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Preparedness Portfolios and Portfolio Studios: Supporting Self-Authoring Engineers

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In this work, we engaged engineering undergraduate students in constructing an ePortfolio. The purpose of the research presented here was to explore the question, "If and in what ways do students report experiencing the construction of a preparedness portfolio in a portfolio studio as an opportunity to develop into self-authoring individuals?" The findings of this study suggest that the ways in which students reported experiencing the construction of a preparedness portfolio in a portfolio studio aligns with movement toward self-authorship, which indicates that this ePortfolio activity supports and challenges student development toward self-authorship. These findings contribute to the evidence-base for the use of ePortfolios in higher education. Furthermore, this study demonstrates the broad applicability and usefulness of self-authorship to guide educational practice through understanding (a) how this ePortfolio activity (and other ePortfolio activities) can connect to opportunities for fostering student development toward self-authorship; and (b) how self-authorship can be used to understand students' descriptions of their experience in this ePortfolio activity (and other ePortfolio activities).

The many demands of modern life, such as complex thinking and problem solving, connect to objectives of higher education: "Advocates of educating the whole student have argued for years that emotional, social, and cognitive development are equally important aspects to consider in creating effective learning environments" (Haynes, 2006, p. 17). However, in teaching, more concrete and immediate issues, such as institutional requirements and accreditation, are often prioritized.

In connecting to this call for educating the whole student, this research uses development throughout the lifespan, specifically socialization and self-authorship (Kegan, 1994), to understand students' experiences constructing a preparedness portfolio in a portfolio studio (i.e., five sessions in which engagement with ePortfolio-related tasks was scaffolded; for more details about this ePortfolio activity, see Turns, Sattler, Eliot, Kilgore, & Mobrand, 2012). According to Kegan (1994), a socialized mind is one that has come to align with the values and beliefs of others—*looking outward* for one's values and beliefs. A self-authoring mind, in contrast, has subjected its own values and beliefs to inspection and has consciously chosen what to value and believe—*looking inward*. Self-authors have taken on the responsibility of deciding for oneself, having internal authority. This shift involves developing more complex ways of making meaning of the world.

Attributes of self-authorship, such as thinking critically, recognizing the complexity of knowledge, relying on personal values and beliefs, and engaging in mutually respectful relationships with others, connect to the mental demands of modern life. For example, an individual who thinks critically can consider multiple perspectives when reasoning. In the professional world, a self-authoring individual can grapple with ethical issues in light of his or her own beliefs. Even further, in a world that is increasingly becoming defined by intercultural communication (King & Baxter Magolda, 2005) and globalization (Jarvis, 2007), individuals must be able to "manage complexity and engage multiple perspectives" (Baxter Magolda & King, 2004, p. xviii). These attributes of a modern citizen represent the ability to address such problems in light of one's personal and professional values and beliefs, which are fundamental to being a self-authoring individual.

Self-authorship connects to attributes that higher education aspires to impart to learners (Baxter Magolda, 2000, 2003, 2004b; Kegan, 1994, 2000; King & Baxter Magolda, 2005). For example, a goal of higher education is to instill in future leaders the ability to solve complex problems, deal with ambiguity, self-initiate, be responsible for personal experiences, participate in interdependent relationships, and participate in groups (Baxter Magolda, 2008). These objectives of higher education link to concerns about the transferability of academic skills to a professional context. While initially constructed more broadly with respect to adulthood (Kegan, 1982, 1994), self-authorship has primarily been researched and applied within college-student development (Baxter Magolda, 2000, 2001, 2003, 2004a, 2004b, 2008; Haynes, 2006; Pizzolato, 2003, 2004, 2005, 2007; Torres, 2003; Torres & Baxter Magolda, 2004).

