate quality engagement with e-portfolios. For instance, training and support sessions reinforce the overall purposes and differing goals, such as improving computer skills, better understanding alternate forms of assessment, critical thinking, showing creativity, and evaluating career goals (Barrett & Carney, 2005; Chau & Cheng, 2010). Likewise, personalization of e-portfolios led to the development of e-portfolios around self-marketing and demonstration of skills for employment. Barrett and Carney (2005) labelled this as "portfolio for marketing." Students who personalized their e-portfolio as a portfolio for marketing, assembled their e-portfolio to highlight projects they had critically reflected on, evaluate career goals, and show their creativity and competency skills. Essentially, they "showcased their best work for employment or other promotional purposes" (Barrett & Carney, 2005, p. 2). Figure 7 presents

the facilitating factors of training and support and personalization of e-portfolios, and improved student engagement with e-portfolios.

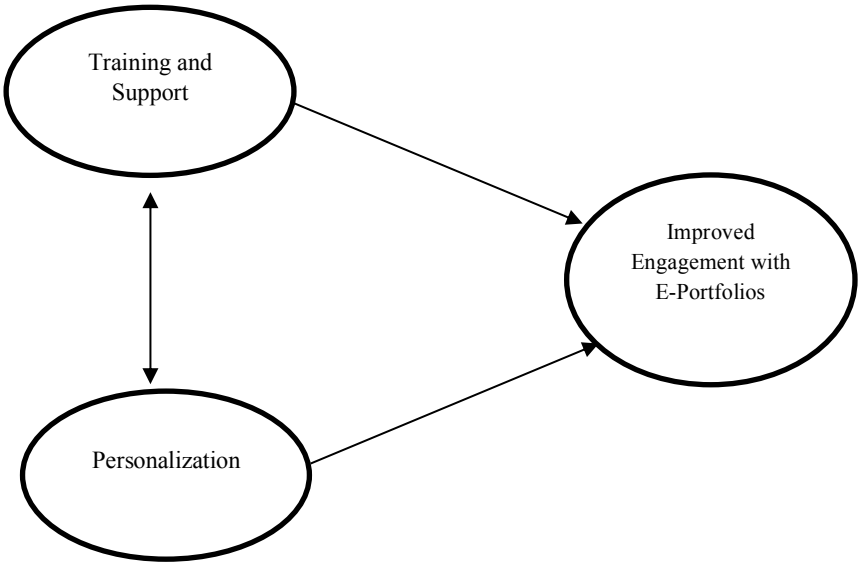

Figure 7. Training and support and personalization of e-portfolios, and improved student engagement with e-portfolios.

The observable evidence from this multiphase study shows students who attended more training and support or personalized their e-portfolio improved their engagement with the system. Additionally, students who used more training also had greater personalization of their e-portfolios. Together, the relationships between training and support and the degree of personalization supported a greater ability to leverage the e-portfolio for employment or career advancement. Therefore, this contributes to the greater personal value and ownership of e-portfolios (Buzzetto-More & Alade, 2008; Love et al., 2004; Shroff et al., 2014; Shroff et al., 2013).

There was also a greater emphasis on the utilization of assessment practices, as recommended by students, through the qualitative iterative approach. Table 38 presents the thematic analysis from all of the phases of the study and students' recommendations in improving student engagement with the system.

Table 38

Results from the Thematic Analysis from All Three Phases of the Study: Survey Analysis and Recommendations

	EDSW		FMHS
	Study 1	Study 2	Study 3
Training and support	✓	✓	✓
Personalization (i.e., continued and long-term benefits)	✓	✓	✓
Reflective practice and feedback (i.e., from teachers and supervisors)	✓		✓
Assessment practices	✓	✓	✓

7.2.3 E-portfolios and assessment practices.

It is without a doubt that the balancing of the formative and summative priorities is a focal concern in assessment environments (Brown, 2013; Deneen et al., 2017). In e-portfolios, this is no different. Both the formative and summative functions of e-portfolios need to be carried out and promoted, regardless of whether the mechanism of the system allows it or not. Students in these studies wanted to engage with the combined functionalities of reflection and feedback from teachers (i.e., formative learning) and the summative-evaluative processes. Pre-service student teachers and nursing students aptly expressed that the sense of ownership can be attained if the assessment framework allows conversational and reflective feedback practices and the summative evaluations are secured internally or externally. They wanted communication during practicum and clinical practice about what they had or could post. They were eager for prompt feedback from lecturers and supervisors as to how they were progressing towards their professional certification. Embedding and positioning assessment practices (especially evaluative judgments of quality) within e-portfolios will definitely improve students' engagement and increase quality of learning with the system. This is because assessment can improve learning as well as make students accountable for outcomes (Brown et al., 2009). Being more accountable has a significant influence on student ownership of their learning and they may perceive a greater sense of personal value as learning becomes more meaningful (Shroff et al., 2013).

E-portfolios and students' engagement with the system can be highly transformative if assessment practices are appropriately embedded and purposefully affixed. Figure 8 visually represents the facilitated-learning factors of e-portfolios towards improved student engagement

with the system. The role of assessments in e-portfolios can succeed if assessment functions are enabled along with training and support, and personalization of e-portfolios, based on what is presented in this thesis. The assessment practices encompass the overall curriculum purposes of e-portfolios and the expectations of students. E-portfolios can be curated based on who the student is, his or her needs (i.e., personal value), knowledge and content acquisition, achievements, and, essentially, the story of his or her learning towards growth and development, FIC and accountability (Buzzetto-More & Alade, 2008; Chau & Cheng, 2010; Edward, 2015; Shroff et al., 2014; Shroff et al., 2013). The value and affordances of e-portfolios are in the communication and what students are communicating based on their growth, development, achievement, and satisfaction of the learning objectives. Characteristically, students are communicating who they are and what they have become using their e-portfolios.

