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Enabling Systemic Change: Creating an ePortfolio Implementation Framework Through Design and Development Research for use by Higher Education Professionals

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Drawing from a design and development research approach, specifically model research, this study investigated the perspectives of higher education faculty and administrators regarding their experiences with a university-wide electronic portfolio implementation initiative. Participants in the study were fifty-two faculty and administrators at a large research university in the United States who were either continued users or recent abandoners of electronic portfolios. Survey and interview data were used to understand participant perspectives on the electronic portfolio implementation process, including perceived enablers and barriers to adoption of this instructional technology. Study findings and Diffusion of Innovation (DOI) theory informed the development of a six-component electronic portfolio implementation framework. Three external experts in systemic change were then asked to review the framework. Feedback from these external experts was incorporated into a revised version of the framework that is presented here. The framework can be used by an educational institution to support the successful adoption and integration of electronic portfolios regardless of where the organization is within the implementation process.

In recent years, higher education has witnessed an increase in the availability and use of electronic portfolios (ePortfolios) to support learning, assessment, and professional development. ePortfolios offer a unique way to capture a variety of learning evidence from students over time in multiple formats and across varied contexts, while also gaining students' personal reflections on individual learning and growth (Chen & Light, 2010). ePortfolios enable instructor insight into student mastery of knowledge as well as fluency with technology (Chen & Light, 2010). As an instructional technology, ePortfolios offer customized approaches to learning and assessment through the integration of varied technologies that provide more choices for students and educators; thus, broadening opportunities for pedagogical change in higher education contexts.

While essential to successful ePortfolio adoption and implementation, higher education faculty are engaged rarely as active participants in an open innovation process (C. E. Watson, personal communication, January 19, 2012). Further, whereas student perspectives of ePortfolio adoption are well represented in the literature, faculty perspectives are not (Ruiz, Quadri, & Karides, 2009; Wang & Turner, 2007). Yet it is well documented that the involvement of all key stakeholders throughout an entire change process is important to its success (Patton, 2014; Russ-Eft & Preskill, 2009). The purpose of this study was to investigate faculty and administrators perspectives regarding the university-wide implementation of an ePortfolio initiative in order to develop an implementation framework that integrates their voices in light of systemic change theory. Two research questions supported this work:

- How do faculty and administrators perceive the ePortfolio adoption process? What about the process is successful? What about the process is lacking and requires improvement? What about the process reflects Diffusion of Innovation (DOI) theory?
- In light of participant experiences, what features of DOI theory should be included in an ePortfolio implementation framework?

The resulting ePortfolio implementation framework, as a support for instructional technology innovation management across an organization, informs higher education policy, administration, and process. In addition, the framework transforms ePortfolio implementation into a more accessible and feasible endeavor for faculty interested in ePortfolio adoption and use but at a loss for how to enact, as well as sustain, this innovation.

Conceptual Framework

This study was informed by two major conceptual areas: the evolution and use of portfolios, and specifically ePortfolios, to support learning, assessment, and professional development and the adoption and implementation of an innovation such as ePortfolios through the lens of DOI theory.

The Evolution and Use of Portfolios

The use of portfolios to demonstrate mastery of knowledge and skills is not new to education. Writers, artists, builders, and more have used portfolios to

collect, document, and share growing bodies of work as they developed in knowledge and skill. To be sure, portfolio use spans content areas and dates back centuries (Adams, 2010). Formal portfolio work can be dated back to Leonardo Di Vinci, who diligently kept a portfolio to document his inventions, thoughts, and reflections (H. Barrett, personal communication, August 14, 2014). As portfolios have shifted to electronic formats, a renewed interest in their adoption and implementation has led to new opportunities for learning, assessment, and professional development.

Assessment of student learning will continue to gain importance in ongoing educational reform efforts (Baker, 2001). Assessment approaches must continue to advance if they are to inform individual student learning in more dynamic and sophisticated ways. While traditional assessments such as exams are often considered efficient to administer and grade, these types of assessments typically focus on the acquisition of foundational knowledge and are unable to assess higher-level knowledge and skills (Linn, 1993). However, performance assessments, such as those included in a portfolio of work, require observable disciplinary activity and artifacts (Davies & Le Mahieu, 2003; Linn, 1993) and empower a learner to exhibit the development of new knowledge and skills over time, offering greater depth and complexity (Airasian, 1996).

Watson, Zaldivar, and Summers (2010) claim that ePortfolios assist with assessment of students on three distinct levels. First, the creation process for building ePortfolios provides a method for capturing student learning that is often unable to be captured using traditional assessment, allowing instructors to see the growth of students through a course or program. Second, if the instructor of a course or program builds their own ePortfolio alongside students, that instructor will be able to better reflect on the progress and experiences of their students. Lastly, programs and institutions also benefit from the use of ePortfolios, providing rich learning and program assessment data that can be used for curricular improvements.

Over the last decade, the versatility, portability, and efficiency of ePortfolios have brought prominence to this instructional technology in higher education across disciplines. While this trend may originate in the need to assess students and student work in diverse ways, ePortfolios have also proven useful for examining and supporting individual learning and professional development over time (Mitchelson & Mandell, 2004; Watson & Doolittle, 2011). In recent years, the use of ePortfolios has continued to increase at the undergraduate level in higher education (Dahlstrom & Bichsel, 2014).

ePortfolio Adoption and Diffusion of Innovation Theory

As higher education institutions increase their use of instructional technologies, ePortfolios meet a growing institutional need for relevancy to the teaching and learning enterprise (Bass & Eynon, 2009; Schneider, 2009). However, similar to any other innovation, ePortfolios are subject to the conditions and stages of the innovation diffusion process and barriers to their adoption, integration, and sustainment arise (Annan, 2008; Surry, 2002). In addition, the meaningful and purposeful implementation of ePortfolios on a large scale can be challenging (Cambridge, 2012). Applying what is known about technology adoption and diffusion to the introduction of ePortfolios into an institutional system can support integration while still honoring the unique perspectives and contexts of local faculty users.

