

Finding Common Ground: Identifying and Eliciting Metacognition in ePortfolios Across Contexts

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Research has suggested ePortfolios reveal and support students' metacognition, that is, their awareness, tracking, and evaluation of their learning over time. However, due to the wide variety of purposes and audiences for ePortfolios, it has been unclear whether there might be common criteria for identifying and assessing metacognition in ePortfolios across varied contexts. The purpose of this study was to identify evidence of metacognition across ePortfolios of three distinct populations of students: traditional-age undergraduates, graduate Education students, and adults returning to school to complete a bachelor's degree. We set out to explore if and how ePortfolios could support these different learners' growth as reflective, intentional learners and professionals. Through a qualitative coding process, we identified four key metacognition markers across students' ePortfolios in these three populations. We conclude students can be guided to engage in metacognition in concrete ways through thoughtful assignment design and assessment process, no matter their context.

ePortfolios are designed to promote the integration of learning (Peet et al., 2011) so that students are not only learning a specific subject but also developing an awareness of their learning and thinking processes as well as an ability to monitor, assess, control, and change those processes, a skill generally referred to as "metacognition" (Flavell, 1987; Schraw & Dennison, 1994). Since multiple artifacts are posted and reflected upon within an ePortfolio, students can begin to recognize and assess their learning across time, their learning strategies, and their strengths and weaknesses as learners (Chen, 2009). Universities seek to foster the development of such metacognitive skills institution-wide and to assess their attainment in students across units. These goals support the efforts of higher education to prepare individuals who are responsive to change, engaged with the world, life-long learners, creative thinkers, and flexible problem-solvers (AAC&U & National Leadership Council, 2007). ePortfolios have been adopted across institutions of higher education for these purposes. When ePortfolios are focused on process rather than product alone (i.e., how students have made sense of ideas over time), they can become a tool for identifying and supporting metacognition, allowing students to look into their prior, current, and post-educational experiences and "to talk across them, to connect them, to trace the contradictions among them, and to create a contingent sense of them" (Yancey, 2009, p. 16). However, one challenge of guiding students in developing metacognition through ePortfolios is creating assessment tools and practices that can accommodate a diversity of manifestations of metacognition in learning

products from different student populations. With such tools and practices, institutions can establish common learning goals related to students' metacognition and evaluate their achievement across programs, disciplines, and fields.

This study explores the possibility of gaining a more holistic view of student learning, especially metacognition, through ePortfolio analysis and shows that ePortfolios can be discussed and assessed across programs and units of the university. Portfolio reading is thought to be highly discipline-specific, and the common contention is that only experts in the content area can evaluate the learning in portfolios (Shavelson & Klein, 2009). With this in mind, we searched for a way to identify evidence of metacognitive ability within the work of three very different student populations enrolled in courses at our institution with varying intentions, content, and disciplines:

- Graduate student teachers in the College of Education (COE): Participating COE students are graduate preservice teachers preparing for a career in elementary education. These students are focused on their development as effective educators as well as their employability in the field. Students complete a professional educator ePortfolio intended as a supplement to their resume during a 10-week seminar concurrent with their student teaching experience.
- First-year students taking courses in the Writing, Rhetoric, and Discourse (WRD) Department: Almost all first-year undergraduates (approximately 2,500 students) at our institution are required to take a two-course sequence in

First-Year Writing (FYW). The program aims to prepare students for reading and writing in college and beyond. In FYW courses, students learn about rhetorical concepts and strategies. In the second course of the sequence, students also learn how to research with a critical lens and how to recognize and write arguments. Both courses require a reflective final portfolio that is central to program pedagogy. Instructors explain to students that portfolios allow them to develop writing over time, to consider process as well as product, and to become reflective practitioners.

- Returning undergraduate students in the School for New Learning (SNL): Undergraduates at the School for New Learning (SNL) are “post-traditional learners” (Soares, 2013, p. 5-7). They are 24 or older, usually attend school part-time, work full-time, and have multiple responsibilities. In returning to college, these students bring a wealth of professional and personal learning experiences, which they are encouraged to connect to academic learning experiences in order to promote a synthesis of learning and to increase their confidence. They begin developing an ePortfolio in their introductory Foundations course to integrate learning from past experiences and to develop metacognition relative to their learning processes.

Our research team consists of faculty from these three units within DePaul University, as well as our Associate Provost. The team analyzed ePortfolios for evidence of metacognition across their respective student populations: graduate student teachers, first-year traditional-aged undergraduates, and adults returning for their bachelor’s degree. In searching for common ground for identifying and assessing metacognition in ePortfolios, we found four patterns of metacognitive markers that exist across ePortfolios from different programs and student populations: references to learning over time, to processes of learning, to strengths and weaknesses, and to affect or values. These markers appear in an ePortfolio when the student focuses on his or her experience as a learner rather than solely on course content. Having identified these markers inductively, we now use them deliberately in teaching students to reflect upon their learning, in assignment design, and in assessing reflective components of portfolios.