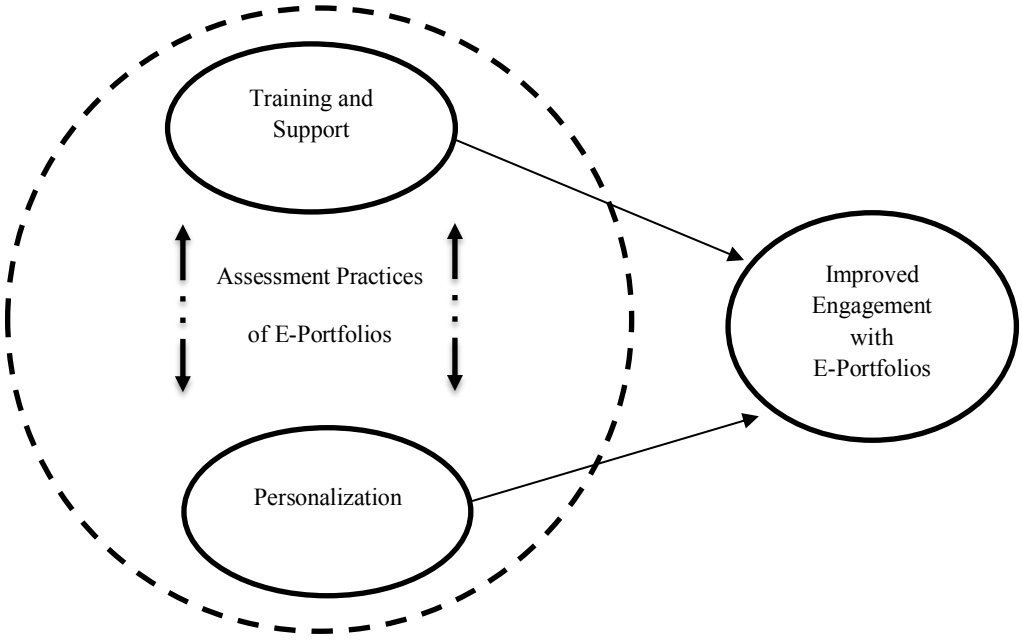

Figure 8. The facilitated-learning factors of e-portfolios towards improved student engagement.

If e-portfolios are to play a part in the panoply of higher education assessment practices, they must address both formative and summative-assessment practices. Assessment practices capture the intentions, purposes, and structural goals for using e-portfolios, especially in professional program certification. Assessment practices are the structure and foundation of how, why, and what students should be learning, communicating, and becoming through their e-portfolios. Without these formative and summative practices, the e-

portfolio will be nothing more than a repository of student works and an unconnected collection of student artifacts.

As discussed in Chapter 2, assessment is a powerful force in students' lives and it is used for a number of purposes including individual certification, improvement of teaching, and feedback on the quality of learning (Brown et al., 2009). For e-portfolios, properties of e-portfolio assessments can:

- showcase and exhibit transparency of user learning and growth (towards course or program completion, certification, or professional practice),
- improve communication around the quality of learning, and
- transform teaching and learning with e-portfolios.

For instance, the EPASS, from the Dutch Electronic Portfolio Assessment and Support System, seems to have been designed specifically to address these assessment functions of e-portfolios. EPASS has its analytics set up to track log-ins and log-outs, time in and out, and how and what students are posting. System tracking such as this can show observable and measurable outputs in how students are engaging and progressing within the system and can be utilized as an intervention. Teachers can be notified (i.e., via push notification) if a student has not completed and/or shared his or her contribution by a certain date and can send a message reminding the student that they haven't shared their contribution, that good e-portfolios have been shared and received feedback from at least a peer or a tutor, and providing a list of classmates they could share their contribution with in exchange for reviewing theirs.

Other functions of e-portfolios, as a system that is built upon the assessment practices, may also include features such as when a student uploads a new artifact the system can alert them as follows:

- Xxx classmates have just uploaded an artifact for the same standard. Would you like to swap with one of them for feedback? Click here to invite a peer to comment and vice versa.
- You have not added a commentary for this artifact. Click here to reflect on why you added this artifact and how it demonstrates your professionalism.
- You have a new comment regarding your recently uploaded artifact. Click here to view the comment and to add your reflection. You may also click here to invite a peer and/or your associate teacher or your university tutor to converse around this.

- You have completed all of the standards and have reflected with commentaries from your peers, associate teacher, and/or your university tutor. Congratulations! Click here to personalize the showcasing of your e-portfolio.

An e-portfolio that ensures greater opportunities for generating greater feedback, reflection, conversation, and the dialogue around the formative and summative evaluations warrants greater student engagement with the system. The benefits and affordances from e-portfolios are in the uniqueness of the technology system in terms of students creating their own sense of interconnections between artifacts using hyperlinks, buttons, linkages with other websites, and integration of social features (Struven, Blieck, & De Roeck, 2014). The benefits and affordances are also found in how students curate, that is select, develop, showcase, and document their story of learning (Barrett & Carney, 2005; Imhof & Picard, 2009; Struven et al., 2014), and in the innovative assessment processes available such as reflective practice, which includes dialogue and conversations from peers, teachers, and/or mentors, and the transparency of summative evaluations (Bartlett, 2009; Oakley et al., 2013; Struven et al., 2014). Thus, when assessments are embedded and part of the facilitated-learning factors of e-portfolios (along with training and support, and personalization of e-portfolios) students are more cognizant of the significant potential and sophisticated outcomes from e-portfolios (Deneen, 2013; Deneen et al., 2017; Shroff et al., 2013).

7.3 Limitations

This study was not comprehensive or exhaustive, by any means, as it conveniently sampled known and available open-source software systems and course coordinators and classes in the ITE and nursing faculties in the single site of the researcher's own university.

Case studies, as this is, by nature, are limited so the generalizability of these findings gathered from a single academic institution (i.e., the University of Auckland, New Zealand, albeit from two different faculties) may not be representative of all higher education user experiences. Students' experiences reported here concerning the prevailing and established e-portfolios within the ITE and BNurs contexts may generalize to other systems of professional certification but this is uncertain. Furthermore, sampling of participants in this study was through a convenience sampling process that relied on volunteer students. The researcher opted for a convenience sampling procedure as a requirement of ethics restrictions that prevented compulsory participation. Hence, broad conclusions from this group must be tested and replicated with other groups in other contexts. It would be especially interesting to

determine whether similar tensions exist in e-portfolio use in higher education contexts that are not constrained by professional certification (e.g., fine arts or archeology). The sampling of e-portfolios was determined by the convenience of using nursing and teacher education which had compulsory e-portfolio usage. There are many more e-portfolios in the wild which have not been considered. Specifically, the Dutch EPASS seems to have been designed specifically to address some of the problems noted in this thesis. Future research that replicates the methodology in these new contexts has potential to extend our knowledge base.

Next, it is significant to point out the relatively unequal sample size between the ECE pre-service student teachers and the secondary pre-service student teachers; even though the N = 192 sample size is an acceptable sample size, the homogeneity of variance assumption was not affected (Reaves, 1992). The unequal sample size (in Study 1) was due to the convenience sampling of the two in-house e-portfolios adopted by ECE and the secondary teacher education program at the University of Auckland. Ideally, one could assign people to each e-portfolio randomly, thus solving the issue and limitation of this study with the unequal sample size. But such expectation is, sometimes, difficult due to the "state-of-the-actual" and the nature of the quantitative method employed by this study. The problems associated with the lack of the ability to randomize are the possibility of biased results and that some outcomes can be systematically favored over others (Field, 2009) and therefore, inferences are not as trustworthy compared to random sampling (Cresswell, 2014; Keyton, 2014). Moreover, unequal variances between samples affects the assumption of equal variances in tests such as ANOVA and dramatically affects statistical power and Type I error rates (Field, 2009; Reaves, 1992). Nonetheless, future study should seek to maximize statistical power by gathering equal-sample sized groups and randomization of groups.