Diffusion of innovation theory (DOI), which seeks to understand the social process that community members engage in to adopt or reject an innovation (Rogers, 2003; Surry & Farquhar, 1997), was relied on as the broad conceptual framework for guiding all aspects of the study's design including instrument development, data collection and analysis, framework development, and framework review and revision. Specifically, this study drew from two DOI theoretical perspectives: Rogers' five Stages of Adoption and Ely's Eight Conditions for Change.

Rogers (2003) identified five Stages of Adoption of an innovation: knowledge, persuasion, decision, implementation, and confirmation. Similarly, Ely (1990) described Eight Conditions for Change: dissatisfaction with the status quo, sufficient knowledge and skills, availability of resources, availability of time, rewards or incentives, participation, commitment, and leadership. Drawing from Rogers and Ely, Surry and Farquhar (1997) argued that the study of an instructional technology in light of DOI theory can help instructional designers have a better understanding of the adoption or rejection of an innovation, work more effectively with clients, and even "lead to the development of a systematic model of adoption and diffusion" (p. 2). Grounded in DOI theory and his own professional experiences with innovation adoption, Surry developed the RIPPLES survey as a means for studying the adoption of an instructional technology across seven dimensions of DOI: resources, infrastructure, people, policies, learning, evaluation, and support. This study employed a modified RIPPLES survey (Blevins & Brill, 2013), along with selected follow-up interviews, to explore the perspectives of faculty and administrators experienced with the adoption of ePortfolios at a large university to inform the development of an implementation framework.

Methodology

Study Design

This study drew from a design and development research methodology, defined by Richey and Klein (2007) as the "systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development" (p. 1). More specifically, this effort used what was previously known as Type 2 developmental research, recently renamed to model research, in which the research "pertains to the [study] of the development, validation, and use of design and development models." (Richey & Klein, 2007, p. 10).

Consistent with model development research, three phases informed framework development: analysis, development and evaluation, and revision. In the analysis phase, faculty and administrator perspectives about the ePortfolio implementation process were investigated through survey and interviews shaped by DOI theory. In the development and evaluation phase, study findings and DOI theory guided the development of a six-component framework that was then evaluated by three experts in systemic change. In the revision phase, recommendations from the experts directed the revision and finalization of the framework. An overview on how these phases were applied in this study is provided in Table 1.

Setting and Participants

A large United States research university with approximately 30,000 students began a university-wide initiative to implement ePortfolios in 2002. During this time, several credible strategies were considered to support the initiative's success including: strategic alignment of the initiative to department, college, and institutional goals; partnerships with key stakeholders; pilot-testing; faculty development opportunities; and the use of the Concerns-Based Adoption Model (CBAM) for change (Hord, Rutherford, Huling-Austin, & Hall, 2006) and Ely's Eight Conditions of Change (Ely, 1990) for implementation (Watson et al., 2010).

Anecdotal data suggested challenges with long-term ePortfolio implementation. However, empirical data to investigate the success of these strategies and potentially guide improvements did not exist. Thus, approximately 10 years after the initial implementation of ePortfolios on the university's campus, the perspectives of 144 members of the university community were sought through survey and follow-up interviews. These members of the university community were identified through the university's ePortfolio office as faculty and administrators who had used or were currently using ePortfolios.

Data Sources and Analysis

The survey instrument was a modified RIPPLES survey, which is based in part, in DOI theory and specifically designed to explore instructional technology integration in higher education. The 55 question survey was divided into four sections: participant demographics; background (individual historical use of ePortfolios); ePortfolio implementation at their university; and, opinion of ePortfolio adoption and implementation. The ePortfolios at the university section, which was modified to more directly reflect Ely's Eight Conditions for Change, contained seven subsections reflective of the RIPPLES model acronym: resources (time and money); infrastructure; people (communication and shared decision-making); policies; learning (specific instructional outcomes for user training); evaluation; and (user) support. Each of the seven subsections contained close-ended questions as well as at least one open-ended question. The close-ended question in these sections had a possible value between one and six (1 = don't know/unsure; 2 = strongly disagree; 3 = disagree; 4 = neutral; 5 = agree; 6 = strongly agree).

Fifty-two out of 144 individuals (36%) responded to the survey. Typical response rates for online surveys are 52%, plus or minus 20% (Baruch & Holtom, 2008). Thus, while the response rate was lower than desired, it can still be considered acceptable. A descriptive analysis of the data was conducted first in order to determine the means, percentages, and standard deviations for each survey item. Second, participants' answers to the open-ended questions were examined for emerging themes (Creswell, 2009). The survey findings influenced the development of the final interview protocol in order to provide opportunities for more directed data collection based upon the study's purpose.

The ten-question interview protocol probed each participant to speak in greater depth about their experiences implementing ePortfolios at the university. A small interview sample of 12 survey participants was selected to represent a diverse cross-section of the university. Selection criteria included: discipline, gender, years at the university, years teaching, role (faculty or administrator), time using ePortfolios, and current usage status (continued user or abandoner). Interview transcripts were coded for themes. Interview findings were then triangulated with participant survey findings in order to strengthen the analytic process (Creswell, 2009).

