

Engaging the Framework for Information Literacy for Higher Education as a Lens for Assessment in an ePortfolio Social Pedagogy Ecosystem for Science Teacher Education

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This article highlights a case study that assesses how graduate-level, in-service science teachers engage in an ePortfolio social pedagogy ecosystem to document their growth in knowledge practices and dispositions in information literacy. The ePortfolio social pedagogy ecosystem and this study are situated within the context of the Catalyst Framework. The three modes of interrelated social learning activities include: (1) authoring the written ePortfolio in an online ePortfolio digital media platform, (2) presenting the ePortfolio in the webinar platform, and (3) presenting the ePortfolio in-person in a physical setting. We used case study methodology to systematically investigate how each participant used their ePortfolio capstone exit project to engage the Association of College and Research Libraries' (2015) Framework for Information Literacy for Higher Education (ACRL Framework) as a conceptual lens to document their competencies (as part of reflective practice) in information literacy. The unit of analysis we used was the ePortfolio entry focused on using information literacy to understand science education theory and practice. Findings show that the participants emphasized content in different but connected communication modes across the ePortfolio social pedagogy ecosystem. Findings also show that ePortfolio is an effective tool for self-assessment and reflection on one's information literacy competencies. Implications for outcomes assessment are also discussed.

So my personal reflection of information literacy: thoughtful research before adding new things to one's practice can lead to more effective use of new frameworks and models in the classroom. A lot of the [science] literacy tools I researched I've actually used . . . I'm excited to continue and find new ones to experiment with as I continue on in my career. (Graduate teacher education student, ePortfolio capstone project in-class presentation)

Developments in ePortfolio practice necessitate a renewed focus on integrative social pedagogy design and assessment approaches in science teacher education. This renewed focus has developed because (a) as with other types of teacher education programs, science teacher education programs are increasing the use of ePortfolio (Cherner, 2018; National Science Teachers Association, 2018; Parkes, Dredger, & Hicks, 2013; Parkes & Kajder, 2010); and (b) there is increased pressure from accreditation organizations for teacher education programs to intentionally assess student dispositions and professional learning outcomes (Council for the Accreditation of Educator Preparation, 2018; Luera, Brunvand, & Marra, 2016; Richards-Schuster, Ruffolo, Nicoll, Distelrath, & Galura, 2014). As ePortfolio practice has found an increasing place in academic institutions, most recently named as the eleventh high impact practice by the Association of American Colleges and Universities (AAC&U; Watson, Kuh, Rhodes, Light, & Chen, 2016), there is still a need to research evidenced-based approaches in various contexts. For example, the opening quote of this article was retrieved from a student's in-class ePortfolio presentation. The

reflection revealed the student's disposition to use research skills to discover new tools to teach science and literacy in the classroom. Equally important to evaluating evidence of competency found in the student's ePortfolio reflection is assessing in what context and in what mode of communication the evidence was found. The idea of ePortfolio constructed through purposeful processes of social pedagogy, inquiry through professional practices, and reflection provides opportunities and resources to expand the range of assessment approaches for representing competency development in science education programs.

Bass and Elmendorf (2016) described the idea of social pedagogy as "design approaches for teaching and learning that engage students in authentic tasks that are communication-intensive, where the representation of knowledge for an authentic audience is absolutely central to the construction of knowledge" (p. 2). Accordingly, in implementing these projects, a central question arises of how in- and pre-service science teachers use ePortfolio to make their learning, dispositions, and competencies visible at the intersection of integrative social pedagogy and reflective practice. Examining the complexities of these intersections in ways that seek to capture deeper understandings about the creation of learning communities that leverage ePortfolio social pedagogy can offer new insights into how inquiry, reflection, and integration are approached as sociocultural resources in the development of ePortfolio practice. This intersection can form networks of community inquiry spaces where shared knowledge and processes associated with reflection and communication, as social

resources, can be represented and organized empirically to help make learning visible.

Yet at another level, what makes integration possible in the process of ePortfolio creation is not only the intersection of community inquiry spaces, but the development of intentional participatory approaches to authorship that value the connection of purpose with interpretation of experiences over time and context through reflective practice. Building on work conducted in 2004 by AAC&U and researchers like Huber and Hutchings (2004), Reynolds and Patton (2014) defined integrative learning as “an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situation within and beyond the campus setting” (p. 31). Additionally, Chen (2009) developed the term “folio thinking” to help conceptualize the notion of ePortfolio creation as a connected process that entails systematic planning, sense-making of incorporated elements, and ways of sharing evidence of learning and performance over time. What is implicated in this notion of folio thinking is a challenge to generate new ideas and activities that engage the processes of multimodal approaches to social pedagogy in ePortfolio practice. The participatory nature of social practices and reflection-in-community that integrate social pedagogy can present significant challenges to ePortfolio practice. These challenges become particularly evident when inviting science teachers to move beyond the context of a confined course community to participate in broader community experiences where there are opportunities to synthesize sense-making that contribute to their ongoing professional development.

Approaches to ePortfolio pedagogical practice can differ strikingly across academic disciplines and professional learning communities. However, a common goal that shapes ePortfolio implementation is to increase ongoing affiliation among student, faculty, and staff interactions that help shape and increase learning. This is particularly evident in how ePortfolio practitioners operationalize elements of integrative social pedagogy. For example, Fuller (2017) used ePortfolios as a low-stakes, formative assessment tool to support engagement and mastery learning in a biology course for non-biology majors. Fuller (2017) found that students who used ePortfolios showed more engagement and communication about course materials with peers and faculty, particularly outside of class time, than students who did not use ePortfolio. Purposefully operationalized as a communicative formative assessment tool, ePortfolio pedagogy can be designed to help foster student-centered learning environments that support effective and timely communication between instructors and their students as well as among students.

Depending on purpose (intentionality) and expected learning outcomes (competencies), a key challenge to any ePortfolio pedagogical practice (e.g., social pedagogy) is to find design principles to help authors (re)construct and identify their experiences within and across the inter-subjectivities of social practices of a learning community. These design approaches must afford generative pathways to professional development through authentic inquiry experiences. In addition to consideration of purpose and outcomes in the application of social pedagogy, key challenges include harnessing authentic learning activities, using rubrics to evaluate ePortfolios, and identifying stakeholders and authentic audiences (Light, Chen, & Ittleton, 2012). Perhaps what is most important in addressing these challenges are social pedagogical practices that are guided by design approaches that integrate intentional reflective collaboration and thoughtful communicative and educative social practices. The accountability and interest grounded in being and becoming part of a learning community helps authors to experience ePortfolio design principles that are meaningful and relevant to collaborative inquiry, reflection, and integration. Within this approach, we address the follow challenge: How do ePortfolio practitioners assess the development of competencies and dispositions in the contextual circumstances of social pedagogy and learning practices of a community?