Moreover, will the generalization of results from Study 1 and the exploration of alternative hypotheses, with respect to ECE and secondary people using alternative e-portfolio platforms, offer a different result? A quick answer to this question is, no. User satisfaction and usability benefits of MyPortfolio (Mahara) over Google Sites was due to MyPortfolio (Mahara) being designed, in 2008, specifically to attest to the graduating teacher standards and documentation of pre-service student teachers' "story of learning" as the scope of practice for ITE. Thus, the ease of use and mechanisms of MyPortfolio (Mahara) were designed to assist students in documenting their development toward mastery of teaching and showcasing the standards of the GTS. Generalization of the results of Study 1 can, then, be achieved as long as the platform comparisons are based on e-portfolios that are designed for professional practice and satisfaction of standards. Future studies should, then, focus on the

confounding or possible differences between how pre-service student teachers are developing their e-portfolios and what they are populating them with. For instance, ECE teachers are and tend to be more receptive to professional development activities than secondary teachers. With all things considered, Study 1 did not evaluate the differences between ECE and secondary teachers with respect to the content, what students were studying, and the formative learning practices e-portfolios can capture. Therefore, results and generalizations from Study 1 should only be applied to other e-portfolio evaluation that mainly focuses on summative assessment.

As for Study 2 and the factor analysis of the two facilitated-learning factors of training and support, and personalization of e-portfolios, the two factors of students who attended two or more training and support sessions and who also personalized their e-portfolios, in combination, were not conducted due to the small sample size (N=59; see Table 21). SEM dictates that when contemplating sample size, investigators usually prioritize achieving adequate statistical power to observe true relationships in the data, and SEM techniques usually recommend minimum sample sizes of 100–200 (Boomsma, 1982, 1985). Therefore, the small sample sizes of the two factors of training and support (i.e., 0-1 versus high) and personalization (i.e., no personalization versus personalization), in combination, were not evaluated (i.e., to make a Type II error; Cohen, 1988) and future research involving large sample sizes would be useful to determine the relationship between training and support and personalization of e-portfolios and the outcome factors of e-portfolios, that is, showing an e-portfolio to potential employers, and understanding the required items to fulfill the summative evaluation.

Lastly, the findings were based on self-reported data from pre-service student teachers and nursing students. Although a mixed-methods approach was utilized to increase the reliability and robustness of the data, nonetheless, the issue was the lack of observed behavior data and achievement evaluation, which was out of scope. Future studies may utilize other methods of collection of observed behavioral data such as actual e-portfolio usage, or evaluation of graded e-portfolios especially around the relationship of personalization (i.e., degree of personalization) and reflection upon grading, and the relationship of e-portfolio behavior and achievement to students' GPA (see Deneen et al., 2017).

Nonetheless, findings from these studies extend the body of knowledge about the implementation of technology in education and, especially, with e-portfolios and the principles of assessment.

7.4 Future Research Direction and Considerations

Just as there is growing utilization of ICTs in education, so there is a growing understanding of how assessment practices and these ed-tech systems interact to enhance and enrich learning in the 21st century and beyond. Both the theoretical and practical findings of this study have several implications for future research and practice. In a more inclusive and extensive measure of users' evaluative perspectives of e-portfolios, teachers' voices need to be considered, as they too are users of these e-portfolios and they are not impervious to the challenges that are associated with use, particularly when teachers are supposed to support their students with these e-portfolios, even though they themselves may lack (or fail to operate) the technological and integrative skills to purpose the system for learning (Alansari, 2015; San Jose, 2014).

On a larger scale or with blue-sky thinking about future research directions, it would be compelling to generate an experimental design study to test user engagement (i.e., 0-1 versus high and compliance versus learning) with e-portfolios where a software system company can create (program) a highly interactive e-portfolio platform with customizable avatars, fully embedded ICTs with an interactive communication function (i.e., push notification), and with assessment practices inherently built in (automated or provisioned by an instructor). In other words, a highly interactive, customizable system, in which communication, reflective feedback, and student and teacher dialogue around the student artifact are captured internally within the software system, and, further, the summative assessments (i.e., scoring, grading, etc.) and any evaluative mentoring are all embedded in the system. A similar experimental design study was conducted by Lieberman (2009), "Designing Serious Games for Learning and Health in Informal and Formal Settings," in which she explored the behaviors of info-seeking and learning with a highly interactive gaming educational software system. The e-portfolio experimental design would explore and test levels of system interactivity, with or without avatars, with or without assessment practices (testing for formative and summative concurrently), with automated versus human scoring of e-portfolios, and any combinations of these interactive features and how it would measure teaching and learning with any ed-tech system. A study of this magnitude would out rightly fashion conceptions around the mechanisms of technology systems and education, pedagogical designs, user perspectives, and innovative technology-enabled assessment systems.

On a practical level, the balancing of the formative and summative functions of assessments seems to be a priority in technology-enabled assessment systems (Deneen et al., 2017). An e-portfolio research study that examines which assessment practices (i.e., formative versus summative) would lead to improved or higher quality student engagement needs to be prioritized. Fortunately, e-portfolios can serve both formative (i.e., reflective learning) and summative-assessment practices simultaneously. This case-specific research would feature more on student learning instead of the technology system. This would be a significant research undertaking in the field of education, as the technology would be afterthought, with learning in the forefront, as it should be.

7.5 Conclusion

This thesis corroborates and extends previous work that showed that assessment with and around e-portfolios is the largest unresolved tension. Taken together, this study is not just an evaluation of current technology software platforms and a greater understanding of user perceptions (i.e., how issues with technology impact quality learning and student engagement), but rather an enhanced conceptualization of how technology factors interact with human factors around the evaluation of an educational technology. The unique contribution is the cost-reward analysis framework, which deduced that there is a cost in mastering the e-portfolio technology but when that cost is paid through further training and personalization of e-portfolios, it would appear that students are rewarded with greater personal benefits through quality, personalized, and improved engagement with e-portfolios.

The facilitated-learning factors of e-portfolios were then discovered, which include training and support, personalization of e-portfolios, and assessment practices. The facilitated-learning factors of e-portfolios, when embedded, indicate not only a conceptual relationship between technology use, understanding of the required end-of-year summative evaluation, and improved quality engagement as a career procurement with the system, but also notably showed students' greater reflection on projects, development of critical thinking skills, evaluation of career goals, exhibition of creativity, demonstration of technology skills, and better understanding of alternate forms of assessments.

E-portfolios can be a powerful tool in the accessibility and transparency of student learning and teaching outcomes. The interaction between students, teachers, and other stakeholders can be all captured in the e-portfolio environment (Chau & Cheng, 2010; Oakley et al., 2013). However, the administrative work of the curriculum design, objectives,

and assessment goals of e-portfolios (i.e., alignment of e-portfolios, curriculum design, and assessment practices), and the several underpinning tasks upfront for course leaders and teachers prior to the e-portfolio deployment cannot and must not be underestimated. Likewise, the challenges or cost (as observed in this study) for students. For that reason, the criteria for best practice or success need to apply if e-portfolios are to live up to expectations. For leaders and overseers of institutions of higher education, training and support for all users must be at the forefront and budgeted for. This includes teachers, students, tutors, mentors, and stakeholders alike as they are all susceptible to stress, anxiety, and the scarcity of time and resources in learning to operate, learn from, and teach with e-portfolios.