Using the findings from the survey, interviews, and DOI literature review, a framework for supporting the adoption of ePortfolios by university faculty, staff, and administrators was developed. Conceptually, the framework was meant to operationalize those aspects of DOI theory that appeared to be most supportive of successful ePortfolio adoption. Five experts in DOI theory were asked to provide feedback, via a rubric, regarding the extent to which the framework effectively

Table 1
Overview of Study Phases

Phases	Framework Development and Validation
Analysis	Analyze DOI Literature and create survey and interview protocol to collect participant data. Analyze survey data, interview data, and DOI literature.
Development and Evaluation	Develop framework based on analysis. Develop rubric for DOI expert reviewers. Administer expert reviews.
Revision	Analyze expert reviews. Incorporate feedback from expert reviewers to create a revised framework.

and appropriately integrated important DOI elements. Three reviewers completed the review process. This feedback was analyzed and incorporated into a revised ePortfolio implementation framework.

Findings

Participant Demographics

Fifty-two out of 144 individuals responded to the survey (36%), and all of them indicated that they were currently or had previously used Sakai, the university's ePortfolio system. Sixty-two percent (32) of the participants who submitted the survey were female, and 38% (20) were male. In response to age, 4% (2) indicated they were age 20-29; 10% (5) selected age 30-39; 27% (14) indicated age 40-49; 38% (20) identified as 50-59; 17% (9) selected age 60-69; and 4% (2); age 70 or above. Thus, based on age alone, 14% of respondents could be considered early career, while 69% could be characterized as mid to late career.

Regarding professional position, 67% (34) of survey respondents were faculty with at least some teaching responsibilities and 29% (15) were in administrative roles. When asked the number of years teaching at the college or university level, 35% (18) answered zero to 10 years; 40% (21) answered 11 to 25 years; and 25% (13) answered 25 years or more.

ePortfolio Use

When asked how long participants had been using or previously used ePortfolios, 48 of 52 participants (92%) responded. Of those responses, 23% (11) answered less than one year; 35% (17) answered one to three years; and 42% (20) answered four or more years. Surprisingly, 42% of respondents reported abandoning the use of ePortfolios. When asked why they stopped using them, 22 of 52 participants (42%) responded. Responses were grouped into the following six categories, ordered here from high to low: change in employment position (8); usability and reliability of technology (8); faculty or student resistance (3); too much time or effort required (3); change in course structure (3); and, still in development (1). Of note here are the two categories of technology usability and time investment in that these themes also arose in other sections of the data.

Regarding the purpose(s) for using ePortfolios, 50 of 52 participants (96%) responded. Of those responses, 58% (29) answered to track learning; 60% (30) answered to assess learning; 40% (20) answered to support professional development; and 36% (18) answered Other. From the Other category, the following response themes emerged: scholarship and employment (4); course or program requirement (3); showcase student work (3); and accreditation (1). Thus, most respondents rely on assessment and the tracking of learning as the main reasons for using ePortfolios.

When prompted to identify what they liked most about using ePortfolios, 50 of 52 participants (98%) responded. Ordered high to low, these categories included: housing and showcasing of artifacts (27); self-reflection and learning process engagement (15); meets accreditation and assessment requirements (7); reveals whole picture of student (6); flexibility (4); and availability and security (1). Thus, most survey respondents value ePortfolios as a means to store and access student work. A comment by Professor Adams (Instructor) reflected how ePortfolios have been of value:

> Prior to [ePortfolios], we were doing [artifact creation and collection] in different areas. We had a piece here, a piece here, and we were trying to teach the [students] a methodology of developing themselves, but in addition to that, 'How can I prepare myself for finding a job?'

When asked to pinpoint what they liked least about using ePortfolios, 51 of 52 participants (98%)

responded. Responses were grouped in categories, high to low, as: lack of user-friendly electronic platform (33); time spent planning and grading (11); student and faculty difficulty and resistance (9); defining and understanding ePortfolios (2); and inaccessibility after graduation (2). Given these responses, survey respondents appear most troubled by the limitations of the current ePortfolio system, Sakai.

Regarding what participants perceived as the most important factor(s) influencing faculty adoption and use of ePortfolios, 49 of 52 participants (94%) responded. Responses were categorized as follows: usability and flexibility of system (20); faculty buy in to a clear purpose (19); support and training (7); reward for use and time commitment (6); and, the learning curve (5). Consistent with prior responses, quality of the ePortfolio system and user buy-in to a clearly communicated purpose arose as the top two factors in ePortfolio adoption.

ePortfolios at the University

To investigate more closely how participants viewed the seven DOI factors previously identified in the RIPPLES model, they were asked to rate the importance of each of these factors in regards to ePortfolio implementation at their university as well as ePortfolio, as a representative instructional technology, for adoption and implementation in general. Regarding the importance of each individual RIPPLES item to implementation, participants rated Infrastructure of greatest importance (94% agree or strongly agree); Resources (time and money) of second greatest importance (92%); Learning (specific instructional outcomes of user training) in third place (87%); and User Support as fourth (85%). The rest of the items fell in line as follows: Policies (60%), Evaluation (66%), and People (communication and shared decision-making) (52%).

Given that Infrastructure was rated of greatest importance, it is not surprising that participants chose to comment on infrastructure issues the most on both the survey and during the interviews. Survey data revealed that, while the overall university infrastructure is viewed positively, the ePortfolio technologies are not. In fact, the ePortfolio technology system's design was identified by survey participants as the top barrier to ePortfolio use. As Professor Johnson (administrator) put it during his interview, "You cannot have a successful portfolio program if you have a product that is full of holes and bugs." Interestingly, when asked on the survey what they felt was the greatest potential enabler to ePortfolio use, participants identified the technology's capabilities as second only to support.

While 92% of survey respondents ranked the Resources of time and money as second most important to ePortfolio implementation, they distinguished time as more important than money to successful use. In fact, they identified a lack of time to learn about and implement ePortfolios as the second most significant barrier to use. In his interview, Professor Lewis (Associate Professor) commented, "You have to have time to be able to think through the process. There has to be time dedicated to the instruction of the technology itself and the support of that technology." Professor Young shared, "If you put a lot of technology into your class, you get a pat on the head…Nobody's saying to me, 'Oh here, let me give you fewer classes or something to make up for the time you are spending.'"

