Print and electronic portfolios historically have featured *reflection* as their centerpieces. By *reflection*, educators have typically meant both the processes in which students have engaged and one or more reflective texts. In print portfolios, these texts are often a reflective essay or a reflective letter, both of which introduce and interpret the portfolio contents to one or more readers, sometimes a teacher but also the student. As portfolios have gone electronic, reflective texts have taken myriad forms—from concept maps to written texts to streaming video. In this shift from print to electronic, the claims for reflection have widened and increased as well. Three of these claims are that (1) through reflection, students make knowledge by articulating connections among portfolio exhibits, learning, and self; (2) reflective activities introduce students to new kinds of self-assessment, often an outcomes-based self-assessment, that they carry into life outside of and beyond educational settings; and (3) through engaging in reflective activities, students develop the stance and practices of a reflective practitioner who can synthesize multiple sources of evidence and make contingent and ethical sense of them.

Collectively, institutional members of the Inter/National Coalition for Electronic Portfolio Research, like many portfolio advocates, have found considerable promise in reflection. As a research entity, however, the Coalition wanted to know if the claims for reflection could be substantiated. We had many related questions: What counts as reflection, and what evidence of learning do we see in reflection? Does the medium matter, and, if so, how? Are students who practice reflection more engaged than other students? Do students who practice reflection stay in school longer? Do these engaged students graduate at a higher rate than non-portfolio practitioners? To inquire into the efficacy of reflection, then, we began a multiyear study of reflection. Our processes were, like portfolio processes themselves, *reiterative*: that is, we began with one question, considered a related question, and returned to the first, seeing the first question anew through a new context. More specifically, Coalition participants engaged in five iterations. We

1. began with reflection itself, including definitions of and research about reflection;
2. analyzed a reflective artifact;
3. reviewed a reflective artifact in the immediate context of the entire eportfolio;
4. considered reflection and electronic portfolios in larger institutional contexts; and
5. created a “catalog entry” for a reflective artifact.

In taking up these questions, we engaged in several kinds of learning. We understood reflection anew, as we saw reflection-as-text differently—through multiple contexts. We traced the development of students as they reflected. We were able to link students’ reflective practices with their school performance, thereby documenting the claim that reflection enhances learning. Most significantly, through reflective activities, we saw students inventing themselves as they co-invented our universities.

FIRST ITERATION

Our initial focus on reflection enabled us to define it, especially in the context of an electronic portfolio. In a first exercise, we took up seven questions, which together functioned as a heuristic for understanding the place of reflection in electronic portfolios.

1. Our first question inquired into the materials of reflection and the evidence of reflection. What are the materials of reflection, and what counts as evidence of reflection? Given the context of the Coalition’s diverse set of institutions, what are the ways that reflection is defined, solicited, and valued at different institutions? Is reflection a distinctive feature of electronic portfolios? What role do linking, coherence, and accessibility play in reflection? Is there sufficient commonality among definitions that we can talk about reflection in some useful way?

2. Our second question focused on guiding principles and practices. What are those principles and practices at individual schools? How do electronic portfolios appear to inside stakeholders and to outside stakeholders?

3. Our most challenging question was the third: Do electronic portfolios enhance student learning, and, if so, in what ways? Key to this question, of course, was the idea of learning: how would we define it? One approach involved a taxonomy like Bloom’s; a second involved national outcome statements like the Writing Program Administrator’s Outcomes for First-Year Writing; a third approach was to use locally developed statements of outcomes or competencies.

4. Because electronic portfolios are by definition digital and can be networked, we asked, Which literacies are fostered by eportfolio use?

5. Because electronic portfolios were being sponsored by different units on campuses, from first-year composition programs to career centers, we asked the following questions: What are the uses of eportfolios? Can these uses or purposes be categorized?

6. Student engagement, as a proxy for learning or as evidence of learning, could be connected to reflection. How might we correlate these two dimensions?