For teachers, e-portfolios are a promising assessment tool that promotes learning by means of the formative functions of the tool, and provides valid measures of high-level learning such as demonstration of competences (Bartlett, 2009; Deneen et al., 2017; Havelock, 2009; Struyven et al., 2014). However, if students are not under the impression that they are being "followed" in terms of the reflective practices and the dialogue and conversation around the reflection, and "guided" in the fulfillment of the summative evaluation, then students will not be convinced of the effectiveness of e-portfolios. In light of the results, even the most basic form of training and support for students, a simple personalization of e-portfolios, and some utilization and clear articulation of the formative and summative functions of the system, can most aptly improve student engagement.

For students, the e-portfolio can be a transformative tool for learning and development (Chau & Cheng, 2010; Love et al., 2004; Shroff et al., 2014). It can also be a functional tool through the creation of the e-portfolio (i.e., personalization) as self-marketing or, as Barrett and Carney (2005) labelled it: a "portfolio for marketing," and to position the system for employment and career advancement. However, it does require work and effort. There are favorable and experiential benefits in the openness and willingness to engage and be somewhat self-regulated in the ownership of learning with e-portfolios, despite the challenges that seem to accompany it. The development of this thesis and the facilitated-learning factors of e-portfolios towards best practice and improved student engagement definitely seek to alleviate these challenges.

There is a sense that when students are trained and supported in their use of e-portfolios, thus increasing their technological competences; when they, appropriately, illustrate a degree of personalization with their e-portfolios; and are supported in the assessment for learning (i.e., formative learning) and the assessment of learning (i.e., summative evaluation), they then have the capacity to care, or find personal value, and

exhibit quality engagement with the system. Because it matters how students are using e-portfolios, learning from them and the personal benefits the system offers. Indeed, more work, evidence-based and case-specific research that aligns e-portfolios with assessment practices, is warranted. However, empirical and conclusive evidence outlined in this study indicates positive and improved student engagement with e-portfolios is highly plausible.

Appendices

Appendix A: Site Access Consent Forms

School of Learning, Development and Professional Practice
Faculty of Education
Epsom Campus
Ph: 623 8899
The University of Auckland
Private Bag 92601
Auckland, New Zealand

CONSENT FORM
THIS FORM WILL BE HELD FOR A PERIOD OF 6 YEARS
Site Access Consent Form

Project Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education

Name of Student Researcher: Mr David L. San Jose (University of Auckland PhD student).

I am aware the study aims to evaluate the electronic portfolio systems being used within the Faculty of Education and it will take 20 minutes of classroom time to complete the survey. The study will provide Faculty teacher education staff and students with a user and usability learning evaluation of the electronic portfolio systems being utilised in the University of Auckland, Faculty of Education.

I have read the Participant Information Sheet and have understood the nature of the research. I have had the opportunity to ask questions and have had them answered to my satisfaction.

- I agree to allow site access for the research project titled, Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education, to be conducted on site and in my course.

Yes ☐ No ☐

- I confirm that the research study is independent from the class and any participation or non-participation by the students will not impact their grades.
- I understand that the data will be stored securely for six years so that it can be used for further analysis. After this time, the data will be destroyed by shredding.
- Electronic data will be stored in a password-protected computer for six years so that it can be used for further analysis. After this time, the data will be erased from the computer hard drive.
- Generalised findings of the study may be published in research journals, presented at conferences, and Ph.D. thesis requirements.

Full Name _____

Signature _____ Date _____

David L. San Jose
Ph.D. Candidate University of Auckland, Faculty of Education
For questions, I can be contacted:
EMAIL: d.sanjose@auckland.ac.nz

Telephone: +64 9 623 8899 ext 48384
CONDITIONAL APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 29-Jul-14, Reference Number 011928

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

School of Learning, Development and Professional Practice
Faculty of Education
Epsom Campus
Ph: 623 8899
The University of Auckland
Private Bag 92601
Auckland, New Zealand

CONSENT FORM
THIS FORM WILL BE HELD FOR A PERIOD OF 6 YEARS
Site Access Consent Form (Dean)

Project Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education

Name of Student Researcher: Mr David L. San Jose (University of Auckland PhD student).

I have read the Participant Information Sheet and have understood the nature of the research. I have had the opportunity to ask questions and have had them answered to my satisfaction.

- I agree to allow site access for the research project titled, The User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education, to be conducted on site.

  Yes ☐ No ☐

- I confirm that the research study is independent from the class and any participation or non-participation by the students will not impact their grades.
- I understand that the data will be stored securely for six years so that it can be used for further analysis. After this time, the data will be destroyed by shredding.
- Electronic data will be stored in a password-protected computer for six years so that it can be used for further analysis. After this time, the data will be erased from the computer hard drive.
- Generalised findings of the study may be published in research journals, presented at conferences, and Ph.D. thesis requirements.

Full Name _____

Signature _____ Date _____

David L. San Jose
Ph.D. Candidate University of Auckland, Faculty of Education
For questions, I can be contacted:
EMAIL: d.sanjose@auckland.ac.nz

Telephone: +64 9 623 8899 ext 48384
CONDITIONAL APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON DD/MM/YY, Reference Number 011928

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

School of Teaching Learning and Development
Faculty of Education
Epsom Campus
Ph: 623 8899
The University of Auckland
Private Bag 92601
Auckland, New Zealand

CONSENT FORM

THIS FORM WILL BE HELD FOR A PERIOD OF 6 YEARS
Interview Consent

Project Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education

Name of Student Researcher: Mr David L. San Jose (University of Auckland PhD student).

I have read the Participant Information Sheet and have understood the nature of the research. I have had the opportunity to ask questions and have had them answered to my satisfaction.

- I agree to take part in this interview.
- I understand that whether or not I agree to take part in this project, the lecturer has given assurance that my decision will not impact my relationship with the lecturer and/or my grades.
- I give permission for my interview to be recorded: YES NO
- I understand, even if I agree to being recorded, I may choose to have the recorder turned off at any time.
- I understand that I may review the transcript of my interview which will be emailed to me at: (Your email): _____
- I understand that the data will be stored securely for six years so that it can be used for further analysis. After this time the data will be destroyed by shredding and erased from the computer.
- Generalised findings of the study may be published in research journals, presented at conferences, and Ph.D. thesis requirements.

Full Name _____ Contact Info:_____
(Email or Mobile)

Signature _____ Date _____

- For questions and interview purposes, I can be contacted:
  - EMAIL: d.sanjose@auckland.ac.nz
  - Telephone: +64 9 623 8899 ext 48384

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON DD/MM/YY, Reference Number 011928.