In regards to RIPPLES, user Learning (87%) and user Support (85%) were rated as third and fourth most important respectively to ePortfolio implementation. At the university, one central office was dedicated to providing both training and support to ePortfolio adopters across the campus. This type of centralized support was viewed as both essential and exemplary by survey respondents. Comments included the following:

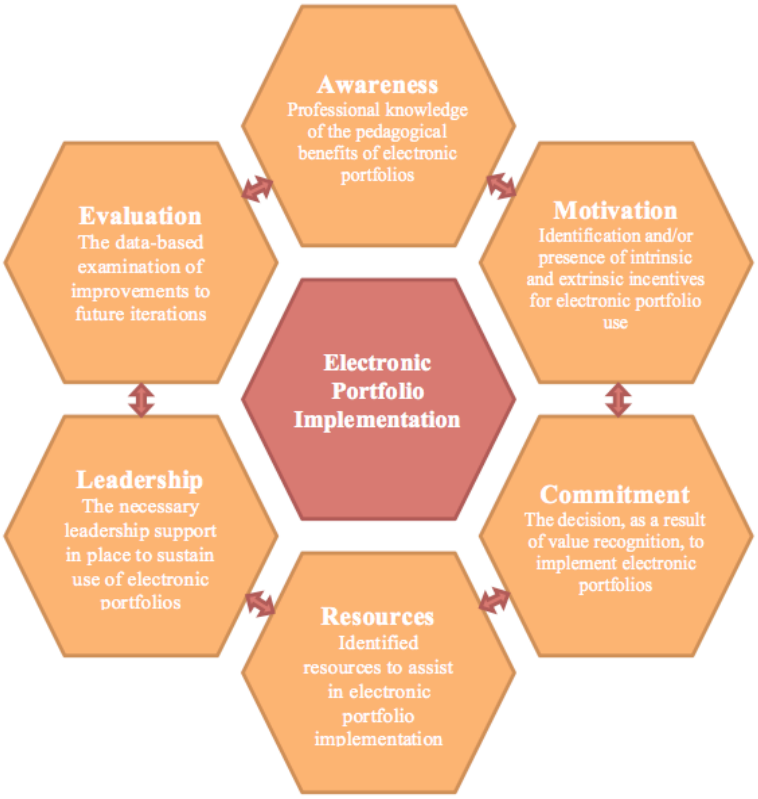
- "The university office responsible for administering ePortfolio support is excellent. They are always very helpful" (Lecturer).
- " The eP office group is great. They have been extraordinarily helpful" (Instructional Faculty).
- "The eP office is a lifesaver. Without those folks and their support, I would not have included ePortfolios" (Instructional Faculty).

In contrast, elements of support at the program, department, and university levels, particularly in regards to leadership, were also viewed as essential but inconsistent and disjointed. In his interview, Professor Adams (Instructor) addressed this need for a more unified culture of support: "We all need to be aligned in the goals of the ePortfolio…there's a lot of moving parts, and a lot of people need to be on board for it to work." Recall that survey respondents identified faculty buy-in to a clear purpose as the second most important adoption factor.

The ePortfolio Implementation Framework

Based on the findings from survey and interview data, as well as a review of the DOI literature, a framework for implementing ePortfolios was created. This original framework was reviewed by three external DOI experts. These experts were selected based on their expertise in technology integration and systemic change. In addition, all three had experience working within higher education as either faculty or administrators. Their feedback was then analyzed and incorporated into a revised framework. Generally, the reviewers agreed that the framework had strong

Figure 1
ePortfolio Implementation Framework components



alignment with DOI theory. They also agreed that the framework would prove useful for its intended audience. Reflective comments include: "For institutions new to ePortfolio, this framework will provide much needed guidance and systematic recommendations for moving an adoption campaign forward" (Reviewer 1); "The framework provides a guidance process for implementing and sustaining ePortfolio in higher education" (Reviewer 2); "Great potential and practical use in the field" (Reviewer 3). Reviewers also agreed that the purpose of the framework and use of the rating scale could be clarified with concerns addressed through the addition and revision of some of the framework's column headings and descriptive text. This section describes the revised framework in detail.

The framework developed is meant to support those implementing, or attempting to implement, ePortfolios in a higher education context by guiding them through key attributes of systemic innovation in a practical and applied manner. First, six essential components were identified and defined through both the DOI literature, specifically Rogers (2003) and Ely (1990), and study findings. The framework was then assembled to include these six components in a modular format: awareness, motivation, commitment, resources, leadership, and evaluation (see Figure 1).

Awareness is defined as the professional knowledge of the pedagogical benefits of ePortfolios. The Awareness component reflects Rogers' (2003) knowledge stage in his Stages of Adoption model and Ely's (1990) dissatisfaction with the status quo and sufficient knowledge and skills conditions in his Conditions for Change model. Study findings demonstrate that participants had developed an awareness of the usefulness of ePortfolios, especially to capture and show student work and as a means for assessment. Further, through the centralized ePortfolio office, adopters had opportunities to knowledge and skill-build and viewed these support experiences as positive. Participants also saw the importance of a clear purpose for ePortfolio use, an awareness goal that can be supported through professional development.

The Motivation component of the framework is defined as the identification and/or presence of intrinsic and extrinsic incentives for using ePortfolios. The Motivation component reflects Rogers' (2003) persuasion stage in his Stages of Adoption and Ely's (1990) dissatisfaction with the status quo and need for rewards/incentives conditions in his Conditions for Change model. A remark by Professor Johnson (Administrator) pinpoints a recognized intrinsic value to ePortfolios, the move from unwieldy paper-based to more manageable electronic means for storage and access:

> Because again, you've got a portfolio [this] thick for every student in the department and, you know we were graduating at that point 20 to 25 students a year. Twenty or 25 students a year was three quarters of a drawer and after 10 years we had … a lot of records and so … we were very eager to see the ePortfolio and we participated from the very beginning.