Literature Review

This literature review covers two key aspects of our study: (1) metacognition and its role in student success and achievement, and (2) the role of the ePortfolio and related assignments to reveal and/or support students’ metacognition.

Metacognition is an individual’s awareness of and thoughts about his/her own thinking and learning processes; it is also an ability to monitor, track, evaluate, and change those thinking and learning processes (Flavell, 1987; Schraw & Dennison, 1994). An example of a learner engaging in metacognition is when she says to herself, “I tend to do X better when I do A and B first,” or “In order to be more successful at presenting my research than I was last time, I should get a review from a peer and practice the presentation aloud in front of a mirror a few times beforehand.” Research has shown that metacognitive ability like this leads to stronger learning transfer, deeper learning, academic improvement, and personal success (Akyol & Garrison, 2011; Bransford, Brown, & Cocking, 2000; Dede, 2010). In higher education, there is a positive correlation between metacognitive awareness and end-of-course grades, as well as GPA (Young & Fry, 2012). Additionally, research on the relationship of performance, self-efficacy, and metacognition has shown that undergraduate students with mastery goals (i.e., goals to master a particular subject), rather than simply performance goals (i.e., goals to simply perform well on a test), will have a higher GPA; the students with these mastery goals also tend to have higher metacognitive awareness (Coutinho, 2007).

Furthermore, metacognition changes and can be learned over time (Kuhn & Dean, 2004; Lewis et al., 2014; Paris & Paris, 2001). In an effort to better support learners’ cognitive and metacognitive development, pedagogical tools and processes that facilitate development of, critical reflection upon, and representations of learning have evolved rapidly in the last two decades in terms of their scope and reach. One pedagogical practice that researchers claim facilitates metacognition and critical reflection is a student’s development of an educational portfolio or learning portfolio. Helen Barrett (2007) noted that

An educational portfolio contains work that a learner has collected, reflected upon, selected, and presented to show growth and change over time, work that represents an individual’s or an organization’s human capital. A critical component of an education portfolio is the learner’s reflection on the individual pieces of work (often called artifacts) as well as an overall reflection on the story that the portfolio tells about the learner. (p. 436)

Researchers have asserted that ePortfolio development in higher education is valuable for metacognitive development because it helps learners track and reflect on their learning over time (Barrett, 2007; Blackburn & Hakel, 2006). It allows students to analyze and synthesize their experiences across the

curriculum while connecting them with learning experiences outside of the classroom and sharing them with instructors, other students, and outside organizations (Cambridge, 2008). Studies have shown evidence of metacognition in ePortfolios by focusing on analysis of text-based reflective artifacts within the ePortfolio and post-ePortfolio-development self-reports (Dalal, Hakel, Sliter, & Kirkendall, 2012; Meyer, Abrami, Wade, Aslan, & Deault, 2010). The new media aspects of ePortfolios have been examined as well for evidence of metacognition suggesting that photos, videos, and hyperlinks can reveal learners' understanding of learning processes, their role as learners in broader contexts, and their participation in learning communities (Wozniak & Zagal, 2013).

Many assignments that prompt metacognition are not deliberately designed with metacognition in mind, nor do they make this goal explicit to the student, so they are not as effective as they might be. Recent research on ePortfolios clearly shows that many educators and educational researchers want students to reflect upon their learning and make connections about their learning over time, but there is not a clear set of criteria by which this metacognitive action is ultimately assessed. For example, Luther and Barnes (2015) stated that one purpose of the ePortfolio for their students is to "reflect upon developmental growth and skill application" (p. 27). It is clear here that the researchers aim to encourage students to demonstrate their metacognitive abilities in their ePortfolios; evidence of this is referred to as "reflective statements" in their assessment rubric (Luther & Barnes, 2015, p. 33). Later, they stated that educators should "teach and model the use of a feedback and reflection cycle" (Luther & Barnes, 2015, p. 35), but there is no further elaboration upon or definition of reflective statements. Less clear is whether students know from this rubric why reflective statements are important for their learning or how they might be written well according to a faculty member's expectations. Our review underscores the need to identify and collect best practices for teaching and modeling a reflection cycle in the context of ePortfolio development, as the authors suggested.

Overall, existing research shows that metacognition is key for 21st century learners to succeed in academic and professional contexts and reveals the need for metacognitive support in higher education. It also suggests that learning ePortfolios can be used not only as a means of finding evidence of students' metacognition but also as a means of supporting metacognitive development in higher education. Our goal was to determine what, exactly, metacognition looks like in learners' ePortfolios and whether we could find common ground across the various learners and learning situations in higher

education today. We believe that our findings can help educators design assignments that facilitate metacognitive development and provide a way for students to demonstrate evidence of it in their ePortfolios. Moreover, by providing a common vocabulary, our findings can help educators to structure assessment across units and programs.