7. Because in electronic portfolios success is not defined in conventional ways—either grades on one end of the spectrum or nationally normed tests on the other end—what does count as success in eportfolios? What are the criteria for success for specific disciplines or outcomes? What counts as evidence of student learning? Is reflection part of that evidence, and by reflection, do we mean metacognition and/or something more?

SECOND ITERATION

Our second iteration focused on a detailed description of a single artifact as a mechanism for defining reflection more specifically, and the artifacts taken together for reading across institutional examples of reflection (Figure 1.1).

**Question 1:** Describe the context of your chosen artifact. (What assignment generated this artifact? Was it required? Graded? Given feedback? What was the desired outcome?)
Question 2: Provide a thick description of your chosen artifact from a student electronic portfolio.

Question 3: What is the impact of the artifact on student learning and the educational environment?

Question 4: Please use this space to pose questions to your Inter/National Coalition colleagues regarding student electronic portfolios.

**THIRD ITERATION**

Our third iteration was influenced by our sense that a detailed description was not enough; context was essential. To explain and analyze the reflective properties of the artifact, we needed a fuller picture of the *artifact-in-context*. We hoped that this iteration would enable us to look at artifacts relative to each other as we continued to ask: How does reflection supported by electronic portfolios influence learning? To focus on the artifact-in-context, we designed a set of six questions that formed an hourglass: beginning at the scope of a portfolio, narrowing to one artifact, and moving out again to all the identified artifacts in the portfolio.

1. Choose one student portfolio that you can share. List all the possible artifacts from that portfolio that you would categorize as examples of reflection. List only artifacts that are reflective.
2. Of these, which three are most useful for analysis about reflection. Why?
3. Which artifact will you choose to analyze first? Why?
4. What information would a reader (such as a member of the Inter/National Coalition) need in order to understand how this artifact shows reflection?
5. Is there evidence that the act of composing this reflection, in itself, contributed to the student’s learning?
6. How is this artifact congruent or not congruent with what you learn about the student’s ability?

**FOURTH ITERATION**

Our fourth iteration took a different turn, toward prior work on reflection and the intellectual development of college students. We considered research on transfer of knowledge, especially that presented in the National Research Council volume *How People Learn* (Bransford, Brown, & Cocking, 1999), paying special attention to the mental maps characterizing expertise. We considered Donald Schön’s (1983) scholarship on reflective practice, with its attention to reiterative practice and to the results of unsuccessful reflection, in over-learning and counter-learning. We reviewed Marcia Baxter Magolda’s (2001) work on epistemological reflection, with its three-part framework: validating the student as knower; situating learning in the student’s own experience; and defining learning as jointly constructed meaning. Finally, we considered how interviews themselves, particularly because of the dialogue characterizing them, construct a reflective space and how the reflective interview, even when not captured, constitutes a legitimate form of reflection.

**FIFTH ITERATION**

Our fifth iteration focused on developing a catalog of Coalition-reflective artifacts. For each artifact, we looked for the following:

- School and Contact Person
- Artifact
- Medium/Media/Genre
- Context
- Focus/Intent
- Practices Surrounding/Supporting Reflection
- Special Features

**CATEGORIES OF FINDINGS**

Our findings from these processes fall into three categories: a set of findings linked to the relationship between eportfolios, structure, and reflection; evidence of the efficacy of eportfolio-reflective practice
on students; and a set of claims—and new questions emanating from them—about the materials, contexts, and practices of a new kind of reflection that students are inventing in eportfolio environments.

Eportfolios, Structures, and Reflection
One of the more surprising findings across institutions was that of eportfolio structures and of the ways that established or student-created eportfolio structures invite, foster, and support reflection. The University of Washington’s composition program, for example, worked with IT personnel to create a structure specific to desired writing outcomes for students, outcomes linked to a national outcomes statement. In addition, this structure, represented in an eportfolio shell, includes curricular support—for example, reminders to students about their task and a rationale guiding student selection of texts (see Figure 1.2). The shell, therefore, is not a shell but a resource, in this case about the genre of the eportfolio. The shell provides guidance with prompts such as, “Does one of your papers demonstrate especially compelling support for a claim? Talk about how you found and developed this evidence to make your argument.” Students then can work in the context of both structure and guiding questions.