Appendix B: Participant Information Sheet

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

School of Learning, Development and Professional Practice
Faculty of Education
Epsom Campus
Ph: 623 8899
The University of Auckland
Private Bag 92601
Auckland, New Zealand

PARTICIPANT INFORMATION SHEET

Project Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education

Researcher Introduction
My name is David L. San Jose and a Doctor of Philosophy Candidate in the University of Auckland, Faculty of Education. I wish to evaluate electronic portfolio systems within the Faculty of Education and seek empirical insights in how electronic portfolio assessment systems is contributing to student-learning outcomes for my doctoral research study.

Project Description and Invitation
Electronic portfolios have been used to document and showcase student achievements for the purpose of meeting course or programme standards and assist in job hunting. However, the deployment of electronic portfolios, an educational technology tool (eTechnology), is not a straightforward process. Previous research has identified that any eTechnology (a) is easy to use, (b) produces a beneficial user experience, and (c) does not distract or prevent users from achieving intended purposes (Hattie, Brown, Ward, Irving, & Keegan, 2006). Furthermore, technology must reflect real world applications to enable meaningful learning from users (Kumar, 2010). This study aims to evaluate electronic portfolio systems being utilised within the Faculty of Education. The study will provide Faculty teacher education staff and students with a user and learning usability of electronic portfolio systems.

You are invited to take part in this research project, because you are a course coordinator or a student who is in a course that requires the use of an electronic portfolio technology platform. Participation or non-participation in this study will not affect your relationship with your school, teacher, or your grades. This research is independent of the markings carried out for any course. Your participation and assistance would be much appreciated.

Project Procedures
This research study uses a survey questionnaire and an optional interview portion. First, you will be asked to complete a 20-minute, self-report questionnaire regarding your use of electronic portfolio. Next, if you are willing to participate in the interview portion of the study please sign up using the sign-up sheet during the survey portion of the study. Then, the student researcher (David L. San Jose) will contact you to set up a date and time for the follow-up interview.

It is anticipated that the interview portion of the study will take approximately 40 minutes and will be conducted out of course hours. Please be aware that the interview process will be digitally recorded with your consent. You will have the opportunity to review the transcript for accuracy after it has been transcribed. The transcript of the interview will be used for research purposes only.

Data Storage/Retention/Destruction/Future Use
If you participate in the research study, the completed questionnaires and written transcripts will be kept in a locked cupboard on the premises of University of Auckland for six years at which time they

will be shredded. The electronic data gathered in this research will be stored in an electronic data file. The file will be kept confidential in a password-protected computer at the University of Auckland for six years at which time it will be erased from the computer. Findings from the data analysis will be shared with the participants upon request, while final results will be disseminated in scholarly journals, conferences, and Ph.D. thesis requirements.

Voluntary Participation
You are under no obligation to participate. Your participation or non-participation will be kept confidential from the course lecturers and/or markers, peers, and will have no impact on any marks or grades awarded.

Right to Withdraw
You have the right to withdraw from the research study at any time and without having to give any reason(s). However, once the survey is submitted the research team will be unable to identify the data to enable its withdrawal due to the survey being anonymous.

Interview participants have the right to withdraw your interview answers and exclude your answers from the study on or before the 15th of December 2015. Please be aware, after this date your interview items cannot be revoke.

Anonymity and Confidentiality
The survey portion of the study is anonymous. Completion of the anonymous survey implies consent in participation to the study. However, all data from the interview will be kept confidential solely to the research team. While other students in the course may know that their peers are being interviewed, no information will be provided to them regarding the interview. All reports and publications will not contain any information that could lead to the participants being identified. The information from both the survey questionnaire and interview will not be used for any other purposes other than for this research study.

Thank you very much for your time. I hope you will agree to participate in this research study under the conditions set out on the Participant Information Sheet.

Contact Details
Thank you very much for your time and help in making this study possible. I look forward to your response.

Kind Regards,

_____

University of Auckland contacts:

Researcher	**Supervisor**	**Co-Supervisor**
David L. San Jose	Prof. Gavin Brown	Assoc. Prof. Kumar Laxman
PhD Candidate School of Learning, Development and Professional Practice, Faculty of Education, The University of Auckland	School of Learning, Development and Professional Practice, Faculty of Education, The University of Auckland	School of Curriculum and Pedagogy, Faculty of Education, The University of Auckland

d.sanjose@auckland.ac.nz	gt.brown@auckland.ac.nz	k.laxman@auckland.ac.nz
+64 9 623 8899 ext 48384	+64 9 623 8899 ext 48602	+64 9 623 8899 ext 48131

For any queries regarding ethical concerns you may contact the Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Office of the Vice Chancellor, Private Bag 92019, Auckland 1142. Telephone 09 373-7599 ext. 83711.

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 29-Jul-14, Reference Number 011928

Appendix C: Ethical Issues and Considerations

The ethical issues involved in this study are (1) informed consent, and (2) privacy (confidentiality and anonymity). These ethical issues are outlined and addressed in details below.

1. *Informed Consent*

Ethical participation in research depends on voluntary, informed consent. This is assured by the following means:

- Participants are not dependent on the researcher in any way. Thus, there is no conflict of interest.
- The research team, with field work conducted by the student researcher David L. San Jose, will provide all participants with an appropriate Participant Information Sheet (PIS) for the Phase 1 (Survey Questionnaires) and a separate sign-up sheet and Consent Form (CF) for the Phase 2 (Interviews) prior to each phase of the research.
- All programme coordinators and lecturers, upon explanation of the purpose and procedure of the research study, will sign site access consent forms to allow access to student participants.
- All students will provide voluntary consent for the questionnaire by completing it anonymously and for interviews through signed CFs.
- All programme coordinators and lecturers will assure students that their decision to participate or not will not impact upon their status in the course or programme.
- All participants will be guaranteed the right to withdraw themselves and their data up to a set date without having to give a reason.
- All data will be securely stored in a locked cupboard or on a password-protected computer located in the Department of Learning, Development and Professional Practice, University of Auckland.
- All data will be destroyed after a period of six years.
- All data collected will be used for the student researcher's Doctor of Philosophy in Education thesis, academic publications, and conference presentations.
- All participants will be given a copy of the research findings upon request.
- All participants will be told of these provisions in the PIS and CF documents.

2. *Privacy (Anonymity and Confidentiality)*

Participation in this project has a potential threat to anonymity and confidentiality of identity and contribution. The identity of courses requiring the use of E-Portfolios is known as well as that of the programme and course instructors. The number of students in each course is not large, so it is possible lecturers might determine the identity of participants. Further, voluntary participation in the interviews requires that the identity of each interviewee is known. The following provisions are put in place:

- Serial numbers will be given to survey questionnaires, interview recordings, and interview transcriptions to identify participants. All real names will be deleted from any paper or electronic document. Note it will not be possible to match survey serial numbers to interview recordings or transcriptions.
- No names will be used in all reports arising from the study.
- No personal information will be collected or stored.