Although participants recognized the intrinsic value of ePortfolios, they also recognized the significant time investment necessary to implement and that such an investment should be acknowledged and even mitigated or compensated through extrinsic rewards such as a course release or graduate assistant support.

Commitment, the third component in the framework, is defined as the decision, as a result of value recognition, to implement ePortfolios. The commitment component reflects Rogers' (2003) decision stage in his Stages of Adoption and Ely's (1990) participation and commitment conditions in his Conditions for Change. The need for consistent commitment across program, department, and university levels was evident in study findings. As Associate Professor Lewis, remarked, "We all need to be aligned in the goals of the ePortfolio… there's a lot of moving parts, and a lot of people need to be on board for it to work."

The next component, Resources, is defined as identified resources to assist in ePortfolio implementation. This component reflects Rogers' (2003) implementation stage in his Stages of Adoption and three conditions in Ely's (1990) Change model: sufficient knowledge and skills, availability of time, and availability of resources. Study findings supported the importance of adequate resources and resource allocation, including adequate time and support, for successful ePortfolio implementation. As Professor Clark (Administrator) commented:

> "We ran into a whole lot of resource issues, no one had the time to work on it even though we had leadership buy-in. Resources were not provided to back it up even though I think [faculty] were interested in it. They felt overwhelmed all the time."

Leadership is defined as the necessary leadership support in place to sustain use of ePortfolios. This component reflects Ely's (1990) leadership condition in his Conditions for Change. Study findings supported the idea that ongoing involvement and support from leadership at all levels is important to sustaining ePortfolio implementation. As Professor Johnson (Administrator) remarked:

> "You need to make sure that the faculty are aware of the opportunity and how easy it to use. I do not see much information coming across my desk anymore that says, "Hey we have this cool tool, why don't you try it?"

The final component, Evaluation, is defined as the data-based examination of ePortfolio use for improvements to future iterations. This framework component reflects Roger's (2003) stages of implementation and confirmation. Further, it is also reflective of the need for systemic evaluation of the ePortfolio initiative, as documented in study findings. One survey respondent, an administrator, noted the following:

> "I think evaluation is very important. Evaluation results need to be communicated and acted upon in order for them to be enablers. I think if evaluations are done in a solitary way and not acted upon, I am not sure how helpful they are."

Lumsden (2007) reports evaluation as one of five success factors to the university-wide implementation of ePortfolios at Florida State University, providing further support for including an Evaluation component in the framework.

After the six essential components were identified and arranged, more work was done to expand the framework into a usable resource (see Appendix) that anyone considering implementing ePortfolios, or already in the process of implementation, could use to assess the workgroup's current status in the implementation process as well as critical next steps. In addition to providing a definition of each component, guidance in the following areas was provided for each component: Selected Strategies to Support Component, Key Stakeholder Involvement, Assessment of Current Implementation Status, and Next Steps for Implementation Efforts. The "Selected Strategies to Support Component" column offers selected strategies to act on each component. The "Key Stakeholder Involvement" column identifies stakeholders that can impact progress on that component. A rating scale is

provided in the "Assessment of Current Implementation Status" column for users to assess where a workgroup stands with each component and identify next steps for implementation. A rating of one (1 = low) would identify a component as a priority in planning efforts, whereas a three (3 = high) would indicate the component is well-attended to and therefore of low priority. Through such a quick check, action planning provided in the "Next Steps for Implementation Efforts" column could then be based on top priorities, perhaps minimizing time required toward adoption and implementation efforts.

Summary

Study findings resulted in an understanding of faculty and administrator perspectives as participants in an ongoing university-wide ePortfolio implementation that, through the lens of DOI theory, were used to construct a framework that can be used by higher education community members to enable such a systemic initiative. The ePortfolio framework consists of six essential elements: awareness, motivation, commitment, resources, leadership, and evaluation,. Importantly, the framework is modular, not linear, with individual elements taking on varied degrees of emphasis at different stages in the innovation life cycle. An action planning tool accompanies the framework to support faculty implementation efforts over time. To ensure the framework was appropriately aligned with DOI theory in addition to practitioner experiences, it underwent expert review by three systemic change scholars. Reviewer feedback was then incorporated into the final version of the framework in Appendix.

Discussion

A university-wide ePortfolio implementation is a complex undertaking that requires the long-term and attentive coordination of infrastructure, resources, and people. This study contributes to the instructional design and technology field in two ways. First, it offers a framework for ePortfolio adoption and implementation in higher education contexts that acknowledges and includes the perspectives of faculty and administrators while addressing key elements of DOI theory. Second, the study contributes to a small but growing collection of design and development research studies, providing an example of what this newer methodological approach can look like in practice.

A Robust ePortfolio Implementation Framework

This study contributes insight into faculty and administrator perspectives regarding a university-wide ePortfolio adoption process, as well as a framework for supporting it. As noted, faculty perspectives on instructional technology adoption, including ePortfolio adoption, have not been well documented in the literature (Ruiz et al., 2009; Wang & Turner, 2007), and yet they are key stakeholders in the process. Findings from this project shed light on what faculty and administrators value in an ePortfolio implementation process including a user-friendly infrastructure, a clear and communicated purpose, support and training, and rewards for use and time commitment. By creating a framework for implementation that acknowledges faculty priorities and engages them early and systemically in the process can heighten instructional technology adoption and sustainment success. In a study of Florida State University's (FSU) ePortfolio adoption initiative, Lumsden (2007) identifies "feedback and buy-in from key stakeholders (students, staff, faculty, and employers)" (44) as a critical success factor. Further, components of the framework are consistent with several other named success factors of the FSU program, including university-wide leadership and vision and ePortfolio evaluation. At FSU, stakeholders established the goals and created the prototype for the ePortfolio system through an iterative, design-evaluation-revision process prior to a team of information technology professionals beginning work on the infrastructure, thus resulting in a more usable system (Reardon, Lumsden, and Meyer, 2005), a prominent concern of participants in this study.