Methods

Taking a qualitative research approach, our study involved an analysis of student ePortfolios using descriptive coding (Saldaña, 2012) with an intentional focus on discovering any evidence of metacognition in the ePortfolios from the three populations. We then conducted a post-hoc analysis of each unit's ePortfolio assignment design to discover any relationships or patterns between these and the coding results.

Research Question

Early in 2012, as part of our participation in Cohort VII of the International Coalition of ePortfolio Research, our team came together to design a study of students' metacognition across three units of the university. We formulated the following research question: How do students demonstrate metacognition in their ePortfolios? In other words, we sought to understand in what ways students demonstrate awareness of their learning process in their ePortfolios. In formulating this research question, we defined metacognition according to the education and learning literature: the knowledge of information or action that has been learned in the past and, through the learner's monitoring, is applied strategically or is considered for application in future scenarios (Flavell, 1987; Schraw & Dennison, 1994). We were not looking for demonstrations of learning (i.e., submitted assignments or products that meet different curricular standards or goals) but rather for evidence that students were aware of their learning.

Participants and Context

Our participants are from three programs at DePaul University that were each early adopters of ePortfolios, and that represent very different student populations: traditional-age undergraduates taking First-Year Writing, graduate students in their final seminar in the College of Education (Elementary Education program), and adults returning to school to complete a bachelor's degree in the School for New Learning (SNL). Our nine-person research team includes faculty and staff from these three programs and Academic Affairs: a pedagogy and technology specialist who teaches writing, the (tenured faculty) director and (staff)

associate director of First-Year Writing, a faculty member and an associate dean in SNL who also teaches, a tenured faculty member in Education, two instructors from the different programs, and an associate provost. The members of the research team served as the ePortfolio coders and analyzed the data.

Our sample came from courses that were taught before our research project began, so instructors designed and implemented assignments around their own and their departments' goals, rather than the goals of this study. In all three courses, the instructors directed learners to include artifacts and assignments they created in the course and reflections on their learning (influenced by research from Peet et al., 2011), but also welcomed other artifacts and elements and encouraged them to explore all the features of the platform. Students built their ePortfolios in Digication, which includes a flexible web page editor and offers features of a social learning network such as sharing, tagging, a directory of other individuals' portfolios from within the university, and privacy settings.

ePortfolio Collection and Analysis

Members of our research team contacted students from the three units (SNL, COE, WRD) who had completed ePortfolios as part of their regular coursework in a required course in the respective program and asked them to share their ePortfolios for analysis in this study. From the pool of 60 students who gave their permission, we randomly selected 10 student ePortfolios from each population for analysis. We chose coding as our method of portfolio analysis because it offers an opportunity to analyze static documentation to find concrete evidence of learning, cognitive skills, and metacognition (Akyol & Garrison, 2011; Newman, Webb, & Cochrane, 1995; Saldaña, 2012). Initially, we attempted to use a common rubric adapted from Alverno College's rubric, *Developmental Perspectives on Reflective Learning* (Rickards & Guilbault, 2009), to evaluate the SNL, WRD and COE ePortfolios. However, after piloting the use of the rubric on a small group of ePortfolios, the research team discovered that too many changes had to be introduced to the rubric to accommodate the traits of each group of ePortfolios. The rubric did not feel common; it was not useful to describe evidence of learning awareness in the different ePortfolios across units. Yet, as a team, we observed evidence of metacognitive processes, or reflection, in the ePortfolios crafted by all three student populations.

Therefore, we decided to develop a codebook with which we could code students' demonstration of awareness of their learning in the 30 ePortfolios selected for the study. Each researcher used descriptive coding (Saldaña, 2012) to identify text or new media in each page of the ePortfolios and describe, through an

inductive process, what we saw in the ePortfolios from these three units with regard to students' awareness of their learning. Since ePortfolios offer affordances with new media, we not only looked at text in the ePortfolios, but also analyzed images, embedded documents, forms, videos, audio clips, and links. For example, if a student included an image of a winding pathway on a page of her ePortfolio to support her discussion of the difficulties she encountered while completing a project, a researcher may have coded this image as a form of metacognitive awareness.