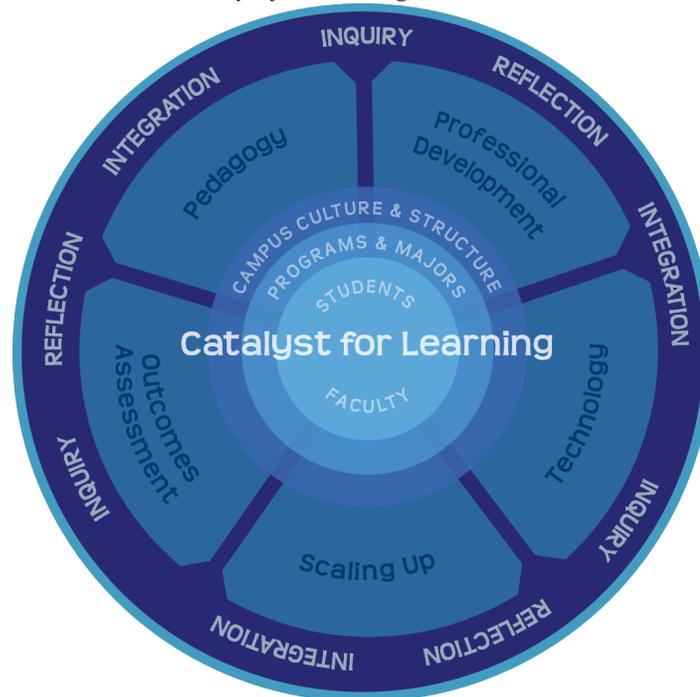
Overview and Research Questions

In this article, we highlight an ePortfolio case study that investigates how in-service science teachers engage in an ePortfolio social pedagogy ecosystem to document their competencies in information literacy in the context of learning how to conduct science education research. The Association of College and Research Libraries’ (2015) Framework for Information Literacy for Higher Education (ACRL Framework) is used as an assessment lens to locate evidence of how development of competencies and dispositions in information literacy is documented by the in-service science teachers in the ePortfolio social pedagogy ecosystem.

Guided by the aforementioned challenge statement, four central research questions frame the study:

1. What ACRL frame(s) do participants select to use as a lens to demonstrate their growth in competency in the ePortfolio social pedagogy ecosystem?
2. How do they demonstrate the use of the ACRL Framework to structure their reflections on their competencies and dispositions in information literacy in the context of the ePortfolio social pedagogy ecosystem?

Figure 1
Catalyst for Learning Framework



Note. From *High-Impact ePortfolio Practice: A Catalyst for Student, Faculty, and Institutional Learning* (p. 33), by B. Eynon and L. M. Gambino, 2017, Sterling, VA: Stylus. Copyright 2017 by Stylus. Reprinted with permission.

3. Where is evidence of competencies and dispositions being found within the ePortfolio social pedagogy ecosystem?
4. How can we use what we have learned about students' understanding of information literacy through the ePortfolio social pedagogy ecosystem to improve future instruction and course and assessment designs?

Theoretical Framework

The Catalyst Framework

We situate our ePortfolio practice and this study within the context of the pedagogy and outcomes assessment sectors of the Catalyst Framework. The Catalyst Framework (Figure 1) asserts three connecting value propositions: (a) ePortfolio initiatives advance student success; (b) making student learning visible, ePortfolio initiatives support reflection, social pedagogy and deepen learning; and (c) ePortfolio initiatives catalyze learning-centered institutional change (Eynon, Gambino, & Török, 2014). Guided by the aforementioned three propositions, the Catalyst Framework contains a learning core that interacts

integratively with two major mushrooming but highly integrated recursive and multi-sector components of the framework. The learning core is conceptualized around institutionalized structures such as campus mission, policy, and culture that help to steer the conditions of educational practice and learning experiences (Eynon & Gambino, 2017). The learning core is inscribed by five interlocking sectors: pedagogy, professional development, technology, scaling up, and outcomes assessments. The sectors centrally focus on properties that instrumentally connect ePortfolio pedagogy with broader institutional practices articulated in each sector.

What is particularly interesting to us about the Catalyst Framework is the pedagogy and outcomes assessment sectors and their potential to link processes of engagement that frequently come together in communities within higher education with foundational design principles of ePortfolio practice, such as social pedagogy (Bass, 2017). Accordingly, the five sectors are brought together by three overarching and multilayered design principles: inquiry, reflection, and integration. As with any new framework presented to a field of practitioners and researchers, the presentation often invites interrogation and opportunities to put the framework into action and action into the framework.

In this respect, we put the framework into action by showing it at work in the context of a graduate science education capstone project. Accordingly, the Catalyst Framework is a tool for understanding ePortfolio social pedagogy practice and research as a transformative learning space. It also provides a context in which knowledge practices and dispositions found in the ACRL Framework are used as a lens to assess growth in information literacy. Next, we introduce the ACRL Framework for Information Literacy and offer a definition of information literacy.

Framework for Information Literacy for Higher Education

The ACRL Framework was adopted by the Association of College and Research Libraries Board in February 2015, was approved in 2016, and was intended as a revision of the prior ACRL (2000) standards document, *Information Literacy Competency Standards for Higher Education*. The task force responsible for revising the competency standards was charged with including continuity with American Association of School Librarians' Standards for the 21st Century Learner, and the inclusion of affective, emotional learning outcomes, and consideration of the role of student as content creator and curator (Fulkerson, Ariew, & Jacobson, 2017). The following six frames of the ACRL Framework offer core conceptual ideas about the nature of information literacy: (a) authority is constructed and contextual, (b) information creation as a process, (c) information has value, (d) research as inquiry, (e) scholarship as conversation, and (f) searching as strategic exploration. Each frame is made up of an introductory statement, knowledge practices, that demonstrate "ways in which learners can increase their understanding of these information literacy concepts" (ACLR, 2015, para. 2) and dispositions, which "describe ways in which to address the affective, attitudinal, or valuing dimension of learning" (para. 2).