Working in our own research where we seek to understand how to support college student development toward self-authorship, we recognized an opportunity to explore and understand preparedness portfolios and portfolio studios (Turns et al., 2012) through the lens of self-authorship. Using self-authorship to understand this ePortfolio activity is significant because research suggests the profound nature of ePortfolios (e.g., Bryant

& Chittum, 2013; Eliot & Turns, 2011; Nguyen, 2013; Parkes, Dredger, & Hicks, 2013; Turns et al., 2012). However, most of these studies focus on one aspect of student development, such as identity (Eliot & Turns, 2011), learning (Nguyen, 2013), lifelong learning (Sattler, Kilgore, & Turns, 2010), or reflection on past experiences (Parkes et al., 2013). While these areas are important in their own right, in our work we noticed that they do not completely capture the profound impact students reported about their experience constructing an ePortfolio. We recognized an opportunity to explore and understand it through a broader perspective, such as self-authorship. Given the importance of attending to student development, understanding preparedness portfolios and portfolio studios through the lens of self-authorship fills an important gap in providing

> empirically-based evidence for [ePortfolio's] adoption . . . Although the theoretical foundation for ePortoflio use is strong, it is not sufficient to justify widespread use. As ePortfolio use continues to grow and valuable time and resources are being invested in this fairly new pedagogical tool, it becomes even more important that we have empirically-based evidence for its adoption. (Bryant & Chittum, 2013, p. 190)

Our research is a response to calls for more empirically-based evidence supporting the use of ePortfolios (e.g., Bryant & Chittum, 2013; American Association of Colleges & Universities, 2014; Rhodes, Chen, Watson, & Garrison, 2014).

Conceptual Framework

The purpose of this section is to outline the conceptual framework of self-authorship. In this section, we (a) present the origins of self-authorship; and (b) describe why we could anticipate that students would move toward self-authorship from their participation in this ePortfolio activity.

In his work, Kegan (1984, 1994, 2000) has demonstrated the importance of continued development throughout a person's lifespan, connecting to how adults are continuously dealing with the hidden curriculum of life in domains such as work, relationships, and parenting. He explored these areas of life as an opportunity to suggest the importance of how people make meaning of and engage with the world around them. Kegan (1994) described how individuals, without continued development, are unable to deal with demands of the modern world, leaving them "in over their heads" (p. 5). Attributes of a self-authoring individual include, but are not limited to, the ability to analyze critically and evaluate problems, formulate an identity, learn independently, engage in interdependent mature relationships, embrace and value diversity, consider multiple perspectives, collaborate, self-initiate, be responsible for one's own experiences, and handle ambiguity (Baxter Magolda, 2001, 2008; Kegan, 1994).

Kegan (1994) described fundamental shifts in how people make sense of the world around them, which represents the development of more complex ways of making meaning of the world—a movement from socialization to self-authorship. While Kegan (1994) acknowledged that socialization is an accomplishment because that means an individual has learned to play by the rules, he noted that self-authorship is being able to engage in the world. He described these shifts along three dimensions—cognitive, intrapersonal, and interpersonal. Along the cognitive dimension, there is growth from viewing knowledge as right or wrong and dependent on an authority figure to recognition of knowledge as complex and contextual and viewing the self as able to contribute to the construction of knowledge. The intrapersonal dimension represents one's identity and shifts from an externally defined identity to one that is internally defined. Along the interpersonal dimension, relationships change from dependent to more interdependent and become defined by mutuality (i.e., the ability to see others' perspectives).

Kegan (1994) described movement toward self-authorship in terms of a transformation in which individuals step outside of their experiences, observe them, and *have* them (i.e., self-authorship) versus being *had* by their experiences (i.e., socialization). These changes in the ways in which people interact with and interpret their experiences can be characterized as a shift from looking outward to looking inward. While Kegan (1994) proposed a more complex theory about development throughout the human lifespan, for the purposes of this paper the focus will be on the journey toward self-authorship—a journey defined by a movement from looking outward to others as authority figures to looking inward and trusting oneself as an authority figure.