In the first round of coding, each researcher analyzed three ePortfolios from each program for a total of nine portfolios. The research team then met in person to share their descriptive codes with each other and identify patterns that would suggest common manifestations of students' awareness of learning in the ePortfolio sub-sample (Saldaña, 2012). After identifying common patterns and themes, we developed a codebook of nine codes: past/present/future; process; strengths/weaknesses; strategies; learning outcomes; broader issues; social; artifact integration; emotional response. We then attempted to re-code the nine portfolios with these nine codes, using one ePortfolio web page as our unit of analysis and looking for evidence of any of the codes on each page of an ePortfolio. Portfolios could have more than one code per page, and, if a code was present, the coder noted at least one example of text, image, video, etc. that demonstrated that code on that page. We subsequently reduced the codebook to four codes to narrow our focus and reduce overlap. We refer to these four codes as "markers" of metacognition:

1. Awareness of transfer of learning over time. This occurs when students connect or transfer a prior learning experience to a present or future one: "I used to think/do X, but then I experienced Y, and I now think/do Z." It may also include plans for the future: "Now that I understand P, I plan to apply that knowledge to Q in the future."
2. Awareness of processes and strategies for learning. These discussions address *how* the learning came about. They may describe what activities students engaged in that resulted in learning, what procedures they may have followed, and/or who helped them or inspired them in the learning.
3. Awareness of strengths and weaknesses in learning. In these discussions, students may identify the skills they bring to an experience and/or the weaknesses they want to address. They may also describe the skills gained as a result of their learning and point to areas that still need to be addressed.

4. Awareness of affect and values while learning. Here students include their emotional response to a learning experience (“I loved . . .” “I hated . . .”). They may also relate some aspect of their learning to their values (“This experience was important to me because . . .” or “This experience confirmed/refuted my belief that . . .”).

We also included a suffix code to append to any of the above four codes to note when students used digital new media (image, video, audio, hyperlink) to demonstrate their awareness of learning. We refer to this code as *Marker E*. While all these markers appeared in the ePortfolios of students in all three of our populations, they appeared in different combinations and proportions for each group, shaped by the assignment and context for creating the ePortfolio.

Before coding all the portfolios for the presence of the four markers, we met as a team to collectively code one portfolio from each program using the final codebook. After reaching agreement about the markers present in those three portfolios and establishing inter-rater reliability, each remaining portfolio was then coded by two raters: one who was from the program from which the portfolio was developed and one rater who was not. The partners met individually to resolve any disagreement about their codes and submitted their final codes per ePortfolio page to a shared spreadsheet. After an initial assessment of the results by individual team members, the team reconvened to collectively synthesize and discuss the findings. As a result of that discussion, each unit recognized and analyzed the role of their ePortfolio assignment design in students’ development of their ePortfolios.

Results

We found the four markers of metacognition in ePortfolios from all three units of the university. Table 1 shows the percentage of total number of markers for each population in order to account for differences in coding frequency, since the total number of markers in each set varies. A primary finding of our study was the realization of the commonality of student reflection across these three very different student populations. One overarching pattern here is that Marker 2 (awareness of processes and strategies) was the most frequently appearing marker of metacognition found in the ePortfolios overall. To provide the necessary context to explain these findings, results are discussed according to each unit.

The Adult Undergraduate: School for New Learning

SNL undergraduates are post-traditional learners (Soares, 2013) who have multiple responsibilities and roles. They are encouraged to connect their professional

and personal learning experiences to academic learning experiences in order to promote a synthesis of learning and to increase their confidence. Reflecting on these students’ ePortfolios, we conclude that the design of our assignment probably affected students’ development and/or demonstration of their metacognitive skills.

Foundations of Adult Learning is a required introductory course designed for reflection on prior learning and planning of future learning goals. Influenced by the work of Peet et al. (2011), we added the ePortfolio to this course to promote the integration of past experiences and the development of metacognition relative to students’ learning processes. We designed this course based upon research indicating that adult learners are most likely to persist when they see a direct connection between their goals and their learning, are most likely to learn when they can connect new to prior learning, and are more likely to graduate if they have the opportunity for prior learning assessment (PLA), which involves the documentation of knowledge and ability for credit (e.g., Brookfield, 2013; Knowles, Holton, & Swanson, 2012; Kolb, 2015). In their Foundations portfolios, students articulated their goals, reflected upon and connected their learning, identified opportunities for PLA, and planned their program of study. The primary goal of the Foundations portfolio assignment was to scaffold learner agency and efficacy. As a result, it deliberately prompted metacognition. Students were told in the assignment that the portfolio will help them “further develop the metacognitive skills that enhance lifelong learning.”

The analysis of our students’ 158 portfolio pages generated 311 instances of the metacognitive markers described earlier. Each SNL student’s portfolio had at least one instance of each of the four metacognitive markers, demonstrating our students’ varied awareness of their learning.

Of all markers tallied for SNL portfolios, the highest frequency was for awareness of processes and strategies for learning (Marker 2) at 32%. For example, one student articulated an awareness of how networking within her community will enhance her knowledge and effectiveness professionally and civically: “My networking in the autism community will give me a better understanding of the funding and in general how to communicate with key universities and corporations in order to show them who individuals with autism really are.” Another student reflected upon learning processes as a caretaker for her mother: “I have learned to listen better to my [chronically ill] mom when she’s not feeling well in an effort to learn what might be wrong. By doing so, I have found that she gives me more real information.”