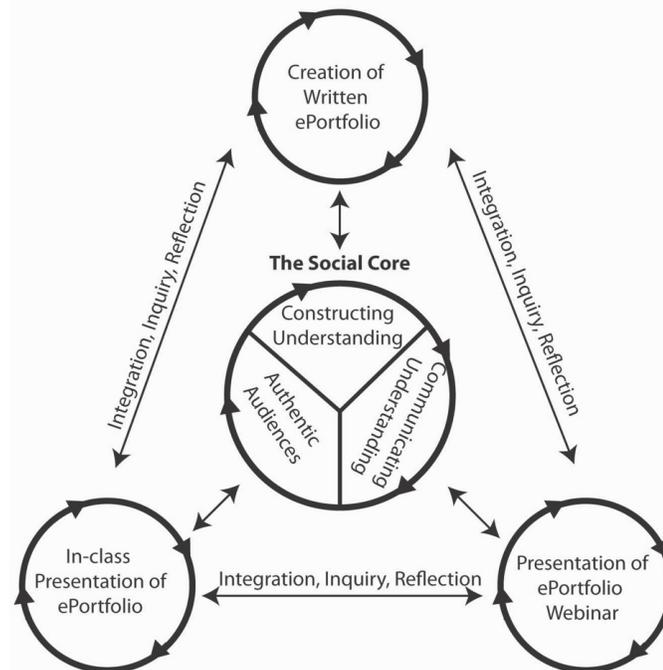
While information literacy was defined previously as recognizing when information was needed and having "the ability to locate, evaluate, and use effectively the needed information" (American Library Association, 1989, para. 3; also see ACRL, 2000), the new ACRL Framework has deepened the definition by including reflection and other concepts, stating that information literacy is "the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning" (ACRL, 2015, para. 6). In our project, this expanded definition and the structure of the framework provide opportunities for reflection on the growth of the participant's understanding of information literacy.

We use the ACRL Framework in our ePortfolio practice to help guide deeper reflections in community conversations about information literacy in science education (Jacobson & Gibson, 2015). Even though the ACRL Framework is relatively new, it has been used as a tool to assess information literacy programs and courses by looking at student work. Rubrics have been developed on framework knowledge practices and dispositions to score student papers (Willson & Angell, 2017), to code a single question survey in a large-scale first-year composition course (Gammons & Inge, 2017), and to code first-year-student reflection essays on library search experiences (Dempsey & Jagman, 2016). These studies provide insights on ways to assess student work and improve instruction using the ACRL Framework. What happens when students use the framework as a document to guide self-reflection and integration of knowledge in ePortfolio social pedagogy is an area yet to be explored.

Theoretical Framework: Reflective Practice, ePortfolio, and Integrative Social Pedagogy

Approaches to reflective practice have been associated with several interpretive traditions that have been used to illustrate its range and potential, while also laying a foundation for questions about its utility and challenges in ePortfolio processes. Three interpretive traditions used to theorize reflective practice are summarized by Lyons (2010) as follows: (a) reflective inquiry as thinking (Dewey, 1933), (b) reflective inquiry as a way of knowing (Schön, 1983), and (c) reflective inquiry as a means to engage in critical consciousness and emancipation of practice (Freire, 1970; Van Manen, 1990). Reflective practice, as both an individual and a social process, can be approached as an interpretive inquiry-based activity (Bass, 2017; Rodgers, 2002a). In this sense, reflective practice is a search for meaning, methods, and capacities in order to interpret socially connected pathways to learn how to learn integratively and to realize and value knowledge, dispositions, and action (Reynolds & Patton, 2014). Over the last 30 years, Schön's (1983) inquiry into practitioner-generated knowledge has influenced a rich stream of research that connects various traditions of reflective practice to academic disciplines and professional practices such as, teacher education (Korthagen, 1993; Loughran, 2002; Osterman & Kottkamp, 2004), TESOL education (Farrell, 2007), medical education (Wald & Reis, 2010), nursing education (Hatlevik, 2011), biochemistry education (Walsh, 2010), and information literacy (Miller, 2018). While the term "reflective practice" encompasses varying interpretations (Corrall, 2017; Farrell, 2012; Lyons, 2010; Reynolds, 2011), perhaps what holds the most promise for thinking about reflective practice in teacher education is how it helps to shape ways to communicate dispositions towards pedagogical competencies and

Figure 2
ePortfolio Social Pedagogy Ecosystem



learning during participation in learning communities (Valli, 1993; Zeichner & Liston, 1996).

Reflection-in-community is a type of community building approach, particularly when used in the context of social pedagogy, which embraces active communication with audiences as a method for (co)constructing social learning. In her work with teachers, Rodgers (2002b) used the notion of reflection-in-community not only to create dynamic conversations and to find shared meaning, but to challenge claims about meaning and interpretations that serve to intentionally engage social experiences for collaborative learning. Similarly, Yoon and Kim (2010) explored collaborative reflection in teaching across three modes: writing, sharing, and discussing. They found that while reflective writing and sharing allowed student teachers to express their “dilemma cases” about classroom teaching, reflective discussion allowed participants to gain a deeper understanding of their own values about teaching (Yoon & Kim, 2010).

Using reflective practice in teacher education still poses challenges. Fendler (2003) summarizes some of the critiques and challenges of reflective practice in teacher education, cautioning that reflective practice may have performance gaps that fail to capture power relations. Loughran (2002) reminded us that rationalization of practice can shape consciousness and thinking about ways to justify existing perspectives about a particular situation. In this sense, he indicates that “rationalization may masquerade as reflection” (p. 35). Accordingly, reflection

is not always transparent in consciousness and available for observation and assessment even when attempts are made to systematize and to communicate and use outcomes of reflective experiences in community settings. In addition, Yoon and Kim (2010) found that participants in their aforementioned study often harbored the belief that a goal of collaborative reflection is to achieve a unifying conclusion. The social act of communicating the outcome of reflective practice helps to contribute to (and to problematize) the different expectations and ways of sharing learning within a community. However, having engaged in reflective practice does not always mean the desired outcomes (e.g. new ways of teaching and learning) can be communicated as they had been consciously conceptualized (Roth, 2011).