A structure that works toward different aims is designed into the general education electronic portfolio at Indiana University Purdue University Indianapolis (IUPUI). Keyed to the general education competencies—the PULs, or principles of undergraduate learning—the IUPUI framework offers students a number of possibilities (see Figure 1.3). Perhaps most obvious is the developmental structure; students can include exhibits at one of three achievement levels: introductory, intermediate, and advanced. In addition to exhibits from schoolwork, there is a column for exhibits completed outside of school. Through the inclusion of both academic and nonacademic learning samples in the matrix, IUPUI invites the student to create a whole composition of learning in and through

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**Figure 1.1**

![Diagram of Identifying and Cataloging Reflective Artifacts](image)
the portfolio. In addition, the electronic portfolio is itself an interactive environment where students can receive response to their exhibits. As important for consideration of reflection, the designers of the electronic portfolio see in it both structure and invitation for advanced reflective thinking:

Our findings included the predictable discovery of more evidence of advanced reflective thinking in our seniors than in our first-year students, which also provided a level of confirmation for the construct of our developmental framework for reflection. Much more noteworthy, however, was our discovery of a phenomenon that we call “matrix thinking,” the kind of reflective thinking that results when students combine the elements of a matrix and use the resulting conceptual construct as a lens through which to revisit work initially created in a different context for a different reason.

In other words, and as Hamilton and Kahn explain in Chapter 10, the matrix itself shows students how to see doubly. This ability to see in multiple contexts is one characteristic of reflection.

Drawing from a review of student work and from research on learning, the Alverno model of reflective development is a structure used as a context for student development by several other campuses—among them IUPUI and Portland State University in the United States, and Sheffield Hallam University in the United Kingdom—as a context for student development. In this single structure, three dimensions associated with reflection—self-assessment, understanding of how knowledge is created, and identity as a lifelong learner—are crafted into a single developmental schema. Such a schema is valuable for at least three reasons. First, each dimension is developmentally articulated, and each level is fully operationalized.
Thus, the advanced learner understands not only how knowledge is constructed but also how to construct it himself or herself. Specifically, the advanced learner incorporates feedback and past performance in constructing further performance and learning plans; uses his or her growing command of knowledge structure (e.g., expertise, discipline, theory, abilities) as a foundation for further learning; and understands his or her own performance as a learner and transfers learning strategies to multiple contexts (see Chapter 2).

Second, because the dimensions are all included but crafted onto a schema rather than woven together, a student’s differentiated development can be acknowledged, with progress rewarded and support provided as appropriate. Third, because of its comprehensiveness, the easily adoptable and adaptable schema offers potential for a context for reflection operating across multiple institutions, thus supporting students and providing a foundation for additional interinstitutional research.

The last set of structures, created by students themselves, takes the form of concept maps where students plot their understandings as a function of visual and verbal relationships. As explained by an accounting student at the University of Waterloo, “The biggest challenge I faced when creating my concept map was trying to identify relationships. It was very easy to name accounting concepts, but developing relationships between the concepts was a challenge.” A key shift is that students create the concept maps that used to be given to them in textbooks and syllabi and by faculty.

Through creating, students construct their own map of learning, one congruent with the digital medium of an electronic portfolio (see Figure 1.4). For example, at Clemson University, psychology students created e-portfolios that produced another
kind of map directly related to learning. In this project, the links that students created to connect different exhibits in initial eportfolios were compared with those they created for later eportfolios. In this analysis, a developmental pattern emerged; the sunburst heliocentric structures of early eportfolios expanded and elaborated into the more complex structures of the final eportfolio (Figure 1.5). In this eportfolio model, students literally link their way to connectedness and meaning. An important motivator in this linking is the audience, which for these students, as Clemson faculty member