Appendix D: Study 1 Survey

UIS and UEM Evaluation of ePortfolio Systems 2.0

***1. Please tick which ePortfolio technology system you are using for your class**

- Mahara
- Wordpress
- Blogger
- Tumblr
- Google Docs
- LiveBinders
- Others

Other (please specify)

UIS and UEM Evaluation of ePortfolio Systems 2.0

***2. User Information Satisfaction of ePortfolio system**

	Strongly disagree	Usually disagree	Slightly agree	Moderately agree	Usually agree	Strongly agree
I am confident in using the ePortfolio system						
I was able to format my classwork as I pleased using a text file (word, txt., etc.)						
I was able to format my classwork as I pleased using a video file						
It was convenient in accessing my ePortfolio using any of my computer						
It was convenient in accessing my ePortfolio using any of my tablet or iPad						
It was convenient in accessing my ePortfolio using any of my mobile smart phone						
I felt my information was secure in the ePortfolio system						
I was able to make my classwork private						
I was able to publish (share) my classwork on the ePortfolio site through the share feature						
I was able to publish (share) my classwork on the ePortfolio site and to other social media site (facebook, Linkedin, etc.)						
The ePortfolio system was flexible to my needs						
I felt a sense of participation when using the ePortfolio system						
The ePortfolio system was easy to understand						
I was satisfied with the ePortfolio system domain						

UIS and UEM Evaluation of ePortfolio Systems 2.0

***3. Usability Evaluation Method of ePortfolio Systems**

	Strongly disagree	Usually disagree	Slightly agree	Moderately agree	Usually agree	Strongly agree
The ePortfolio system was easy to learn						
Navigating menus, indexes, dashboards, and any systems function were easy to find						
Navigating menus, indexes, dashboards, and any systems function were easy to use						
I can predict the general purpose of the menus, indexes, dashboards, and any systems function						
The ePortfolio system was free from technical problems						
Fonts (style, color, saturation) were easy to read						
The ePortfolio system was efficient to use and allowed high level of productivity						
It was clear to me what I needed to accomplish						
It was clear to me what I gained as a learner when I accomplished tasks using the ePortfolio system						
I was able to reflect upon my course work using the ePortfolio system						
My instructor was able to provide me feedback on my ePortfolio work using the ePortfolio system						
My peers were able to provide me feedback on my ePortfolio work using the ePortfolio system						
The feedback I received was consistent to my work I published (share) in the						

UIS and UEM Evaluation of ePortfolio Systems 2.0

ePortfolio system						
The ePortfolio system provided me an opportunity for self-assessment that advanced my learning						
I felt the use of the ePortfolio system allowed me to conduct a deeper analysis of my course work						
I felt a sense of adequate accomplishment of the course learning objectives when analyzing my ePortfolio work						
The ePortfolio system was easy to use and I was able to return to the system without having to re-learn the systems features once again						
The ePortfolio system was pleasant to use						
I was able to quickly get my course work done with the system						
I was satisfied with my learning while using the ePortfolio system						

***4. Which feature did you liked the most regarding the use of electronic portfolio?**

***5. Which feature did you liked the least regarding the use of electronic portfolio?**

6. What feature(s) would you like to add regarding the continued development of electronic portfolios?

UIS and UEM Evaluation of ePortfolio Systems 2.0

7. If you are willing to participate to the next part of the study, please copy and paste this link to your browser and sign up for the interview portion of the study.

https://www.surveymonkey.com/s/interview_signup

Thank you for your time and participation

Appendix E: Study 1 Interview Questions

1. Evaluate your technological abilities. Are you an avid user of technology or you tend to shy away from technology?

2. In evaluating the technology platform (software) of the electronic portfolio you used in class, how effective do you feel is the technology platform (software)?

3. In evaluating the technology platform (software) of the electronic portfolio you used in class, do you feel that you have achieved the course objective(s) using technology platform (software) issued to you?

4. In evaluating the technology platform (software) of the electronic portfolio you used in class, was it easy to use or was it difficult? Explain positive and negative features of the technology platform

5. Think back when you first access your e-portfolio. How confident were you in creating your profile and adding content? Also, how about the basic usability of the system in order to complete your task and required by your teacher?

6. What are your thoughts regarding the use of electronic portfolio in documenting your course work? Think back to when you first access your e-portfolio. Next, when you are creating and adding items in your e-portfolio. Lastly, if you had completed your teacher training programme (congratulation if so) how do you feel now regarding the required e-portfolio documentation?

7. What are your thoughts regarding the use of electronic portfolio to showcase your course work? How did you like showcasing your work during your GST requirements presentation?

8. What are your future intentions in using electronic portfolios? Personal course work? Will you use electronic portfolios in your own future teaching courses?

9. Do you feel that your technological abilities got in the way in showing your competence as a student teacher or now an up and coming teacher? How about your teacher's technological abilities? Do you think their computer knowledge and their ability to support you while you are creating your e-portfolio would have affected the quality of work with e-portfolio?

10. Any other comments regarding your experience with e-portfolio use and the required use of the system?

Appendix F: Amendment Request Form for Study 2 and Ethics Approval

AMENDMENT REQUEST FORM
Ethics Approval Protocol Number 011928

Current Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems at The University of Auckland, Faculty of Education.

A: 1 Proposed Title (if different from current):
None

A: 2 Summary of changes – please provide a numbered list of the proposed changes and how these changes vary from the approved application(s). Max 2000 characters including spaces.

1. Addition of 2 survey instruments to measure user satisfaction and usability evaluation of electronic portfolio. Moreover, the added survey instruments will also measure user attitude, experience, perceived benefits, usefulness/importance, perceived value of the system and students' attitude toward e-portfolio as a technology based assessment.
2. Furthermore, the addition of 2 survey instruments is set up to measure differences between (a) Beginning Pre-Service Teachers and (b) Graduating Pre-Service Teachers.
3. Both surveys will include some basic computer/technology ability questions, prior experience or training with the system and demographics – Gender and Age Group.
4. Both surveys (as stated in the previous Ethics Application) will continue to be an anonymous survey.
5. See attached (uploaded) surveys – labelled Phase 2 (Semester 1 – Beginning Pre-Service Teachers) and Phase 3 (Semester 2 – Graduating Pre-Service Teachers).
6. New Consent Form from Course Coordinators – Approved CF (site access) to survey students in class and at 2 different times of the year (end of semester 1 and end of semester 2).
7. Ethical Issues and Consideration were updated to take account for surveying students, in class, at 2 different times of the year.
    a. Ethical Issues and Consideration were also updated to take account for viewing graded e-portfolios.
8. Lastly, access to graded electronic portfolio at the end of semester 2 will be required to examine the quality portfolio students create with the system. The graded portfolios are either peer graded or simply a tick mark showing fulfilment of the end of the programme requirements (e.g., Graduating Teacher Standards).