Across all populations, SNL portfolios had the highest evidence of awareness of affect and values in

Table 1
Frequency of Metacognitive Markers Across Portfolios

Marker	WRD	COE	SNL	All
	<i>n</i> = 10 ePortfolios (195 total markers)	<i>n</i> = 10 ePortfolios (292 total markers)	<i>n</i> = 10 ePortfolios (311 total markers)	<i>n</i> = 30 ePortfolios (798 total markers)
1. Awareness of learning over time	22% 42 markers	23% 67 markers	20% 62 markers	21% 171 markers
2. Awareness of processes and strategies	31% 60 markers	23% 68 markers	32% 98 markers	28% 226 markers
3. Awareness of strengths and weaknesses	19% 38 markers	15% 43 markers	18% 56 markers	17% 137 markers
4. Awareness of affect and values	13% 25 markers	16% 46 markers	20% 61 markers	17% 132 rkers
E. Use of digital elements	15% 30 markers	23% 68 markers	11% 34 markers	17% 132 markers

learning (Marker 4) at 20%. Typically, students expressed emotion about finding more confidence in academic settings and skills, or in workplace accomplishments, as did these two students:

- Student 1: “I would like to feel comfortable in my classes so that I could be more confident in asking questions and freely giving my ideas about the reading literature.”
- Student 2: “What I found most rewarding about this experience was that I was pleased with myself for setting these files up in this way, and it saves me time from searching for documents while I am on the phone with vendors.”

Lastly, across all populations (COE, SNL, WRD), SNL portfolios demonstrated the lowest percentage of digital representations of learning (Marker E) at 11%.

We hypothesize that these findings are a direct result of the language of the Foundations portfolio assignment. While the assignment only noted once that students should incorporate “visuals” into their portfolios, which likely led to the low frequency of Marker E, students were given several prompts that encouraged their tendency toward Markers 2 (awareness of processes and strategies) and 4 (awareness of affect or values). Regarding Marker 2, the assignment stated that students should “document what you already know and can do, how you learn, and what behaviors and elements of your personality contribute to your successes.” It also stated that students should “review the knowledge, skills and behaviors you will need to cultivate to

achieve your goals.” Similar language throughout the assignment may explain why Marker 2 was the marker most frequently found in SNL portfolios.

In reference to Marker 4 (awareness of affect or values), the assignment emphasized the portfolio as a “personal development portfolio,” reinforced through statements such as “you own your portfolio” and “your style of writing can be relatively informal.” The assignment also stated that “the portfolio should allow you to celebrate your growth through the SNL program” and that “the portfolio will evolve with you as you develop as a learner.” We believe this emphasis on growth led students to be expressive and relate affectively to their learning.

Preservice Teachers: College of Education

College of Education graduate preservice teachers were developing ePortfolios for a career in elementary education. Students completed their ePortfolios during a 10-week student teaching seminar that followed the integrative knowledge ePortfolio (IKE) model (Peet et al., 2011). The ePortfolio was intended to show their employability as effective educators. Upon analysis of COE ePortfolios, we conclude that the design of the assignment, as well as the perceived audience for whom the ePortfolio is constructed, affects the development and/or demonstration of students’ metacognitive skills.

As part of the IKE model, students selected, reflected on, and integrated key learning experiences across time (i.e., connecting past to present and projecting into future) and contexts (e.g., in and out of school). There was a deliberate attempt to mark the contrast between IKEs and the more traditional

ePortfolios of the past, which were typically a collection of work samples gathered in a binder format. Three main traits of IKE or folio thinking (Chen, 2009) were emphasized for students: IKE is a new genre, a text with unique traits stemming to a great extent from the affordances and constraints of the digital space in general and of the adopted digital tool in particular (i.e., Digitization), which addresses a specific audience (i.e., professional). The crafting of the ePortfolios was highly structured; the pieces to be posted constituted required course assignments that had to include specific components. Each piece was heavily modeled using past student IKE samples and scaffolded via ongoing feedback from peers and instructors on preliminary drafts.

The framework and structure described above explain the higher incidence of Markers 1 (awareness of learning over time), 2 (awareness of processes or strategies), and E (using digital elements) observed in the COE sample ePortfolios included in this study. Students were directed to search for and reflect on past learning experiences and to connect them to current professional work and future goals, yielding frequent statements that provide evidence of Marker 1, such as the following:

I'm a webzine publisher, music journalist, award-winning fiction writer, and poet who caught the teaching bug after working for more than half a decade in these writing-related fields. My goal is to bring my real-world experience, practical knowledge, and passion for writing to both college and high school classrooms.

Similarly, statements describing process and strategies (Marker 2) were also frequently observed as the prospective teachers showcased their professional skills: for instance, "Incorporating movement into the activity not only helped students to stay focused but also demonstrated how measurement is used in sports and how it connects to students' everyday lives." Marker E (e.g., images, videos, links to external sites or across artifacts) was also prevalent in COE ePortfolios. Since students had gained experience in the schools as part of their program, they were encouraged to document those activities with (permission-granted) photos and videos. Again, the role and function of these digital elements as well as the relationship between text, images, extra- and intralinking as meaning-making devices were discussed, modeled, and required throughout the quarter.