While we recognize that communicating the outcomes of reflective practice can be a substantive part of various pedagogical approaches in teacher education, like Zeichner and Wray (2001), Loughran (2002), Fendler (2003), Farrell (2012), and other reflective practice researchers, we also caution that not all approaches are productive. Keeping this caution in mind, it is important to bring into focus how the (social) pedagogy sector in the Catalyst Framework is used to guide our implementation of outcomes assessment of reflective practice in the ePortfolio social pedagogy ecosystem implemented in this study.

In this study, the ePortfolio social pedagogy ecosystem depicted in Figure 2 is grounded in the ideas of

reflection-in-community and social pedagogy shared across three complementary modes of social learning spaces. The three modes of interrelated social learning activities include: (1) authoring the written ePortfolio in an online ePortfolio digital media platform, such as TaskStream; (2) presenting the ePortfolio in a webinar platform, such as Adobe Connect; and (3) presenting the ePortfolio in-person in a physical setting. Together these modes form a social pedagogy ecosystem that is bound together by a community of participants that uses ePortfolio to share learning via reflection, integration, and inquiry, in our case, to learn about how to teach and learn science in secondary school settings. Similar to what occurs among the sectors in the Catalyst Framework, integration, inquiry, and reflection not only function to bind all three modes in the ePortfolio ecosystem, but together they also occur as key learning processes within each of these modes. Accordingly, activities that occur between and within each mode offer different as well as similar opportunities to engage the interrelated practices (Cope & Kalantzis, 2009).

Within the ecosystem, Rodgers's (2002b) notion of reflection-in-community and social pedagogy come directly together to help guide the set of interrelated social modes of practices found in what Bass (2017) called "the social core." The idea of the social core, shown as conceptually inscribed in the center of Figure 2, is an organizing feature of social pedagogy within the ecosystem. In higher education course settings, Bass (2017) characterized three essential interrelated practices in the social core as: (a) constructing understanding (ways that students deepen their core understanding of subject specific concepts by engaging in ways of thinking in a field), (b) communicating understanding (ways that students make their knowledge and learning visible to others), and (c) engagement with authentic audiences other than the instructor. The social core practices occur in iterative cycles connected by integrative learning, inquiry, and reflection in communicative social events. In this way, the social core informs essential social practices within and across each mode of the ecosystem. The social core also supports activities that use ePortfolio for building a sense of intellectual community, connecting participants to wider communities outside the classroom, deepening student reflection and other learning outcomes.

Additionally, the core provides another set of reflective resources used for growth that lie in information that is available in and for communicative actions. In social pedagogy, growth (increased competencies and literacies) comes from connecting audiences and context, and also participating in processes that offer a variety of ways to construct and communicate meaning using overlapping but different integrated literacies, including multimedia skill sets (New London Group, 1996). Accordingly, the mode of interactions depicted in the ePortfolio social pedagogy

ecosystem are connected by the three fundamental design principles found in the Catalyst Framework: integrative learning, inquiry, and reflection in the process of communication. To the extent that inquiry and integrative learning in the ecosystem help to structure and build professional competencies and literacies in social connections for communicating reflections in complementing modes of community spaces (Rodgers, 2002b), so does reflection help to structure social connections for inquiry and integrative learning in these same spaces (Bass, 2017; Reynolds & Patton, 2014).

For example, Parkes and Kajder (2010) used ePortfolio that incorporated digital modes of expression, such as blogs, vlogs (i.e., video-based journal entries), and video collages, as evidence to explore the reflective performances of English education and music education pre-service teachers about their student teaching experiences. The content of the blogs, vlogs, and video collages incorporated course assignments and analytical reflections from field placement experiences that were dynamically selected and used as evidence by the students in their capstone ePortfolio to illustrate reflection-on-practice and critical reflection of growth. Each student produced their master's thesis ePortfolio capstone project and then defended it orally. Parkes and Kajder (2010) noted in their findings that even students who were challenged by the technology indicated that they consistently felt that their learning was enhanced by frequently reflecting on their understanding of practice.

In a follow-up study with a similar context, Kajder and Parkes (2012) assessed pre-service teachers' journal reflections about their student teaching experiences created across weblogs and vlogs. In this study, they found that in general, participants produced weblogs that documented reflection practice categorized by Larrivee (2008) as service-level reflection capturing pedagogical context and instructional descriptions, while vlogs documented level-three reflection capturing ways participants thought about student learning and how to enhance learning experiences. Participants in their study seem to produce different reflections depending on the mode of digital media used (e.g., weblogs or vlogs) and depending on the students' perceptions about the processes. Building on their study, we assert that the use of social pedagogical practices creates new opportunities in ePortfolio practice to connect multiple modes of purposeful and participatory reflective practice for social learning. In this context, reflective practice is informed by the processes of integration and inquiry, as well as the social core. Unlike Parkes and Kajder (2010), the study presented in this article explicitly explores where evidence of competencies is being found in the process of assessing the outcome of reflective practice in the ePortfolio social pedagogy ecosystem.

Methodology

Background and Context

The science education ePortfolio exit project is a high-stakes assessment that was added as a degree requirement to the Master of Science: Secondary Science Education Program at an urban public college in New York State in 2010. The ePortfolio exit project is semi-structured where students have to illustrate growth within each of the following competency areas: (a) reflective practice, (b) using information literacy to understand science education theory and practice, (c) using pedagogical knowledge in designing instruction and assessment; (d) culturally responsive pedagogy, (e) using science content area knowledge, and (f) professional collaborations. The ePortfolio exit project is designed in TaskStream with general guidelines requiring that participants use appropriate baseline and corresponding post-baseline evidence to explain and depict growth within six major competency areas (Pitts & Ruggirello, 2012).

In 2015, the ePortfolio capstone project was reframed in the context of the social pedagogy ePortfolio ecosystem using design approaches for teaching and learning that engage students specifically in: (a) constructing understanding (i.e., ways that students deepen their core understanding to inform their understanding of teaching and learning science), (b) communicating understanding (i.e., ways that students make their knowledge and learning visible to others using the modes of interaction framed by the ePortfolio capstone project), and (c) engaging with an authentic audiences (i.e., audience other than the instructor; Bass, 2017; Bass & Elmendorf, 2016). In an effort to reframe the information literacy ePortfolio entry and the information literacy instruction in the capstone courses, the ACRL Framework was introduced to the class in January 2017 with the intention of being used as a conceptual lens and tool for student reflection on their own information literacy skills and dispositions. In the middle of the second semester, students created a 30-minute webinar based on the information literacy component and two other components of their choice which they presented in the Urban College ePortfolio Seminar Series. The webinars were conducted using Blackboard Collaborate. The college community, including program alumni and other science education professionals, were invited to participate in the webinar. At completion of the second semester, students were required to present their ePortfolios in-class (i.e., in-person) to members of the class and invited guests. In this way, Students presented their written ePortfolios in two additional interconnecting

modes of the social pedagogy ecosystem (i.e., the webinar and in-class presentation).