In his work, Kegan (1994) explored these developmental ideas as a part of adulthood. In bringing this work to college student development, Baxter Magolda (2001) examined college student development over the course of a longitudinal study of undergraduates into adulthood. Her early work suggested that there is little evidence that college experiences push students toward self-authorship during college. Rather, her research provided strong indication of the evolution toward self-authorship later in life, when college students graduate and are faced with the ambiguities of life, asking questions, such as "Who am I?" and "What are my contributions to the world?" (Baxter Magolda, 2001). Other research has suggested that specific groups of students may progress

toward self-authorship earlier and that certain types of experiences may better support student development toward self-authorship. Torres and Baxter Magolda (2004) suggested that underrepresented populations (e.g., Latino) may progress toward self-authorship because they encounter cognitive dissonance earlier in their academic careers. In recognizing that development toward self-authorship is possible in the undergraduate years, scholars have been exploring the ways in which higher education can support students' development toward self-authorship more explicitly (Baxter Magolda et al., 2007).

Baxter Magolda's (2001) early work sheds light on the importance of attending to student development. Her more recent work focuses on the need for education to find a balance between support and challenge in order to support student development (e.g., Baxter Magolda, 2004b; Meszaros, 2007; Pizzolato, 2003, 2004, 2005). The goal is to "propel students toward self-authorship by creating contexts whereby formulas for success are not readily available" (Pizzolato & Ozaki, 2007, p. 198). Contexts built on these suggestions require students to depend on their own secured internal voice and therefore have the potential to disrupt students' current ways of making meaning. In these situations, students will either fit the disruptions into their current ways of making meaning or adjust to more sophisticated ways of making meaning (i.e., self-authorship). In supporting students' development along the cognitive dimension, educators should portray knowledge as complex and socially constructed. In scaffolding activities that encourage student engagement in identity work (i.e., intrapersonal), educators must position students at the center of knowledge-construction activities. To help students develop along the relationship dimension (i.e., interpersonal), educators should share authority and expertise in the mutual construction of knowledge. Our research adds to the community's understanding of how to construct educational practices in order to support student development.

As a first step in exploring the evidence-base for ePortfolios, it is important to understand why we could anticipate that students would move toward self-authorship after constructing a preparedness portfolio in a portfolio studio. We provide this evidence by connecting this ePortfolio activity to suggestions about how to foster the development of self-authorship. According to scholars (Baxter Magolda, 2001; Kegan, 1994), a balance of support and challenge is critical when trying to foster students' development toward self-authorship. It is possible to see how this ePortfolio activity has the potential to support and challenge student development toward self-authorship along all three dimensions (i.e., cognitive, intrapersonal, and interpersonal). Along each development dimension, it is possible to see students engaging in different learning activities that have the potential to support development toward self-authorship: (a) cognitive: making a portfolio, understanding what counts as engineering; (b) intrapersonal: presenting oneself as an engineer, internalizing the engineer as an identity; and (c) interpersonal: giving and receiving portfolio feedback, interacting with other engineers.

In this ePortfolio activity, our pedagogical approach is to provide a structured, yet flexible work environment—in other words, "liberating constraints" (Davis & Sumara, 2006). This pedagogical approach connects to supporting and challenging self-authorship development because it helps students learn how "to choose from among multiple alternatives" (Baxter Magolda & King, 2004, p. 42). While there is no "right" way to construct an ePortfolio, students are given guidance on various aspects, such as word count and format. For example, in connecting to the cognitive dimension, making an argument about one's preparedness is defined by ambiguity—there is no right way. The purpose of such guidance is to catalyze students' engagement in the making of an ePortfolio, which can help them focus on in-depth issues rather than surface logistics. As noted in our previous research, this ambiguity removes the comfort afforded by external formulas (i.e., being told exactly what to do and how to do it by an authority figure) and requires students to grapple with ambiguity (Turns et al., 2012).