The two markers that were less prevalent within COE students' ePortfolios were Marker 3 (awareness of strengths and weaknesses) and Marker 4 (awareness of affect and values), and when they were present, they were typically clustered with other metacognitive

markers. Pre-service teachers frequently represented their work in the classroom using this pattern: (1) here's the context within which I was working (Marker 1, awareness of learning over time); (2) in this particular classroom situation, I tried this type of teaching methodology (Marker 2, awareness of processes and strategies); and (3) using the knowledge of my students and my knowledge in the field demonstrates why I will be a good teacher (Marker 3, awareness of strengths and weaknesses). This pattern was repeated across the ePortfolios, as students tended to include only information about their strengths (not weaknesses) or that revealed their affective learning in conjunction with contextual and step-oriented information. For example, in one student's Work Showcase area, three of her four pages were coded with Marker 1, Marker 2, and Marker 3. In those pages, she describes teaching ESL courses at a community college, developing work habits in her students, and establishing a safe space in her classroom.

Given the audiences for these ePortfolios, it is not surprising that pre-service teachers were less likely to write about instances that focused on either weakness or an emotional experience. As one student noted in a follow-up survey about her ePortfolio, these ePortfolios provide their first impressions to "prospective employers, principals, other teachers, and students who are building their own portfolios. It is a great resource to have and great way to market yourself as an educator." In their student teaching seminar, students are encouraged to "paint a professional portrait" of who they are as a teacher. A professional ePortfolio is significantly different from a process or a working ePortfolio, and the markers that we found within the students' writing connect with the type of reflective content that one would use in a professional portrayal. Thus, the markers are helpful for analyzing the work, not only of different student populations from different disciplines, but also of different kinds of portfolios.

First-Year Writers: Writing, Rhetoric, and Discourse

First-year undergraduates taking FYW courses learned how to shape language to audience and purpose, develop an appropriate stance, read college-level material, and write in multiple genres, including researched arguments. The two-course sequence required reflective final portfolios that are central to program pedagogy. The portfolio was assigned to promote students' critical practice. As stated in the FYW program's Portfolio Guidelines for faculty, "We value and emphasize the way portfolios prompt meta-awareness and metacognition, allowing students to articulate not only what they learned but how they learned it, why it was significant, and who they are as learners."

Hence, the overall approach is specified, and a common assignment sheet is available for the required portfolio assignment, yet instructors are permitted to shape the specifics of their portfolio assignment to their course. Although there is some resulting variation, in general the assignments ask for evidence about both product and process. Metacognition is explicitly requested, as students are asked to write reflective comments, using evidence from assigned papers and class activities to explain their experience with and degree of success in meeting the learning outcomes of the course. The common assignment calls attention to how to integrate metacognition (called “reflection” here):

Reflection refers to the *iterative process* that we engage in when we want to look back at some activity or decision we’ve made, to think about what we’ve learned from it, and how we might use it in the future.

All portfolios used in the study were final assignments worth approximately 50% of the course grade.

A portfolio approach has been used in the FYW program since the mid 1990s, and the program shifted to required digital portfolios in 2011. Since we taught these required courses to most DePaul undergraduates, we have collected and reviewed as many as 5,000 portfolios per year. Students were told to think of the audience for the portfolio as multiple and layered. The primary audience is the instructor, but the use of the portfolios in program assessment also entails that students consider important secondary audiences like administrators and other instructors. In other words, students were explicitly told to make the portfolio comprehensible to someone outside the course environment.

Our study results indicate that the most prevalent marker noted in FYW students’ portfolios was Marker 2 (awareness of processes and strategies), at 31% of FYW’s total markers. As is the case for the other two units, this result is consistent with the assignment emphasis. Students are asked to use the portfolio to show how their written work meets learning outcomes. Because we taught and valued process-based approaches to learning to write, we are pleased though not surprised to see comments about process and strategy in both reading and writing, such as the following, from two different students: “As I read each of my sources, I took notes on the margins regarding any themes I found on the way. Then, I compared all sources,” and “After the in-class self-evaluation, I did some cleaning up and reordering of paragraphs before I tackled writing a conclusion.”

In contrast to the frequent use of process and strategy comments, results indicate that FYW portfolios

demonstrated the lowest frequency of text showing awareness of affect or values (Marker 4). Our coding identified this marker only 13% of the time for FYW portfolios, less often than the other markers (even less than the E marker) and less than student work in the other two units. Here, the program assignment specified how the portfolio allowed students to present “academic and professional identities,” and the emphasis on collecting credible support for one’s statements is likely to dissuade a first-year student from including affect. The assignment reminds students that:

The design and composition of your digital portfolio draw on the very same strategies and outcomes that you’ve been practicing in your WRD first-year writing course: Readers will attribute credibility and authority to you when your design and arrangement are done with care; thoughtfully integrated examples of your work will support your reflective essay’s main points; and you will get practice in articulating and presenting your academic and professional identities.