Research Design

A case study approach (Yin, 2009) was used to systematically investigate how each participant used the ePortfolio capstone exit project to engage the ACRL Framework as a conceptual lens to document their competencies (as part of reflective practice) in using information literacy. The unit of analysis was the ePortfolio entry concerning using information literacy to understand science education theory and practice. This unit of analysis facilitated comparisons of participants in each mode as to how they used the ACRL Framework in this entry to illustrate and reflect on the ways they improved their understanding and practice of information literacy concepts. Evidence of the outcome of their reflections were tracked across all three key modes of the social pedagogy ecosystem: the written ePortfolio, ePortfolio webinar, and in-class ePortfolio presentation. We looked for consistencies and contradictions to seek out patterns within and across datasets we collected for each participant. Below, we highlight participants' data gathered from the ePortfolio baseline and post-baseline evidence that participants used to reflect on their growth in information literacy.

Participants

We recruited three of seven students in the capstone class to participate in the study. All were graduate students in the secondary science education program. Two of three participants were in-service, early career science teachers while one in-service teacher was mid-career. One of the participants was a career changer. Participants ranged in age from early 20s to early 50s. There was one male and two female participants.

All students created an Information Literacy section in the written ePortfolio. Andrea, Elias, and Fran (all pseudonyms) situated their information literacy reflections in the framework by highlighting three frames: research as inquiry, searching as strategic exploration, and information has value (Table 1). Two of the three students selected two frames and found ways to reflect on the interconnectivity of the frames.

Data Collection

Data were collected in the 2016-17 academic year from all three modes of reflective practice in the ePortfolio social pedagogy ecosystem. Each participant was issued a pseudonym before collecting and analyzing the data. The pseudonyms were used to blind the data and were associated with each category of the data collected from the respective participant (Table 1). The data were collected from the three modes of the information literacy ePortfolio section (Table 2).

Table 1
Summary of In-Service Teacher Participants and Their Selected ACRL Frames

Student	Sciences	Information literacy ePortfolio section title	ACRL Frames
Andrea	Living Environment	Research as Inquiry vis-à-vis Searching as Strategic Exploration	Research as Inquiry & Searching as Strategic Exploration
Elias	Earth Science	Understanding of Science Ed Literature/Theory/Information Literacy Entry	Research as Inquiry
Fran	Earth Science	The Information Literacy Process: Research as Inquiry Leading to Information Has Value	Research as Inquiry and Information has Value

Table 2
ACRL Frame: Research as Inquiry

Research as Inquiry	Andrea			Elias			Fran		
	ePortfolio	Webinar	Pres.	ePortfolio	Webinar	Pres.	ePortfolio	Webinar	Pres.
Knowledge practices: Evidence	5	7	7	7	3	7	6	8	8
Knowledge practices: No evidence	3	1	1	1	5	1	2	0	0
Dispositions: Evidence	8	8	8	7	5	8	7	8	8
Dispositions: No evidence	1	1	1	2	4	1	2	1	1
Total: Evidence	13	15	15	14	8	15	13	16	16
Total: No evidence	4	2	2	3	9	2	4	1	1

Note. “Pres.” = Presentation. Total number of knowledge practices = 8. Total number of dispositions = 9.

All presentations, including the webinar, were recorded and transcribed.

Data Analysis

Data collected from the ePortfolio information literacy entry, which included data from all three presentation modes were subjected to two levels of coding and analysis. The outcome of the level one coding analysis was used to guide the selection of the ACRL frame to code for level two and facilitated the exploration of research question one. To obtain trustworthiness, discrepancies in coding among the two researchers were discussed until agreement was found.

In level-two coding, evidence of participants’ use of the research as inquiry ACRL frame, which was selected by three students, was used to identify their reflections about their information literacy competency across all three modes (Table 2). The knowledge, practices, and dispositions associated with research as inquiry were used to code for evidence. An evidence code was assigned if participants demonstrated all aspects of a particular respective

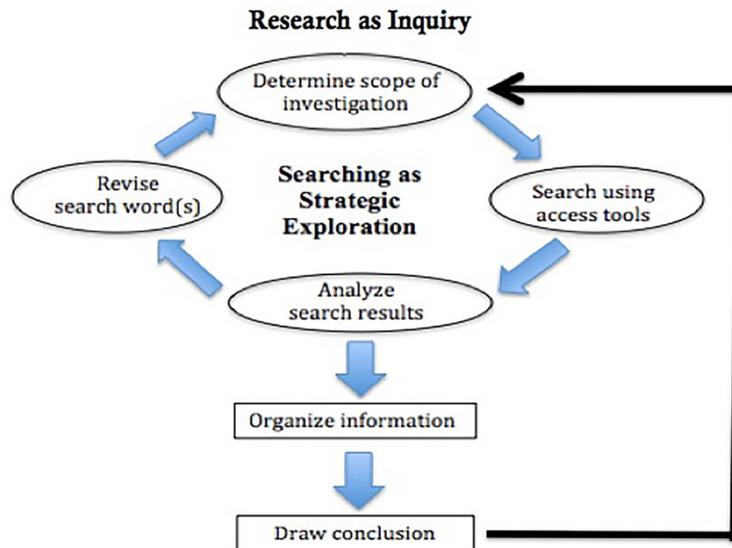
knowledge practice or disposition in each mode of their ePortfolio entry. A partial evidence code was assigned if they only demonstrated a part of the knowledge practice or disposition and no evidence was given if the knowledge practice or disposition was not demonstrated. While we coded for no evidence, partial evidence, and complete evidence, in Table 2 partial and complete evidence have been combined into a single evidence category. Appendix A provides a sample coding chart.