Figure 1.5

Clemson Eport Structures
Ben Stephens notes in Chapter 12, was plural and yet differentiated:

These structures may reflect the interns’ concept mapping of the content of the portfolio designed to appeal to various social audiences for the eportfolio. Some nodes in the hierarchy seem useful for the mentor and graduate schools (e.g., the research project) while others are designed for the instructor (e.g., class activities node). Likewise, many interns constructed nodes that seem directed towards peers; these often contained links to their home institution and/or to photos of summer program peers and social activities. In addition, these concept maps may serve a dual purpose: they may aid both communicator and audience (Wang & Dwyer, 2006). In sum, the development of these maps in our intern eportfolios seems to suggest an awareness of how artifacts connect to self as well as to the needs of valued social audiences.

EFFICACY OF EPORTFOLIO-REFLECTIVE PRACTICE ON STUDENTS

Findings about the efficacy of eportfolio reflection were equally, or perhaps more, important. Four different electronic portfolio projects, at four very different institutions, provided co-relational and institutional evidence of student learning. Put differently, data support the claim that eportfolio reflection, as defined here, is directly related to student success.

Kapi‘olani Community College (KCC) introduced into a Hawaiian values class an eportfolio that helps students succeed in the explicit context of native cultural values. KCC has used several measures to assess this eportfolio-based approach to learning, including the nationally normed Community College Survey of Student Engagement (CCSSE) and a set of local questions. As the leaders of the KCC effort point out in Chapter 11, six local questions received responses worthy of note:

The six questions that were significantly more positive than national and local benchmarks addressed the use of values, critical thinking, writing, teamwork, and a level of engagement. In addition, students’ spontaneous, open-ended comments in the survey support our hypothesis that working on the ePortfolio with the values approach is leading students to engage more deeply in their learning, to mention the values in their reflections, and to relate the values to their understanding of their learning.

One student, in commenting on the value of the eportfolio, especially in the context of native values, noted the role of reflection in learning, the role of time as a factor in learning and the new space for learning provided by the eportfolio: “I like reflecting on what I’ve learned or hope to in the future. Makes it so much easier to focus on what it is I’m trying to learn when I know there is a place for me to reflect upon my work at a later time.”

At LaGuardia Community College, the eportfolio seeks to serve many purposes—increasing academic achievement by strengthening learning and assessment; aiding career development by assisting students to become prepared for employment; and encouraging student expression by providing a site where personal representations are welcome. This eportfolio model also invites students to include two cultures, their home culture and the academic culture, a particularly appropriate structure, given the largely immigrant population of the school. In reviewing the efficacy of their effort, the leaders at LaGuardia drew from a varied set of data, including CCSSE data and local data on course completion rates and retention rates. As at KCC, the student engagement data, here specifically CCSSE data, indicate higher than expected positive responses for eportfolio students:

On virtually every question, students in these ePortfolio-intensive courses tended to score higher in engagement than the collegewide reported by the LaGuardia Office of Institutional Research. For example, on one critical thinking-related question—Question 5a from the 2005–6 survey: “How much has your coursework emphasized synthesizing and organizing ideas, information, and/or experiences in new ways?”—the collegewide mean is 2.85 (a substantial .18 points above the national
mean of 2.67). The mean for students in ePortfolio courses was 3.12, an additional .27 points higher than the already positive college mean. The pattern was similar for questions about writing, effort, technology, and classroom collaboration.

At two very different schools literally halfway around the world from each other, and in two very different models—one a single-class model; the other an institutional, multiyear model—students report higher levels of engagement on questions inquiring into practices critical for academic development and success: writing, critical thinking, and teamwork. And interestingly, at LaGuardia, that engagement is translating into higher course completion and retention rates:

Retention data is similarly positive. For example, analysis of the transcripts of a sample of nearly 2,000 students in ePortfolio-intensive courses in 2005–6 showed an average one-semester return rate that is 5.6 percentage points higher than the college average.