A study on instructional technology adoption by Lei and Morrow (2010) provides further support for an implementation framework that puts faculty at the center of a process early on as collaborative decision makers and enactors who are well-supported by strong leadership, sufficient and timely resources, a means for critical feedback, and incentives. The framework makes the innovation process transparent to all stakeholders and guides open communication and decision-making across the organization. Educators remain connected to the initiative and are better prepared to call on the most important innovation adoption support elements at critical and appropriate times. Using a framework that supports an open implementation process, educators are less distracted by unexpected innovation stumbling blocks and better able to focus on ePortfolios as a means for student learning, assessment, and professional development.

In the past two decades, educational researchers continue to demonstrate that instructional technologies have not been well integrated into teaching and learning practices (Cuban, 2001; Tyack & Cuban 1995; Zhao, Pugh, Sheldon, & Byers, 2002). Significant costs associated with wide-scale integration efforts, such as organization-wide ePortfolio initiatives, certainly warrant concern if investments are not yielding positive and sustainable results. Recall that 42% of respondents in this study chose to abandon ePortfolio use. Rogers

(2003) and other diffusion of innovation experts (Watson, Watson, & Reigeluth, 2008) have well documented the complex nature of innovation adoption and the supports necessary to undergird this type of change. The framework presented here accounts for the necessary knowledge and skill development of those adopting an instructional technology but also provides for other vital supports to an innovation implementation process, as well as a way to assess current performance on these supports in order to move forward in an informed manner. Use of such a framework may improve our track record with instructional technology integration. However, while validated by DOI experts, the framework now needs to be tested in the field in a variety of contexts.

Design and Development Research in Practice

As the popularity of design and development research continues to grow, this research project can serve as a model for those who are considering or currently using this methodology. While there is significant guidance regarding design and development research (see, for example, Ellis & Levy, 2010; Richey & Klein, 2005; Richey & Klein, 2007), the body of research using this methodology remains relatively small (Richey & Klein, 2014). This study adds to the empirical body of knowledge on design and development research, providing another example of what this methodology can look like in practice. Two important lessons were learned by the researchers in using this approach: lessons that may help other researchers. First, it took more time than anticipated to secure expert reviewers and collect their feedback on the framework, a critical component of this methodology. In addition to gaining the commitment of expert reviewers earlier, using a scheduled interview, rather than an online survey, to obtain feedback for the framework revision phase might be more efficient. Second, developing a framework and the supporting instructions for use that was mature enough to be understood and evaluated by experts was a more challenging task than anticipated. Getting feedback on early prototypes of the framework from intended users, akin to a rapid prototyping approach (Tripp & Bichelmeyer, 1990), may expedite the development process and lend greater validity to the framework prior to releasing it for expert review. The second author has inserted this rapid prototyping approach into the development phase of a design and development study to be carried out over the coming year.

Two study limitations should be noted. First, the setting of the study, a large higher education institution with certain ePortfolio resources in place, could be viewed as a study limitation. While the researchers aimed for a framework that could be adaptable to any higher education setting, survey and interview findings may have been different if this study had been conducted in a different setting. For example, a smaller institution with different ePortfolio technologies at hand may have yielded different priorities, potentially impacting the framework. A second limitation relates to when the study was conducted in relation to the institution's adoption lifecycle. The diffusion literature points to an s-curve rate of innovation adoption in which early on adoption rates are low but increase dramatically in later stages and then taper off as time passes often due to fewer adopters and even abandoners (Rogers, 2003). This study was conducted fairly late into the adoption lifecycle, over ten years into the university's ePortfolio initiative, a factor that could have impacted participant perceptions. It is hoped that the grounding of the study, including instrument development, in the diffusion of innovation literature provided a useful counterweight to these concerns. However, the study of the framework in other higher education contexts and at earlier stages of the adoption process is needed to shed light on these issues. As a first step, the first author is now using the framework created in this study to collaborate with faculty on the implementation of ePortfolio as an innovation at a mid-sized university in the United States.

The field of instructional design and technology demands that researchers and practitioners not only create new knowledge, but also research and improve upon current practices. The use of design and development research can assist professionals in the study, improvement, and validation of instructional design tools and practices (Klein, 2013), serving as a useful approach to forming important connections between instructional design theory and instructional design practice.

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Appendix

A Framework to Support Electronic Portfolio Implementation in Higher Education Contexts

Introduction to the Framework

Based on survey and interview data from faculty and administrators who have implemented electronic portfolios (ePortfolios) at a large research university in the United States and improved upon by suggestions from three diffusion of innovation (DOI) expert reviewers, the following framework for implementing ePortfolios was created. The framework is meant to support those implementing, or attempting to implement, ePortfolios in a higher education context by guiding them through key attributes of systemic innovation in a practical and applied manner.