Results

Evidence for How Research as Inquiry is Used as a Lens to Structure Reflection in Knowledge Practices and Dispositions in Information Literacy

Throughout the ePortfolio social pedagogy ecosystem, participants deepened their learning about information literacy and made learning visible by engaging with the knowledge practices and dispositions found in the ACRL frame in a variety of ways guided

Figure 3
Andrea's Synthesis of Research as Inquiry and Searching as Strategic Exploration Chart



by the social core. Bass (2017) indicated that ePortfolio social pedagogy consonant with the social core helps create outcomes that deepen intellectual and personal significance in networks of social learning processes that better connect students with their peers and lift learning outside the boundaries of the classroom. Table 2 shows evidence of research as inquiry knowledge practices and dispositions across presentation modes for the three students. Research as inquiry addresses knowledge practices and dispositions involved in conducting research that are “iterative and depend upon asking increasingly complex or new questions whose answers in turn develop additional questions or lines of inquiry” (ACRL, 2015, para. 19). This frame aligned with information literacy instruction and assignments experienced by the class.

All three students demonstrated greater evidence of the knowledge practices and dispositions in their final in-class presentations and, for all three students, evidence was not consistent across all three forms of presentation. In the research as inquiry frame there are eight knowledge practices and nine dispositions, so the most evidence that could be demonstrated is 17. Two students, Andrea and Fran, showed greater evidence of the knowledge practices in their webinar and in-class presentations than in their written ePortfolios. Andrea demonstrated evidence for 15 knowledge practices and dispositions in her webinar and in-class presentation, compared with 13 in her written ePortfolio. In addition, Fran showed evidence of all of the knowledge practices in her webinar and in-class presentations (eight), but not in her written ePortfolio, where she showed evidence of six. Elias showed more

evidence in his written ePortfolio (14) and final presentation (15) than in his webinar (eight).

Andrea. Andrea titled her information literacy ePortfolio section Research as Inquiry vis-a-vis Searching as Strategic Exploration and she found numerous ways to demonstrate her understanding of the two frames in all of her presentations. Reflection-for-action, a way to guide future action (Killion & Todnem, 1991), was demonstrated in both her written ePortfolio and in her webinar as she discussed sharing new research skills with her students. In the written ePortfolio, she wrote that discovering science education research and learning how to use databases, “eventually helped me realize that as a science teacher, I should enhance myself in information literacy to guide my students as they learn and perform science to foster critical thinking and become well-informed citizens of the world.” She shared a similar idea in her webinar, where she reflected on how developing her information literacy abilities relates to developing those abilities in her students, saying,

I develop my literacy abilities looking for relevant information. If I have developed my literacy abilities, that is to search and to locate information, when I do research, then I will be able to guide my students if I assign projects requiring research.

This is a powerful idea to communicate to the participants in the webinar because she makes explicit the connection between her research skills and the research skills she wants her high school students to possess.

She showed greater evidence of the frame research as inquiry in her webinar and presentation than in her written ePortfolio. In her webinar and in-class presentation, where she showed evidence of 15 of 17 research as inquiry knowledge practices and dispositions, she shared new information about how she developed her research topic by talking with teachers at her school about their information needs. She enhanced her final presentation by adding concepts from her research and communicated understanding by sharing that she has integrated these concepts into her classroom. The webinar and final presentation had more evidence and content not included in her written ePortfolio, for which she showed evidence of 13 knowledge practices and dispositions.

Figure 3 depicts how Andrea used a flowchart to communicate her understanding of relationships between research as inquiry and searching as strategic exploration frames and she shared this understanding with her cohort in the webinar and in-class presentation, as well as in the written ePortfolio. The flowchart shows the synthesis of her experiences in her inquiry into two frames by exploring the relationships between them, noting common knowledge practices (e.g., determine scope, analyze search results, organize information) and those that are unique to one frame, such as research as inquiry (e.g., draw conclusions) and searching as strategic exploration (e.g., use different types of searching language appropriately). To make this original content she needed to draw on her own research experiences and align them with the knowledge practices of the two frames.

Elias. Elias's written ePortfolio demonstrated the second most evidence for research as inquiry frame within his presentation modes by showing evidence of 14 of 17 knowledge practices and dispositions. In his written ePortfolio he introduced his scope of research on "best practices to develop academic literacy for ELLs in the secondary science classroom." His written ePortfolio had more evidence than Andrea's and Fran's written ePortfolios. However, his webinar showed evidence of eight of 17 knowledge practices and dispositions, which, unlike the other two participants, was less than in his written ePortfolio and in-class presentation, which showed evidence of 15 knowledge practices and dispositions. In his webinar, he demonstrated reflection-on-action, interrogating an event that has transpired (Killion & Todnem, 1991; Rodgers, 2002b), when he considered his previous experiences with research where he would "find one article and read about it." He compared this with the rigorous experiences in his annotated bibliography where "you have to keep doing it and you can't give up." This research process transformation reflection was first presented in the webinar. It was not communicated in the written ePortfolio. In his final

presentation he added new information about using other databases and sources, which demonstrated his ability to gather information from multiple sources (research as inquiry knowledge practice).

Fran. Fran demonstrated the most research as inquiry frame knowledge practices and dispositions evidence in her webinar and presentation, with both having evidence of 16 of 17 knowledge practices and dispositions. Evidence in her webinar and presentation was greater than the evidence in her written ePortfolio, which showed evidence of 13 knowledge practices and dispositions. Fran also addressed two frames in her work, which are reflected in her title: *The Information Literacy Process: Research as Inquiry Leading to Information Has Value*. Fran used the ACRL frames in her presentations to support her reflection-on-action and reflection-for-action as she communicated understanding of the value of using research in the context of her work in the classroom. Fran integrated her understanding of these frames in her webinar as she talked about the inquiry process as she homed in on a research topic. In the webinar and presentation, she talked about numerous questions she had asked about her topic throughout the inquiry process. She shared her reflection on the research as inquiry frame and she demonstrated how, through the research process of inquiry, she refined her topic: "investigating how to develop and enhance students' science literacy skills throughout the American middle school experience," thus using reflection to share the process of determining an appropriate scope of her work, a research as inquiry knowledge practice.

Fran shared the following reflection in her final in-class presentation,

I used to . . . think if I'm going to do a research project I would type in a few things, find a few articles, and boom, I got a paper. However, through the process of developing my annotated bibliography and picking a topic I was truly interested because I knew it would help me in my career, [which] changed my perspective about scholarly research.