The relative absence of Marker 4 (awareness of affect or values) is of note, since writing assignments otherwise ask students to take a stance, and therefore typically involve value identification. Further, in this gateway course so crucial for student success and retention, helping students find and articulate affective connections to their learning is especially important. Hence, our finding indicates an opportunity to examine more effective ways to help first-year students appropriately integrate affective responses to learning into course writing.

Discussion

Our findings suggest that all four metacognition markers appear in students’ ePortfolios across these three populations. In other words, metacognition can be recognized and described across different contexts, and in ePortfolios with varied purposes. While we welcome further identification of additional “boundary-crossing” markers, we believe it is of great significance that we now have a vocabulary to talk about metacognition across populations. With this vocabulary, students in multiple contexts can be guided to engage in metacognition in concrete ways, and faculty can use the metacognition markers to aid in their assignment design and assessment process. Overall, used individually or in combination, the markers help us to pinpoint more specifically what kinds of metacognitive comments we find most useful and pertinent to our courses and our students’ learning, and where and how to enhance metacognition.

A Heuristic for Marker Integration and Assignment Design

Much of the literature on ePortfolios supports assignments with a “collect, select, reflect, connect” process, along with the integration of scaffolded learning tasks and assignments that facilitate and contribute to metacognitive development within or tangential to the ePortfolio development process. For example, Parkes, Dredger, and Hicks (2013) provided their graduate students in education with a series of assignments and an ePortfolio assessment rubric that make the expectation for metacognition and reflective activity in the ePortfolio clear with two distinct requirements in a “Reflective Practice Component of ePortfolio” category (beyond the NCATE requirements): “Reflection on Practice” and “Critical Reflection on Growth” (Parkes et al, 2013, p. 115). Jenson (2011) used surveys, prompts, and discussions around metacognition to prepare first-year writers for articulating their metacognitive ability in their ePortfolios. Similarly, at DePaul, our ePortfolio assignments have required students to reflect on and articulate their practice and growth as learners.

Upon comparing the assignments with the resulting ePortfolios, we noticed that the context and details of the assignment shaped the focus of authentic metacognition and reflection for various purposes, audiences, and learning goals. ePortfolio assignments are not always transparent regarding what metacognition is, why reflective statements are important for their learning, and how they might be written well. We believe the markers can aid with these issues. The markers can be used to help students better understand what we mean by reflection and metacognition. In other words, they can be used as a heuristic tool to develop reflective content. Students can be shown the four markers and prompted to use them with questions such as:

- What did you think in the past, and how has your thinking changed? (Marker 1)
- What strategies or processes did you use and how might they be useful in other contexts? (Marker 2)
- What worked well? What do you need to improve? (Marker 3)
- What inspired, influenced, or shaped you while learning this? (Marker 4)

In a similar vein, a teacher can use the markers to guide assessment:

- Does the student compellingly use a past/present/future scheme to consider his or her learning? (Marker 1)

- Does the student identify and adequately describe his or her processes and strategies of learning? (Marker 2)
- Does the student discuss strengths and weaknesses relevant to this learning experience with honesty and accuracy? (Marker 3)
- Does the student write convincingly about the impact of the learning experience on his or her emotions or values? (Marker 4)

We have also found that the markers have a pedagogically self-analytic function, helping us to see our own assignments more clearly by recognizing the kinds of metacognition we are seeking. Using the markers to examine our own assignments and student portfolios made it clear how the rhetorical context for the assignment shaped the focus of metacognition we sought. For example, as regards Marker 3 (awareness of strengths and weaknesses), in FYW we have a long-held belief that when we ask students to comment on their strengths as learners, they too often “schmooze” us—the student shows off rather than shows, and we go through considerable effort to get students not to schmooze us. Further, a student’s recognition of weakness often appears to be more authentic and meaningful, largely because it adheres to a recognizable narrative of failure, learning, and growth (see Yancey et al., 2014, p. 135, on the role of failure). In contrast, pre-service teachers in COE addressed an intended portfolio audience of prospective employers, for whom a message of weakness was considered inappropriate and even damaging. In this setting, we envision students initially using the full set of markers as heuristic, and subsequently refining that yield as they revise for a specific audience and implement their specific ePortfolio goals. Use of the markers in this regard would ensure that these learners have indeed reflected upon their weaknesses: instructors can use assignments and assessments that ask students to identify both their capacities and areas of future growth. At the same time, instructors can coach ePortfolio authors in the effective representation of themselves to multiple audiences in a way that suggests integrity and honesty. While we all stumble over the inevitable interview question, “What do you see as your weaknesses?” ePortfolio authors have the opportunity to hone an answer that indicates an interest in continuous growth as a person and as a professional without inappropriate personal revelation.