The example above provides a detailed illustration of how constructing a preparedness portfolio in a portfolio studio has the potential to support and challenge self-authorship development along the cognitive dimension. It is also possible to connect this ePortfolio activity in detail to the other two dimensions (i.e., intrapersonal and interpersonal). In linking this ePortfolio activity to suggestions for supporting and challenging self-authorship development, we can begin to see why students can move toward self-authorship as a result of engagement in this ePortfolio activity. These connections offer reasons to explore the merits of this ePortfolio activity as a mechanism to support student development, specifically development toward self-authorship.

In this work, we explore the question, "If and in what ways do students report experiencing the construction of a preparedness portfolio in a portfolio studio as an opportunity to develop into self-authoring individuals?" Through this research question, we aim to understand (a) how this ePortfolio activity (and other ePortfolio activities) can connect to opportunities for supporting student development toward self-authorship, and (b) how self-authorship can be used to understand students' descriptions of their experience in this ePortfolio activity (and other ePortfolio activities). In the following sections, we describe this research in more

detail through an outline of our research approach, study findings, discussion, and concluding remarks.

Method

In this study, we used the lens of self-authorship to investigate how engineering undergraduate students experienced constructing a preparedness portfolio in a portfolio studio. In this section, we provide (a) a description of this ePortfolio activity, (b) the participants, (c) data collection, and (d) data analysis.

The ePortfolio Activity: Preparedness Portfolios and Portfolio Studios

The key elements of the preparedness portfolios are preparedness statements, in the form of arguments with written explanations (i.e., statements, artifacts, and annotations). The key elements of the portfolio studio are scaffolding activities; validating students' process; and understanding students' reactions. For more details about these elements, see Turns et al. (2012).

Invited engineering undergraduate students (students at the focus of this study) constructed an argument about their preparedness for a future activity in the form of an ePortfolio. Typically, students chose to make claims about their preparedness for industry; some students used the portfolio as an opportunity to demonstrate their preparedness for undergraduate and graduate school programs. This research focused on what happened when engineering undergraduate students created life-wide engineering preparedness portfolios—students were encouraged to draw portfolio content from all life experiences (e.g., classroom, work, co- and extra-curricular activities, and personal experiences). Scaffolding for this ePortfolio activity was provided in the context of a portfolio studio, an interactive social environment that was semi-structured, with the goal of facilitating students through the process of creating an ePortfolio.

Participants

The findings presented in this paper represent the experience of six participants constructing a preparedness portfolio in a portfolio studio (see Table 1 for participant demographics). Early observations of their engagement with this ePortfolio activity suggested diverse experiences. For example, there were indications that some students found the portfolio experience meaningful and helped them understand their past experience better, while for other students, there were suggestions that the portfolio helped them grapple with their future. These observations were made through watching the students' engagement in the portfolio studio and conducting a preliminary analysis of the data.

Data Collection and Analysis

The data collection and analyses were grounded in prior work on self-authorship, specifically exploring passages that suggest reference to looking inward and looking outward (Baxter Magola, 2001; Baxter Magolda & King, 2007; Sattler, Turns, & Mobrand, 2012).

Data collection. All participants completed a post-survey in the fifth and final portfolio studio session. This survey had a variety of open and close-ended questions that generally targeted participants' experiences in this ePortfolio activity (e.g., "What are your chief take-aways from this experience?") and then targeted questions about self-authorship (e.g., "Did the portfolio contribute to your sense of empowerment?"). Both Baxter Magolda's (2001) Longitudinal Self-Authorship Interview and the Wabash National Study of Liberal Arts Education Interview (Baxter Magolda & King, 2007) provided strong foundations for developing the data collection instruments used to explore this ePortfolio activity. In an effort to target the dimensions (i.e., cognitive, intrapersonal, and interpersonal), data collection questions were formed with an eye towards dimension. Other data collection questions targeted the concept of self-authorship as a whole (see Appendix). The questions in the instruments represented a range of questions probing the movement toward self-authorship and/or markers of a self-authoring individual.