A student’s explanation of the value of this work, of course, is not located in the world of data. As she puts it, it is in the world of seeing anew:

Not only did I gain technical skills, but I learned how to express myself as a student. The different sections of my ePortfolio made me realize important things about how I see myself starting at LaGuardia, how I see myself now and in my future. My experience with ePortfolio at LaGuardia has made me see more of who I want to be.

At another university, the University of Nebraska–Omaha (UNO), eportfolio researchers took another focus. UNO, a major urban institution, has as one of its goals the use of electronic portfolios for disciplinary development and achievement, in this case for teacher education candidates. The eportfolio is a database-driven repository for exhibits from coursework activities throughout a teacher candidate’s undergraduate program, which is itself keyed to a set of standards. UNO’s research focused on the role that the eportfolio and its accompanying reflection play in helping students learn required content. The results were bimodal: students who used it infrequently found little value, whereas those students whose teachers integrated it into the program and who worked on it consistently found it a valuable means of learning:

The respondents that reported consistent use of ePortfolios indicated more often that the ePortfolio had a positive impact on their learning of content. The open-ended comments also confirmed this idea, with several respondents who were generally positive about ePortfolio mentioning the consistent use and generally those who were negative toward ePortfolios indicating there was not a consistent use. Also, elementary education majors were much more positive about ePortfolio than secondary education majors, and we know that the elementary program is much more consistent in the use of ePortfolios than the secondary program.

As is the case in earlier examples, student comments provide a window into the findings. In this case, the student makes a point echoing that of the LaGuardia student about the ways that portfolio and reflection provide a means of seeing oneself in action: “I feel it was helpful in making me more genuinely reflective as I was able to actually see myself in practice.” The ability to see oneself is the ability to see another way of being.

The Clemson model is also oriented toward disciplinary development, in this case in psychology and specifically through a summer internship program. One measure of success for the summer program was the ability of the interns to conceptualize their learning in an appropriate hierarchy. To assess this feature, the leaders at Clemson focused on the “interrelationship among artifacts” within the electronic portfolio:

To determine the interrelationship among artifacts, we calculated a “Hierarchy” score, computed as the weighted average of all website pages where the entry page was equal to 1.0, pages linked to the entry page were equal to 2.0, and so on. The average hierarchy score for the group was...
2.74, indicating that many eportfolios were richly structured within organizing themes.

Moreover, as previously indicated, the Clemson researchers believe that audience may be a compelling rationale for this arrangement. Learning is thus conceptualized with both intellectual and social dimensions. In this model, students formally reflect at mid-experience and at the end of the experience, and that reiteration reveals how students value time and a planned reiterative process. At midterm, this student looks backward as she casts a glance into the future:

For the remaining six weeks of the program, I imagine we'll encounter these questions [about pure and applied research] again. Next time, I'll also provide a larger reflection on my particular project, discoveries I have made, how it contributes to this knowledge base, and how, somewhere along the "continuum," it can be directly applied.

In the reflective conclusion, she notes not only what has been learned but also what might be learned as a function of the initial experience. Interestingly, the identification of weakness—a point made in the Alverno developmental schema—is understood not as a problem but rather as a prerequisite for learning that the student herself wants to acquire:

Even though I have faced many of the challenges of psychological research this summer and now understand where my weaknesses lie, I am all the more interested in conducting further and better research my upcoming senior year and throughout graduate school. After recognizing what limitations, complications, and problems my study had this summer, I feel a strong need to improve upon my research and the research of others.