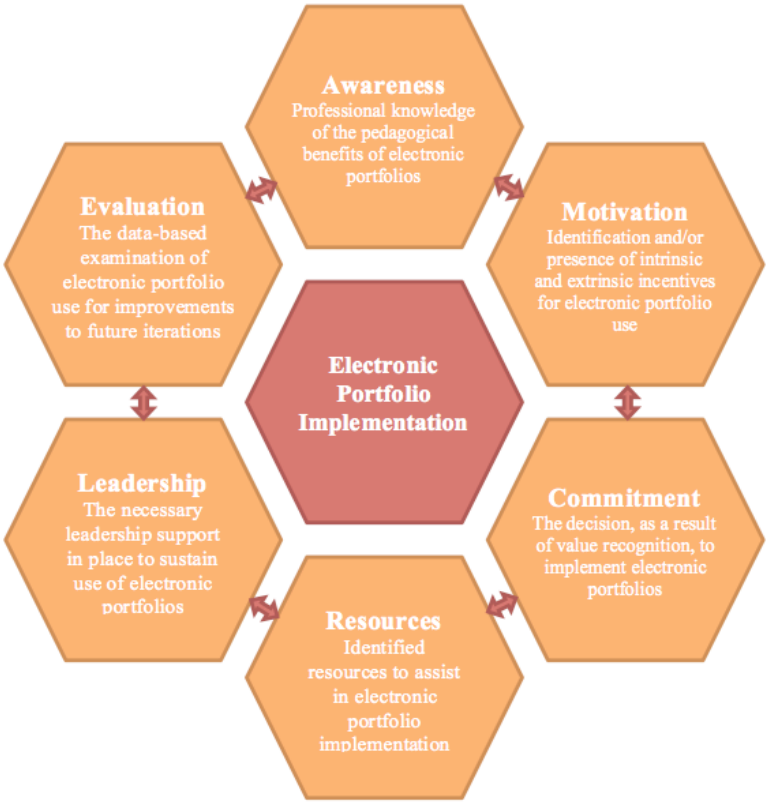

Figure 2. ePortfolio Implementation Framework components

As illustrated in Figure 2, the framework is divided into six components that are vital to the successful implementation of ePortfolios by faculty over time. These components (Awareness, Motivation, Commitment, Resources, Leadership, and Evaluation) reflect important DOI elements put forth by Everett M. Rogers (2003) and Donald P. Ely (1990), prominent scholars in systemic change. Awareness is defined as professional knowledge of the pedagogical benefits of ePortfolios and corresponds with Roger's element of knowledge as well as Ely's condition of dissatisfaction with the status quo. Motivation is defined as the identification and/or presence of intrinsic and/or extrinsic incentives for using ePortfolios and corresponds with Roger's element of persuasion as well as Ely's conditions of dissatisfaction with the status quo and rewards or incentives. Commitment is defined as the decision, as a result of value recognition, to implement ePortfolios and corresponds with Roger's element of decision as well as Ely's conditions of participation and commitment. Resources is defined as identified resources to assist in ePortfolio implementation and corresponds with Roger's element of implementation as well as Ely's conditions of sufficient knowledge and skills, availability of time, and availability of resources. Leadership is defined as the necessary leadership supports in place to sustain use of ePortfolios and corresponds with Roger's element of implementation as well as Ely's conditions of leadership. Evaluation is defined as the data-based examination of ePortfolio use to inform improvements to future iterations and corresponds with Roger's element of confirmation.

The framework was built to assist those in a higher education context who are considering implementing

portfolios or already in the process of implementation to assess a workgroup's current status in the implementation process, as well as important next steps. The framework is modular in that components can be considered in any order as needed. In addition to defining each component, selected strategies to act on each component, as well as key stakeholders who can influence progress on that component are provided (See Figure 3). In column four of each framework component, you may notice a scale for rating the current implementation status of the component. This scale is provided for users to assess performance on each component and identify next steps important to implementation. The intent of the 3-point rating scale is for the workgroup (e.g. organization, department, or program level) to take the pulse of the group's current implementation status. A rating of one would identify a component as a priority in planning efforts, whereas a three would indicate the component is of low priority. Through such a quick check, action planning can then be based in top priorities.

Component	Selected Strategies to Support Component	Key Stakeholder Involvement	Rating of Current Implementation Status	Next Steps for Implementation Efforts
Awareness Professional knowledge of the pedagogical benefits of electronic portfolios	• Websites • Newsletters • Articles • Presentations • Professional development	• Identified high-level opinion leaders including but not limited to: ○ Academic leaders on campus (e.g. provost, teaching and learning directors) ○ Leading electronic portfolio scholars and practitioners ○ Local faculty innovators	1. Faculty are unaware of the pedagogical value of electronic portfolios. 2. Faculty are somewhat aware of the pedagogical value of electronic portfolios. 3. Faculty are very aware of the pedagogical value of electronic portfolios.	Rating of 1 or 2 • Identify multiple avenues for electronic portfolio awareness building. • Plan a 3-6 month awareness building campaign. • Reassess awareness status after one to two academic years. Rating of 3 • Reassess awareness status at next formal, systemic evaluation of electronic portfolio implementation. (A systemic evaluation is recommended every three to five years.)

Component	Selected Strategies to Support Component	Key Stakeholder Involvement	Rating of Current Implementation Status	Next Steps for Implementation Efforts

Motivation
 	
Identification and/or presence of intrinsic and extrinsic incentives for electronic portfolio use
	• Learner incentives
	  ○ Hands-on, applied projects
	  ○ Alternative assessment opportunities
	  ○ Showcases and/or competitions
	  ○ Job seeking resource
	• Faculty incentives
	  ○ Departmental awards
	  ○ Accreditation fulfillment
	  ○ Teaching release time for development
	  ○ Grants and monetary incentives
	• Communication channels (awareness campaign, professional development sessions)
		• Provost and/or academic unit decision makers
		• Electronic portfolio advocates
		• Faculty innovators
		• Student innovators
			1. Faculty are unaware of the intrinsic and extrinsic incentives for using electronic portfolios.
			2. Faculty are somewhat aware of the intrinsic and extrinsic incentives for using electronic portfolios.
			3. Faculty are very aware of the intrinsic and extrinsic incentives for using electronic portfolios.
				Rating of 1 or 2
				• Identify appropriate and realistic complement of learner and faculty incentives.
				• Use communication channels to convey incentives.
				• Showcase examples of student electronic portfolios that are relatable and convey incentives.
				• Reassess motivation status after one to two academic years.
				