Participants were interviewed within a month of participation about their experience constructing a preparedness portfolio in a portfolio studio. The post-survey and post-interview were purposely designed to include the same questions. Participants had an opportunity to grapple with the topic area on their own in the post-survey (i.e., a personal time and space to respond). The post-interview allotted time for the interviewer to elicit further answers to survey responses, as well as to explore new issues that arose during the interview. This design provided an opportunity for triangulation across data points.

Data analysis. The focus of data analysis was on understanding students' experiences in this ePortfolio activity in relationship to their development toward self-authorship. A constructivist grounded theory approach was used to make sense of the data: (1) define what is happening in the setting; (2) narrate participants' individual experiences; (3) compare stories of the research participants; and (4) acknowledge and test assumptions (Charmaz, 2000). This approach aligns well with the data analysis approach suggested by self-authorship scholars Baxter Magolda and King (2007), which involves "identifying meaningful units of conversation, labeling those units to

Table 1
Participant Demographics

Participant	Department	Year	Race	Gender	Enter status
Faith	Applying to ME & MSE	Junior	White	Female	Traditional
Ben	ME	Senior	White	Male	Returning
Eric	MSE	Senior	White	Male	Traditional
Anna	Human Centered Design & Engr.	Senior	Multi-racial	Female	Traditional
David	ChemE	Junior	White	Male	Traditional
Carl	CE	Senior	White	Male	Traditional

convey their essence in terms of meaning making, and sorting the labeled units into categories that portray the key themes" (p. 504).

We attended to issues of credibility, dependability, and transferability to ensure a high level of research thoroughness through the use of data triangulation and disconfirming evidence (Devers, 1999). Using this approach, we maintained a detailed chronology of all decisions, conducted a skeptical peer review, and clearly outlined the study context so that readers could judge transferability.

Possible Study Limitations

In general, it is important to recognize challenges associated with studying and measuring self-authorship (Baxter Magolda & King, 2007; Pizzolato, 2007). Baxter Magolda and King (2007) attributed these challenges to the complexity of the construct: "The complexity of this evolution requires a complex approach to assessment" (p. 494). Further, the study of self-authorship is challenging to observe because it is an internal process—a process that researchers strive to make visible through either asking individuals about life experiences or observing behaviors. According to Baxter Magolda and King (2007), this type of study is even more challenging because

> as King (1990) noted, assessment is complicated because individuals often use more than one meaning-making structure at a time, and prefer (recognize as better) statements using reasoning structures that are more complex than what they are able to produce independently. (p. 495)

Results and Discussion

The findings suggest that the ways in which students characterized this ePortfolio activity align with supporting their self-authorship development in multiple ways along all three dimensions (cognitive, intrapersonal, and interpersonal). In each of the findings presented, first there is a description of the finding with student quotes, then a commentary about how the finding and quotes connect to self-authorship through the "looking inward, looking outward" exploration.

Becoming Proud and Assessing Progress: Connected to the Intrapersonal Dimension

The ways in which students described their experience constructing a preparedness portfolio in a portfolio studio was most often characterized in language that mapped to intrapersonal statements (i.e., identity-related talk). All students had multiple instances of describing their experience in this ePortfolio activity that aligned with the intrapersonal dimension. Students described the process of building a preparedness portfolio as an opportunity to engage with their professional identity, specifically (a) contributing to their sense of pride in their past accomplishments and (b) providing an opportunity to assess their engineering preparedness.

Becoming proud. All students described the experience as contributing to a growing sense of pride in their past accomplishments. Students characterized the process of looking back on their past experiences in light of their future goals as helping them to recognize important aspects of their past accomplishments. For example, Carl described this sense of pride as developing from his accomplishments seeming more real: "I am also more proud of my accomplishments because they seem more tangible." Another student, David, acknowledged how the process of building his preparedness portfolio in a portfolio studio contributed to his respect for his past work:

> Um, a couple of the artifacts I pulled off . . . I included a research paper I wrote about super conductivity for my chemistry class last year, and it sort of it made me respect the work we did in class quite a bit more. Just looking back on it and seeing what I accomplished was kinda cool. I didn't think much of it at the time.