Fran, like her classmates, engaged in integrative learning by recognizing and connecting her past research practices and reflecting on ways that she has improved her information literacy practice (Reynolds & Patton, 2014).

Evidence of Research as Inquiry Knowledge Practices and Dispositions Found Across All Modes

A look at individual knowledge practices and dispositions across all modes (i.e., ePortfolio, webinar presentation, and in-class presentation) can provide information about how to improve information literacy

instruction. Figure 4 shows the summary percentage of evidence across presentation modes of the research as inquiry knowledge practices. In all knowledge practices, the amount of evidence demonstrated (complete or partial) was 66.66% to 100.00%. “Organize information in meaningful ways” and “draw reasonable conclusions based on the analysis and interpretation of information” had 33.33% occurrences of no evidence. Researchers could offer further discussion on these topics in the next cohort.

Figure 5 shows the summary percentage of evidence across modes of the research as inquiry dispositions. Students demonstrated the strength of their research as inquiry dispositions as five of the nine dispositions were evidenced in all modes by all three students. On the other hand, one disposition—“seek appropriate help when needed”—had 66.66% occurrences of no evidence across the various modes of presentation, which will be taken into account for the next cohort.

Limitations

At this stage of ACRL Framework exploration, a few researchers are beginning to develop rubrics for specific knowledge practices and frames, based on their information literacy instruction focus (Gammons & Inge, 2017; Willson & Angell, 2017). In our project, the coding

was based on the evidence discovered in the review of the transcripts. Although we considered the coding and results informative, especially for future instruction, a rubric could help standardize response coding to ensure consistency. A further limitation is the small sample size ($n = 3$) of our case study research. Future studies with a larger sample size should be conducted to help validate the results of this study.

Discussion

Participants emphasize content in their reflections in different but connected communication modes across the ePortfolio social pedagogy ecosystem (written ePortfolio, webinar presentation, in-class presentation; Table 2). In some cases, detailed information found in the written ePortfolio introduction illuminated understanding of the ACRL Framework in a deeper way than the webinar and thus, the greater amount of ACRL Framework evidence in the written ePortfolio reflects this. In two cases (Andrea, with 15 out of 17 research as inquiry knowledge practices and dispositions, and Fran, with 16 out of 17 research as inquiry knowledge practices and dispositions), webinar and in-class presentation ACRL Framework evidence levels were consistent and greater than their written ePortfolios. On the other hand, in one case (Elias, with eight of 17 research as inquiry knowledge practices and

Figure 4
Summary Percentage of Evidence of Research as Inquiry Knowledge Practices

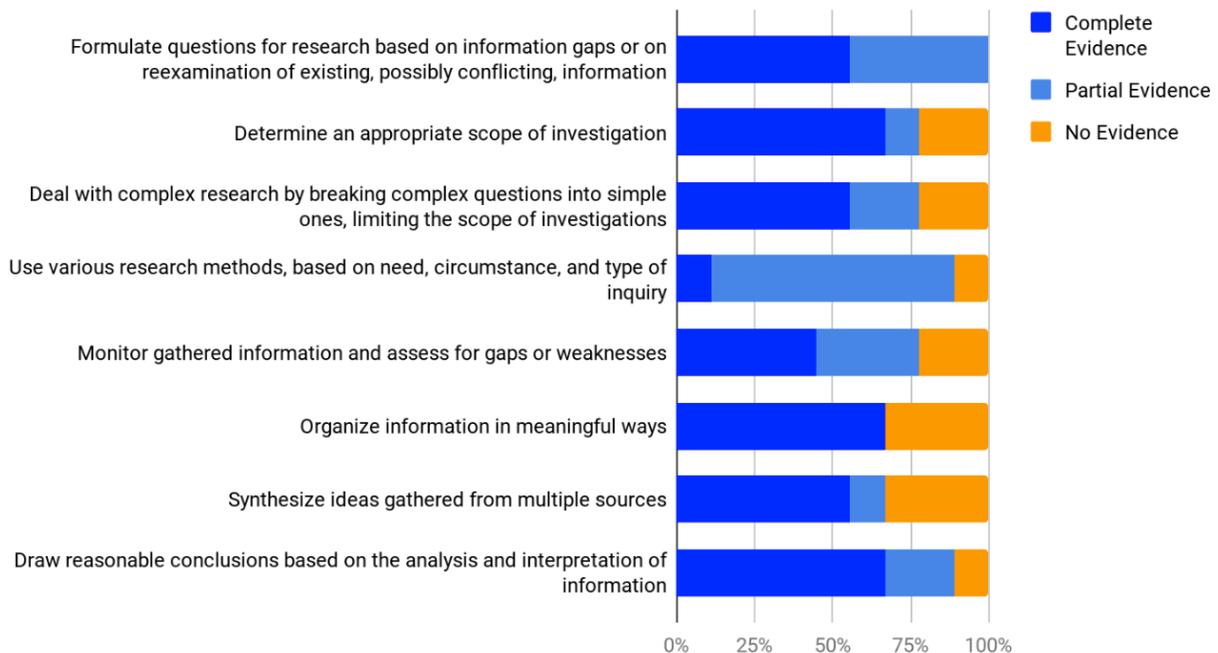
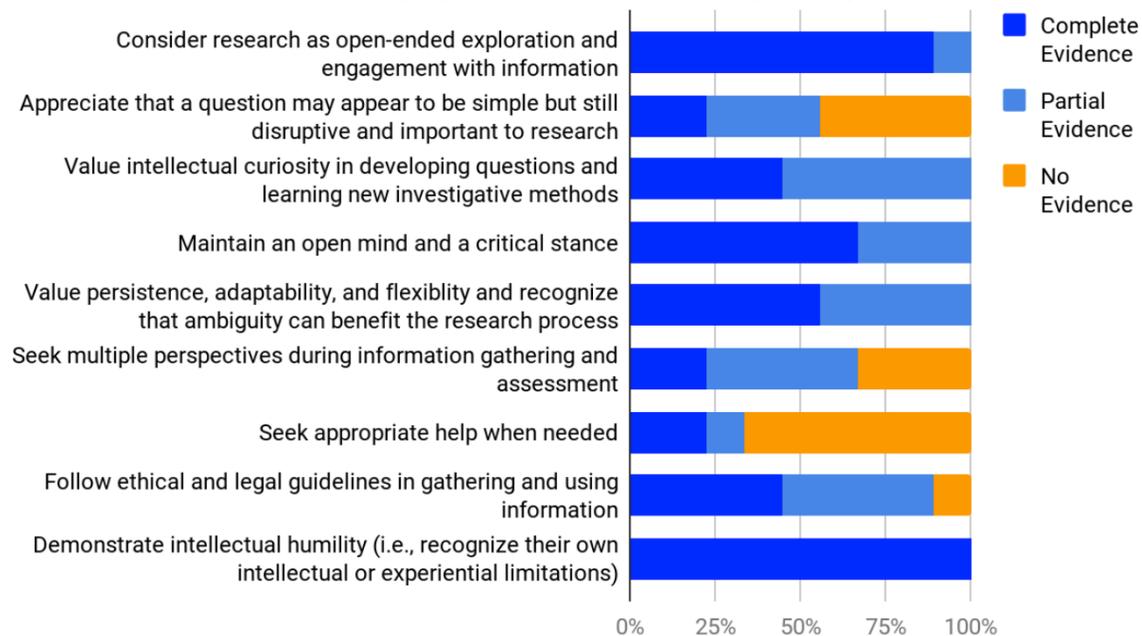