Put more observationally, what is it that we think we have learned? We understand the following:

- Reflection always happens in context. Contexts, like purposes, vary. Where contexts connect with students, where they include cultural and personal values, where they encourage a process view of learning, they are more likely to engage students.
- Portfolio structures are not innocent. Through arrangement, they signal what is valuable.
- Structures that we provide shape reflection. Where the structure provides scaffolding, and where it stimulates connections, it invites the meaning-making characteristic of deep learning.
- Asking students to create their own structures may be a critical move, allowing students to articulate both curricular understandings and personal connections, in the process demonstrating the mapping development associated with expertise.
- Reflection comes in many forms and in reiterative processes: building in reiteration explicitly builds in time, which in turn fosters the identity of a learner.
- "Materials" of reflection warrant further study. Those materials include the use of visuals like images and maps, developmental frameworks, and even the thinking sheets created at George Mason University; these sheets, which are a low-tech way of recording reflective processes that go into eportfolio making, constitute one form of raw material for reflection (see Figure 1.6 and Chapter 21).
- Responses of students to reflection, as defined here, are remarkably similar both in terms of student engagement data and in terms of student articulation of their experience. Although there is evidence of many kinds, there are patterns in the evidence.
- The audience for reflection is not a trivial matter: it motivates students, it often includes peers and other personal audience members, and it may motivate the acquisition of content.
- Reflection as a knowledge-making activity—like the making of knowledge in science and the design of art and performance—relies on reviewing, recontextualizing, and reiterating, processes functioning as means of discovery and development.
- The role of the personal is important in securing learning, perhaps especially in reflection.
George Mason Thinking Sheets

Name: ______________________  Length of time for this session ______________________
( spaced out for fill in space)
Feel Free to use the back of this sheet as necessary
1.) What do you intend to accomplish this session?
2) As you work on the portfolio this session, please note what artifacts (text, links, documents, pictures, audio/video, etc.), or design elements you create or change and briefly explain your reasons for doing so.
3) What issues came up this session?
4) How did you seek out help or work with others during this session?
5) What do you think you achieved/learned this session?

• The power of collective expertise enables insight into student learning. The Coalition’s set of reiterative activities has contributed to the success of the Coalition in addressing questions about student learning. We shared a common question and allowed it to play itself out across different sites. We established a set of questions and used the rhythm of the questioning as a way to pace learning and as a means of learning. We learned, especially in the two artifact exercises, how important it is to document practice and how useful it is to have an external audience who needs that documentation and who is interested in reviewing it and assisting in making sense of it. We learned about the role of inquiry and the need to engage in it. As we moved outward, we found that larger sets of data—such as course completion rates and CCSSE data—allowed us to contextualize our own findings and to discern larger patterns.

QUESTIONS: MATERIALS, PRACTICES, AND CONTEXTS

We do have further questions. Several institutions are now using a version of the Alverno reflective framework, and we are eager to see how it supports reflection and how it might be locally adapted. Other institutions are interested in using a coding schema to inquire into the quality of reflection. Still others are inviting employers to review reflection. And research teams are eager to know more about reflection itself: What is the best medium for it? Does that definition vary by student population, by level of development, and/or by discipline? How else might we encourage quality in reflection, and how else might we scaffold it? What is the role of reflection in disciplinary contexts, in professional contexts, and beyond school gates?

REINVENTING THE UNIVERSITY

In 1985, rhetoric and composition scholar David Bartholomae (1985) coined the expression re-inventing the university to explain the basic task of the postsecondary student aspiring to success: “He must learn to speak our language.” In connecting our language and students’ invention of the university, Bartholomae highlighted a need for students to accommodate to and assimilate into us, into our institutions. Such accommodation does not always succeed, however, as we see in stagnant stu-
dent retention and graduation rates and in disengaged students who are dropouts in waiting.

There are other ways to think about the university, of course. One way is through the lens of three curricula. In addition to the “delivered” curriculum of our catalog copy and syllabus, there are two others—the experienced curriculum, which is what students make out of our delivered curriculum; and the lived curriculum, which occurs prior to and alongside and after our institutional curricula conclude (Yancey, 2004). In the best of all instances, electronic portfolios can provide a common site for these three curricula, and reflection can provide a specific opportunity to see each, to talk across them, to connect them, to trace the contradictions among them, and to create a contingent sense of them. In this sense, reflection is itself a site of invention, a place to make new knowledge, to shape new selves, and, in so doing, to reinvent the university.

That is the promise of reflection, a promise we continue to explore and support.

REFERENCES