Looking outward, looking inward. From the previous quotes, we can see both Carl and David looking inward and acknowledging their own accomplishments. It suggests that preparedness

portfolio construction provided them with a mechanism and that the portfolio studio provided them with a designated space and appropriate scaffolding to become aware of their experiences. In transitioning from looking outward to looking inward, we can see their sense of pride coming from within, rather than from external sources. We can see this growing awareness as mapping onto Baxter Magolda's (2001) description of the process elements of the journey to self-authorship—trusting the internal voice, building an internal foundation, and securing internal commitments. These students became aware of their past experiences, which in turn created a sense of pride that contributed to their ability to trust their competencies as emerging engineering professionals.

Assessing progress. Some students reported that a significant benefit of their participation constructing a preparedness portfolio in a portfolio studio came from assessing their progress. It provided them with an opportunity to assess where they have come from and where they are going. Students described recognizing and articulating their personal growth. Carl reported this assessment: "[Construction of a preparedness portfolio in a portfolio studio] was a chance to assess my progress instead of blindly stumbling forward." Eric described realizing how his artifacts represent a growth in his knowledge and ability:

> While looking for artifacts, I found that my earlier coursework was indicative of an "elementary understanding" of basic academic principles. In contrast, my recent coursework demonstrates exceptional proficiency in comparison with my "starting point" and really suggests tremendous academic improvement. From a retrospective standpoint my earlier coursework was just a "warm-up" for what I am currently doing in my courses. When retroactively looking through coursework from several years ago, an individual really begins to see their improvement on a personal scale.

Looking outward, looking inward. In the previous quotes, we can see Carl and Eric acknowledging the significant role that the construct of a preparedness portfolio in a portfolio studio played in helping them assess their engineering progress. It provided them with a mechanism and space to step outside their engineering experiences and assess their engineering progress. According to Kegan (1994), the ability to move looking outward to looking inward represents the capacity to reflect on something, understand it, and "have it" rather than being "had by it." In this case, we can see students begin the process of shifting from being "had by" their engineering progress to "having it." This transformation aligns with the ways Kegan (1994) and Baxter Magolda (2001) described the fundamental shift from a socialized mind to a self-authoring mind.

Seeing Experiences as Engineering: Connecting to the Cognitive and Intrapersonal Dimensions

All of the students discussed at least one experience in this ePortfolio activity that related to the cognitive dimension. For example, they reported dealing with what counts as knowledge demonstrating one's engineering preparedness. Many students described broadening their conception of engineering knowledge. On the surface, this finding connects to the cognitive dimension in that students are engaging with what counts as engineering knowledge. When these students are making judgments about their own engineering knowledge, it begins to represent the interpersonal dimension because of the personal nature. We can see these as connecting to the intrapersonal; however, this presentation of findings and associated discussion focuses on connections to the cognitive dimension of self-authorship.

Broadening conception of what counts as engineering. Students began constructing a preparedness portfolio with a focus on representing their claims through evidence connected to technical experiences (e.g., internships and co-ops). We can see a shift in students' conceptions of what counts as engineering knowledge. The ways in which some students described their experience suggests that participating in this ePortfolio activity helped them broaden their conception of what counts as engineering knowledge. For example, when asked about her most important decision in constructing her preparedness portfolio, Anna reported including a specific non-engineering artifact as engineering evidence:

> My most important decision was to include the t-shirt design. I was unsure of how it would be received because it was totally not engineering related. I was going to scrap it and use another artifact. I received lots of good feedback from my peers and included the t-shirt design. I am so happy with the decision!