				Rating of 3
				• Reassess motivation status at next formal, systemic evaluation of electronic portfolio implementation. (A systemic evaluation is recommended every three to five years.)

Component	Selected Strategies to Support Component	Key Stakeholder Involvement	Rating of Current Implementation Status	Next Steps for Implementation Efforts

Commitment
 	
The decision, as a result of value recognition, to implement electronic portfolios
	• Faculty acknowledgements and rewards for initial investments of time and effort
	• Exemplar electronic portfolios as models
	• Dedicated ePortfolio staff/office
	• Inclusion in strategic plan
		• Provost and/or academic unit decision makers
		• Electronic portfolio professional staff
		• Faculty leadership team
			1. Faculty are not committed to the use of electronic portfolios.
			2. Faculty are somewhat committed to the use of electronic portfolios.
			3. Faculty are very committed to the use of electronic portfolios.
				Rating of 1 or 2
				• Identify a faculty leader by department or program, to establish and direct a regular schedule of work meetings regarding electronic portfolio implementation.
				• Reward faculty for initial time and effort.
				• After defining the direction of the initiative, involve technology service providers and ePortfolio staff in conversation with the faculty team to ensure potential:
				  ○ technology solutions are feasible.
				  ○ ePortfolio platforms are feasible and will support the features of desired models.
				• Reassess commitment status after one to two academic years.
				
				Rating of 3
				• Reassess commitment status at next formal, systemic evaluation of electronic portfolio implementation. (A systemic evaluation is recommended every three to five years.)

Component	Selected Strategies to Support Component	Key Stakeholder Involvement	Rating of Current Implementation Status	Next Steps for Implementation Efforts
 Identified resources to assist in electronic portfolio implementation	• Targeted in-house professional development activities • Dedicated Technology support • Dedicated Pedagogy support • Professional ePortfolio organizations (AAEEBL, ePIC, EPAC) and associated resources	• In-house professional development service providers (ePortfolio, technologies, pedagogy) • Faculty innovators • Graduate assistants • External electronic portfolio professional organizations, conferences, and/or journals	1. Faculty are unaware of the resources available to assist in their implementation of electronic portfolios. 2. Faculty are somewhat aware of the resources available to assist in their implementation of electronic portfolios. 3. Faculty are very aware of the resources available to assist in their implementation of electronic portfolios.	Rating of 1 or 2 • Use communication channels (awareness campaign, professional development sessions) to convey available resources. • Ensure that available resources (including incentives) are accessible to faculty in light of work habits and environments. • Check for other reasons for non-use of resources. • Reassess resources status after one to two academic years. Rating of 3 • Reassess resources status at next formal, systemic evaluation of electronic portfolio implementation. (A systemic evaluation is recommended every three to five years.)

Component	Selected Strategies to Support Component	Key Stakeholder Involvement	Rating of Current Implementation Status	Next Steps for Implementation Efforts
 The necessary leadership support in place to sustain use of electronic portfolios	• Ongoing recognition by important leaders through preferred communication channels (websites, newsletters, showcases, and presentations) • Inclusion in strategic plan and other policy documents	• Electronic portfolio professional staff • Contact staff for technology and pedagogy supports • Provost and/or academic unit decision makers • Faculty champions	1. Faculty do not have the leadership support needed to sustain their use of electronic portfolios. 2. Faculty somewhat have the leadership support needed to sustain their use of electronic portfolios. 3. Faculty have the leadership support needed to sustain their use of electronic portfolios.	Rating of 1 or 2 • Align electronic portfolio initiative with strategic plan goals. • Recognize faculty and student electronic portfolio work. • Develop new initiatives for enhancing and highlighting ongoing ePortfolio work. • Reassess leadership status after one to two academic years. Rating of 3 • Reassess leadership status at next formal, systemic evaluation of electronic portfolio implementation. (A systemic evaluation is recommended every three to five years.)

Component	Selected Strategies to Support Component	Key Stakeholder Involvement	Rating of Current Implementation Status	Next Steps for Implementation Efforts
Evaluation The data-based examination of electronic portfolio use for improvements to future iterations	• Gather student, faculty, and/or potential employer feedback through survey, interview, or other data collection options.	• Electronic portfolio professional staff • In-house evaluation resources service provider • Faculty	1. Faculty are unaware of the evaluation activities and outcomes related to the implementation of electronic portfolios. 2. Faculty are somewhat aware of the evaluation activities and outcomes related to the implementation of electronic portfolios. 3. Faculty are very aware of the evaluation activities and outcomes related to the implementation of electronic portfolios.	Rating of 1 or 2 • Electronic portfolio staff and evaluation staff plan for and implement an electronic portfolio evaluation • Use evaluation findings to improve the next phase of ePortfolio implementation • Reassess evaluation status after one to two academic years. Rating of 3 • Reassess evaluation status at next formal, systemic evaluation of electronic portfolio implementation. (A systemic evaluation is recommended every three to five years.)

Figure 3. Component details of ePortfolio Implementation Framework

The action planning worksheet in Figure 4 can be used to identify next steps in the implementation process. Project management of these steps can then begin through the identification of key stakeholders and target completion dates.

Component	Current Implementation Rating	Next Steps	Key Players to Involve	Target Completion Date(s)	Additional Notes
Awareness	☐1 ☐2 ☐3				
Motivation	☐1 ☐2 ☐3				
Commitment	☐1 ☐2 ☐3				

Component	Current Implementation Rating	Next Steps	Key Players to Involve	Target Completion Date(s)	Additional Notes
Resources	☐1 ☐2 ☐3				
Leadership	☐1 ☐2 ☐3				
Evaluation	☐1 ☐2 ☐3				

Figure 4. Action Planning Worksheet for ePortfolio Implementation