The purpose for the Amendment Request
An initial understanding of the electronic portfolio's (e-portfolio) technology platform usability (user-friendly or non user-friendly; rigid or flexible) was established during Phase 1 of the study. Preliminary results showed some usability difficulties with both the MyPortfolio (Mahara) and Google Sites systems. However, both systems also showed promising and positive evaluations from students in terms of usage satisfaction, presenting and showcasing their achievements through the e-portfolio.

The researchers, lead by the student researcher David L. San Jose, would like to delve further and explore the relationships between the usability of the technology platforms alongside student's technological abilities, attitudes, experiences and student's perception toward technology based assessments (such as e-portfolio). The difficulty is not just in the technology implementation but the understanding of user characteristics and what Jafari (2004) labelled as *human aspect*. The *human aspect* of the software design deals with the requirements intended to satisfy the desires and needs of the end user (Jafari, 2004). While the *computer aspects* of the software design mainly concern with the mechanical component and the building blocks used to create the software platform of the learning environment (Jafari, 2004). Successful implementation and adoption of e-portfolios hang on the balance between the human and computer aspect design of the system. Understanding the delicate

balance between developing a user friendly, intuitive and flexible software design e-portfolio that closely resonates the needs and goals of the end user will hopefully assist in the usability, acceptance and improved quality of work students create with the system.

Appendix G: Study 2 Survey Time 1 and Time 2

Creating my Electronic Portfolio (E-Portfolio) Helped Me: (Applies to all items below) *PB E-Port*

Improve my computer/technology skills

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Develop a better understanding of alternative forms of assessment

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Develop critical thinking skills

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Develop organizational skills

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Critically reflect on projects I have worked on

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Evaluate my career goals

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Show my creativity

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Demonstrate my technology skills

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Someday I would like to show my e-portfolio to a potential employer

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

Understand the required items are for my end of the semester evaluations or assessments (e.g., course and programme goals/standards or Graduating Teacher Standards).

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	2	3	4	5

In the context of the teacher-training programme, the e-portfolio system was important. *I&U E-Portfolio*

Strongly Disagree	Disagree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree
1	2	3	4	5	6

In the context of the teacher-training programme, the e-portfolio system was useful.

Strongly Disagree	Disagree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree
1	2	3	4	5	6

The e-portfolio system (the technology platform) was well structured.

Strongly Disagree	Disagree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree
1	2	3	4	5	6

The procedures for the e-portfolio system usage were clearly laid out.

Strongly Disagree	Disagree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree
1	2	3	4	5	6

Appendix H: Amendment Request Form for Study 3 (BNurs) and Ethics Approval

AMENDMENT REQUEST FORM
Ethics Approval Protocol Number 011928

Current Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems at The University of Auckland, Faculty of Education.

A: 1 Proposed Title (if different from current):
User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems

A: 2 Summary of changes – please provide a numbered list of the proposed changes and how these changes vary from the approved application(s). Max 2000 characters including spaces.

1. Title change – The proposed title change is due to the lead researcher (David L. San Jose, student researcher) and supervisor, Professor Gavin T. L. Brown wants to investigate user satisfaction and usability evaluation of electronic portfolios outside the Faculty of Education and Social Work.
2. Addition participants are required and outside of the Faculty of Education and Social Work. The study requires additional participants and approximately 500 (*N*=500) more students.
3. No other changes will be required. The research team will continue to use the same survey items and interview protocols. It is necessary to maintain the same survey items and interview protocols, as it will strengthen the consistency and validity of the study.

The purpose for the Amendment Request
An initial understanding of the electronic portfolio's (e-portfolio) technology platform usability (user-friendly or non-user-friendly; rigid or flexible) was established during Phase 1, Phase 2, and Phase 3 of the study. Initial results showed some usability difficulties with both the MyPortfolio (Mahara) and Google Sites systems. However, both systems showed promising and positive evaluations from students in terms of usage satisfaction, presenting, and showcasing of their achievements through the e-portfolio.

The researchers, lead by the student researcher David L. San Jose, would like to delve further and explore the relationships between the usability of the technology platforms alongside student's technological abilities, attitudes, experiences and student's perception toward technology based assessments (such as e-portfolios).

Further, additional participants and participants outside the Faculty of Education and Social Work are required to increase the diversity and validity of the study. Obtaining more diverse population will ultimately allow an encompassing generalizability to other situations and other electronic portfolio users.

The difficulty is not just in the technology implementation but the understanding of user characteristics and what Jafari (2004) labelled as *human aspect*. The *human aspect* of the software design deals with the requirements intended to satisfy the desires and needs of the end user (Jafari, 2004). While the *computer aspects* of the software design mainly concern with the mechanical component and the building blocks used to create the software platform of the learning environment (Jafari, 2004). Successful implementation and adoption of e-portfolios hang on the balance between the human and computer aspect design of the system. Understanding the delicate balance between developing a user friendly, intuitive, and flexible software design electronic portfolio system that closely resonates the needs and goals of the end user will hopefully assist in the usability, acceptance, and improved quality of work students create with the system.

Appendix I: Site Consent Form for Study 3 (BNurs)

Site Access Consent Forms

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

School of Learning, Development and Professional Practice
Faculty of Education
Epsom Campus
Ph: 623 8899
The University of Auckland
Private Bag 92601
Auckland, New Zealand

CONSENT FORM
THIS FORM WILL BE HELD FOR A PERIOD OF 6 YEARS
Site Access Consent Form FMHS

Project Title: User Satisfaction and Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education

Name of Student Researcher: Mr David L. San Jose (University of Auckland PhD student).

I am aware the study aims to evaluate the electronic portfolio systems being used within the Faculty of Education and it will take 20 minutes of classroom time to complete the survey. The study will provide Faculty teacher education staff and students with a user and usability learning evaluation of the electronic portfolio systems being utilised in the University of Auckland, Faculty of Education.

I have read the Participant Information Sheet and have understood the nature of the research. I have had the opportunity to ask questions and have had them answered to my satisfaction.

- I agree to allow site access for the research project titled, Usability Evaluation of Electronic Portfolio (E-Portfolio) Systems in The University of Auckland, Faculty of Education, to be conducted on site and in my course.

  Yes ☐ No ☐

- I confirm that the research study is independent from the class and any participation or non-participation by the students will not impact their grades.
- I understand that the data will be stored securely for six years so that it can be used for further analysis. After this time, the data will be destroyed by shredding.
- Electronic data will be stored in a password-protected computer for six years so that it can be used for further analysis. After this time, the data will be erased from the computer hard drive.
- Generalised findings of the study may be published in research journals, presented at conferences, and Ph.D. thesis requirements.