As a tool for pedagogical self-reflection, the markers allow instructors to recognize the extent to which they value each of the metacognitive markers, to confirm why and whether the markers work in relation to respective contexts, and then to use this knowledge more explicitly to help students, given their purpose, understand what appropriate reflection is. That

appropriate metacognition will vary with context is another lesson we should help students to see because this helps them understand how and why they will be assessed by the audience, including the instructor. Studying our own valuation of the markers, then, helps us concretely identify what we want from students, and contributes to effective assignment design. Moreover, it is the act of using the markers as analytical tools together that has led us to insights about our own pedagogy and greater understanding of one another's contexts, even within the same institution. The markers have helped us cross intra-institutional boundaries by helping to highlight both our commonalities and our differences.

A Tool for Thoughtful Assessment

We believe our markers are of great use in assessment across multiple contexts, as the study shows that the markers can be expected to be present in and useable with different populations, reflecting a range of age, academic exposure, and assignment contexts. Perhaps our most significant takeaway regarding the use of the markers is that they help us to recognize and explain a good response when we read one. This is no small feat, since assessing portfolios can be an overwhelming task, especially for newcomers. Use of the markers answers instructors' ever-present question, "What do I look for?" In other words, what assessors should look for is awareness of learning over time (Marker 1), of process and strategy (Marker 2), of strength and weakness (Marker 3), and of affect or values (Marker 4). Moreover, we found through our assessment with the markers that it is the combination of several markers in one metacognitive comment that creates the fullest sort of reflection. For example, in the following passage, the student relates her learning at earlier points in her life, as well as in the present, and its future potential (Marker 1); she suggests useful processes or strategies she can engage in (Marker 2); she sees strengths and weaknesses (Marker 3); and acknowledges affect or values related to learning (Marker 4):

I learned more about myself [3] than anything else in this class. I was once a proud writer [1 and 4], too proud [3] to believe I could change or get better; maybe I was just too scared to think about it [4]. I realize now [1] that, much like the soldiers that I have studied so dutifully all term, I can thrive and get better [1, 3] with the help of others [2].

This student comment comes from a FYW portfolio, but our observations about it apply to all study groups. The student's ability to integrate several markers is what makes her reflective comment compelling, such

that we believe that real learning has occurred. We note in particular her recognition of the emotional component of learning—she does not simply identify an isolated emotion (e.g., "I've always hated writing"), but understands and demonstrates how her affective responses affected her receptivity and resistance to learn (e.g., "I was too proud or scared to change").

Another example comes from a FYW student who wrote about video games because of his own gaming involvement:

Regardless of how many player controlled characters I murder on a daily basis, or cities I sack in order to advance my virtual cause, in the real world, *I am courteous and respectful and do my best to be an example [3, 4] for others to follow. I feel strongly [4] about my public appearance because I do not think there are enough 'normal' people that act in a way to make society as a whole better [4]. Because this angle defines my social role and normally places a negative light on video games, I again can use this to prevent the media's and politicians' use of violent video games as a scapegoat [1, 2] when violent crimes are committed.*

The student consciously articulates the values (Marker 4) he adheres to in the real world that he thinks are strengths (Marker 3; courtesy, respect, being an example), underscores that he feels "strongly" about them (Marker 4), and goes on to connect these values and emotions to his choice of an argument strategy that he can use now or in the future (Markers 1 and 2).

Hence, after students have been shown how to use the markers to generate reflective content, they can next be taught to interweave that content in meaningful ways. Then, when assessing, instructors can look for a combination of markers as a potential sign of added strength. The instructor can assess portfolio comments by looking for the presence of individual markers and how their combination enhances the quality of a statement.

Conclusion

To conclude, the markers explain what we think a portfolio with effective metacognition looks like. We began the study knowing we valued portfolios, and that we did so because we believed students used ePortfolios to enact and demonstrate an authentic depth of reflection. Now, we know how to identify the kinds of comments and artifacts that reveal such qualities—by looking for the presence of these four markers. Moreover, we understand that the combination and integration of several markers in a single ePortfolio excerpt help to further strengthen that excerpt, yielding

more than the sum of its parts. Understanding how to use the markers can help practitioners understand what to look for when assessing metacognition. Similarly, we have found that markers help us to teach reflection; explicitly teaching students about the available markers and how to integrate them into portfolio or other metacognitive assignments will help practitioners to elicit metacognition. But perhaps the most important outcome of this study is the institutional value of our cross-disciplinary conversation and vocabulary. By reading and coding ePortfolios from one another's programs, we learned about the goals and methods of colleagues next door, down the street, and across town. We can only hope that for others, too, the process may prove to be an unexpected resource for fertile and rewarding institutional dialogue.

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