Figure 5
Summary Percentage of Evidence of Research as Inquiry Dispositions



dispositions in his webinar, and then 15 of 17 knowledge practices and dispositions in his in-class presentation) webinar and in-class presentation evidence varies quite a bit. It also could be a function of the various presentation modes (New London Group, 1996). This is a similar result to what Kajder and Parkes (2012) found in their study in which participants' blogged reflections tended to document their learning about curriculum and technical content while their vlogs tended to document their learning about pedagogical strategies and impact on learning.

When participants engage across modes, what is often found is that some participants will demonstrate greater competency in one area than others. It is possible that their written skills might be stronger than their presentation skills. On the other hand, improved ACRL Framework evidence from webinar to in-class presentation could occur because of the social pedagogy ecosystem. By participating in a structured series of ePortfolio presentations, either as a presenter or as an active member of the audience, Elias had an opportunity to observe presentations that showed greater evidence of the ACRL Framework and to ask colleagues questions about their research experiences. This may have led to reflection in the process of communication, where he may have refined his ideas about how to present in a community, and that may have had implications for how he went about creating and communicating a reflection in his final presentation, where he showed the greatest evidence of his three presentation modes.

According to the outcomes assessment sector of the Catalyst Framework, incorporating reflection in the context of social pedagogy helps to improve future instruction and course and assessment designs (Eynon & Gambino, 2018). In the study presented in this article, the ePortfolio social pedagogy ecosystem helped to transform outcomes assessment associated with the ACRL Framework into collective learning opportunities that highlight the framework's value for student learning in the area of information literacy. Accordingly, a key implication of this study is the opportunity for researchers involved to deepen their understanding of assessing the ways science teachers use the new ACRL Framework to guide their learning about information literacy.

We are considering introducing the ACRL Framework at the beginning of the capstone project instead of mid-cycle in January, after the completion of the annotated bibliography assignment. Although two participants expressed comfort with the framework and felt that it supported their reflections on their research experiences, one participant did not feel that he had enough time to "digest" the concepts. Elias expressed, "[I]t's very hard to digest. I know that we had a very good activity in [January]. . . . How does this apply? Maybe another session, because it would help to have a little more." By introducing the framework earlier in the year, we could provide opportunities to explore and reflect on it throughout the research process and we could give participants time to digest it and more opportunities to connect their work to it.

Conclusion

The second proposition of the Catalyst Framework asserts that by making student learning visible, ePortfolio initiatives support reflection, social pedagogy, and deepen learning (Eynon et al., 2014). Consistent with this proposition, all three students engaged with the ACRL Framework by explicitly identifying frames through which they could explore their information literacy competency growth through the context of the ePortfolio social pedagogy ecosystem. Working within the context of the ePortfolio social pedagogy ecosystem appears to provide an effective way for students to integrate deeper learning and to document their developing competencies as part of reflective practice guided by designed elements found in the social core. Using the ACRL knowledge practices and dispositions in the three modes of the ecosystem, all three students expressed their competencies in information literacy by demonstrating integration, reflection and inquiry. This concurs with Jacobson and Gibson's (2015) suggestion that ePortfolios would be an effective assessment method of a student's growth in information literacy, or in the case of the student participants in this cohort, a self-assessment tool. Students were able to directly study the ACRL Framework, just as they study other frameworks, as part of their ePortfolio social pedagogy ecosystem. The significance of using the ACRL Framework as a reflective lens for information literacy can help secondary science teachers be more intentional in their reflective practice and pedagogy as teachers.

Finally, the use of written ePortfolios as the only form (i.e., mode) to assess learning has the potential to keep aspects of students' learning invisible. As indicated at the beginning of the article, the significance of the opening quote is not only its content, but what mode and when it was produced in the context of the ePortfolio social pedagogy ecosystem. We assert that using the ePortfolio for learning across connected learning environments will provide new opportunities for ePortfolio practitioners and authors to engage in deeper learning activities and more valuable, informative, and social forms of assessment. In this way, ePortfolio social pedagogy has the potential to drive multiple modes of reflective practice, and also multiple approaches to folio thinking. As such, done well, approaches to ePortfolio social pedagogy assessment must take into account multiple modes of reflective practice and folio thinking.

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The authors would like to acknowledge Eden Antalán for the use Figure 3, Synthesis of Research as Inquiry and Searching as Strategic Exploration Chart.

Appendix

Sample Coding Chart for the Frame Research as Inquiry

Knowledge Practice: Monitor gathered information and assess for gaps or weaknesses

Evidence	Participant Text/Speech	Rationale
Complete	“Most of the articles were focused on elementary students” (Andrea, webinar)	Reviews articles and determines that there is a gap as most of the research focuses on children in elementary schools.
Partial	“And in my initial searches, I just, I couldn’t find assessment. I couldn’t find supporting articles for ELLs in the classroom. And I asked myself, ‘What am I doing? Am I asking the right question?’” (Elias, webinar)	Does mention monitoring gathered information, but from the perspective of the discovery and search process rather than gaps in the literature.
None	N/A (Andrea, written ePortfolio)	No mention of gaps or weaknesses in gathered information.