Full Name _____

Signature _____ Date _____

David L. San Jose
Ph.D. Candidate University of Auckland, Faculty of Education
For questions, I can be contacted:
EMAIL: d.sanjose@auckland.ac.nz

Telephone: +64 9 623 8899 ext 48384
CONDITIONAL APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 29-Jul-14, Reference Number 011928

Appendix J: Participant Information Sheet for Study 3 (BNurs)

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

School of Learning, Development and Professional Practice
Faculty of Education
Epsom Campus
Ph: 623 8899
The University of Auckland
Private Bag 92601
Auckland, New Zealand

PARTICIPANT INFORMATION SHEET

Project Title: Evaluating, Comparing, and Best Practice in Electronic Portfolio System Usage

Researcher Introduction
My name is David L. San Jose and a Doctor of Philosophy Candidate in the University of Auckland, Faculty of Education. I wish to evaluate electronic portfolio systems within your programme and seek empirical insights in how electronic portfolio assessment systems is contributing to student-learning outcomes for my doctoral research study.

Project Description and Invitation
Electronic portfolios have been used to document and showcase student achievements for the purpose of meeting course or programme standards and assist in job hunting. However, the deployment of electronic portfolios, an educational technology tool (eTechnology), is not a straightforward process. Previous research has identified that any eTechnology (a) is easy to use, (b) produces a beneficial user experience, and (c) does not distract or prevent users from achieving intended purposes (Hattie, Brown, Ward, Irving, & Keegan, 2006). Furthermore, technology must reflect real world applications to enable meaningful learning from users (Kumar, 2010). This study aims to evaluate electronic portfolio systems being utilised at the University of Auckland.

You are invited to take part in this research project, because you are a Programme/Course coordinator or a student who is in a course that requires the use of an electronic portfolio technology platform. Participation or non-participation in this study will not affect your relationship with your school, teacher, or your grade. This research is independent of the markings carried out for any course. Your participation and assistance would be much appreciated. The survey will only take (approximately) 5-10 minutes of your time, anonymous, and voluntary. An electronic version of the survey is also available.

Project Procedures
This research study uses a survey questionnaire and an optional interview portion. First, you will be asked to complete a 5-10 minute, self-report questionnaire regarding your use of electronic portfolio. Next, if you are willing to participate in the interview portion of the study please sign up using the sign up sheet during the survey portion of the study. Then, the student researcher (David L. San Jose) will contact you to set up a date and time for the follow-up interview.

It is anticipated that the interview portion of the study will take approximately 10 minutes and will be conducted after course hours. Please be aware that the interview process will be digitally recorded with your consent. You will have the opportunity to review the transcript for accuracy after it has been transcribed. The transcript of the interview will be used for research purposes only.

Data Storage/Retention/Destruction/Future Use
If you participate in the research study, the completed questionnaires and written transcripts will be kept in a locked cupboard on the premises of University of Auckland for six years at which time they will be shredded. The electronic data gathered in this research will be stored in an electronic data file. The

file will be kept confidential in a password-protected computer at the University of Auckland for six years at which time it will be erased from the computer. Findings from the data analysis will be shared with the participants upon request, while final results will be disseminated in scholarly journals, conferences, and Ph.D. thesis requirements.

Voluntary Participation
You are under no obligation to participate. Your participation or non-participation will be kept confidential from the course lecturers and/or markers, peers, and will have no impact on any marks or grades awarded.

Right to Withdraw
You have the right to withdraw from the research study at any time and without having to give any reason(s). However, once the survey is submitted the research team will be unable to identify the data to enable its withdrawal due to the survey being anonymous.

Interview participants have the right to withdraw your interview answers and exclude your answers from the study on or before the 1th of July 2017. Please be aware, after this date your interview items cannot be revoke.

Anonymity and Confidentiality
The survey portion of the study is anonymous. Completion of the anonymous survey implies consent in participation to the study. However, all data from the interview will be kept confidential solely to the research team. While other students in the course may know that their peers are being interviewed, no information will be provided to them regarding the interview. All reports and publications will not contain any information that could lead to the participants being identified. The information from both the survey questionnaire and interview will not be used for any other purposes other than for this research study.

Thank you very much for your time. I hope you will agree to participate in this research study under the conditions set out on the Participant Information Sheet.

Contact Details
Thank you very much for your time and help in making this study possible. I look forward to your response.

Kind Regards,

_____

University of Auckland contacts:

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For any queries regarding ethical concerns you may contact the Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Office of the Vice Chancellor, Private Bag 92019, Auckland 1142. Telephone 09 373-7599 ext. 83711.

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 29-Jul-14, Reference Number 011928

Appendix K: Interview Questions Study 3 (BNurs)

Student Ownership E-Portfolio (Chalk and Wire) System.

Interview Protocol

Feeling in Control (FIC)

1. Did you feel a sense of personal control, as in you were able to add your own (personal) resources (e.g., achievements, teacher or supervisor evaluation, etc.) in your e-portfolio (Chalk and Wire) system? If **YES**, please explain. If **NO**, please explain what we can do to help improve and have students feel more personal control and ownership with Chalk and Wire?

2. What other things would like to add or include in terms of Chalk and Wire system use and/or how Chalk and Wire is integrated in your programme (to help increase student ownership of the system)?

3. Did you know that you are able to use your e-portfolio beyond the programme and can show future employers? Upon saying that, will you use your e-portfolio (Chalk and Wire) in terms of career development and/or future employment? Why or Why not? Please explain your answer.

Finding Personal Value (FPV)

1. I found value in constructing my e-portfolio because I was able to effectively reflect on what I had accomplished (self-evaluation and reflect on what you have posted on Chalk and Wire). **Do you agree or disagree**? Please explain your answer.

2. What other factors do we need to consider in terms of increasing value with e-portfolio (Chalk and Wire) use?

3. Creating my e-portfolio (Chalk and Wire) is quite meaningful and rewarding. **Do you agree or disagree**? Please explain your answer.

4. What other factors (would you suggest) we need in terms of increasing reflective and meaningful work with the e-portfolio (Chalk and Wire) system?

Taking Responsibility (TR)

1. I felt a great sense of accountability in taking ownership in creating my e-portfolio (Chalk and Wire) system (includes specific entries and work you posted on the Chalk and Wire system). **Do you agree or disagree**? Please explain your answer.

2. Creating my e-portfolio and showcasing my work is about me. Therefore, I take ownership of my e-portfolio. **Do you agree or disagree**? Please explain your answer.

3. What can we do to help with increasing ownership of e-portfolio (Chalk and Wire) system use?

4. Did you feel that the e-portfolio (Chalk and Wire) use was linked to the core instructional/curriculum design and learning outcomes of your programme? Please explain your answer.

5. What other factors we can do to help with accountability and ownership of e-portfolio (Chalk and Wire) system use?

Other Factors – Please add other factors in terms of increasing e-portfolio (Chalk and Wire) usage, learning, and personal ownership (e.g., incorporate and linking the e-portfolio to the core instructional/curriculum design and learning outcomes).

Thank you for your time. I will be in contact if you are one of the participant who won the $20 Visa gift card.

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