Looking outward, looking inward. In the above passage, the way in which Anna characterized her experience represents a broadening of her conception of what counts as engineering knowledge. She was able to look inward at her experiences and shift the ways in which she views her engineering knowledge from a dualistic understanding (e.g., traditional technical engineering experiences vs. non-engineering experiences) to a more contextual understanding. A broader conception of what counts as engineering knowledge represents a self-authoring mind because

self-authoring individuals can draw connections between different contexts.

Further broadening their conception of what counts as engineering. When asked about his decision-making process for choosing artifacts, Ben initially depicted the process as easy because he did not have much to choose from: "I didn't actually eliminate any. I picked everything I could think of, which wasn't much. So I didn't have to decide." Later in the interview, Ben reported that as he progressed through this ePortfolio activity, he was able to connect other experiences, such as construction work, to his engineering preparedness. Like other students, throughout the course of constructing a preparedness portfolio, he conveyed a continual engagement with thinking broadly about all of his experiences in relationship to his future in engineering. Ben described the realization of having more engineering experiences:

> Coming up with artifacts. It took me a long time to think around, like connect things, and I knew I had done stuff, but I didn't think it connected in any way . . . to engineering in a way that like an employer might want to look at, so realizing that a lot of it could link up took a little bit of work.

He went on to describe this shift as positive: "I like the last artifact I found, my house remodel project. I realized that even though it wasn't an engineering project, working on a large project like that showed off some skills that are important for engineers to have." He acknowledged how he now could recognize how remodeling a house provided evidence of his engineering preparedness:

> So it ended up being a little over a yearlong project. We started in June of 06 and we finished, I think it was August of 07, so, um so, you know, when I was doing it, I'm thinking I tear stuff apart, I put it back together, I get paid. But now reflecting back on it, I see that was very much like an engineering project, where you need to come up with timelines, and kinda connecting it to my 395 class, design process, where you, where you have to come up with work flowcharts and things like that to make sure you meet deadlines and things get done, and then certain things can't be done until something else is done, so . . . you know, you can't get the . . . insulation in there until the plumbing and the electrical is in there and things like that, so it was stuff I didn't have to think about too much on that project, because I had a more experienced partner. But . . . I did learn a lot, and reflecting back on it I learned how much I learned and how similar it was, and then I'm applying things I'm learning now to how I could have done it better, more efficiently, and how I can use that experience in the future . . . to plan projects that are going to be, you know, longer projects.

Looking outward, looking inward. We can see the above quotes as a representation of Ben beginning to broaden his conception of what counts as engineering knowledge. He described being able to connect this knowledge to his engineering preparedness. Ben characterized this realization in the following way: "[The construction of a preparedness portfolio in a portfolio studio] showed me that I have several accomplishments that are relevant to a career in engineering." Initially we see Ben "picking all" his experiences as representative of his engineering preparedness because he was choosing experiences that were canonical to experiences that demonstrate engineering preparedness. In looking outward, Ben described relying on experiences that were externally defined by the engineering community (i.e., internships, course-work). As he continued through this ePortfolio activity, we see a shift in how he defines what counts as engineering knowledge, which is more internally defined, more looking inward.

Interacting With Others: Connecting to the Interpersonal Dimension

All of the students reported at least one experience that was related to the interpersonal dimension. Primarily these comments dealt with their interactions in peer review, both the positive and negative aspects. On the surface, these comments may seem related to peer review only; however, there is evidence that the ways in which students described peer review connects to an opportunity for students to learn how to engage in meaningful mutual relationships with others.

Peer review: Interacting with others. In describing peer review interactions, some students noted wanting more critical feedback, while other students recognized the difficulty of providing such feedback. When describing the challenges associated with giving feedback, Eric said:

> Um, [peer review] was difficult for me in the sense that I tried to avoid being vindictive. I, you know, I had strong English abilities in elementary school, middle school, high school, I was always identified as a gifted writer. And as a result, I kind of tend to always assume that I'm right. So when you're peer editing someone's writing and they're commensurate in education level to you, it's very different in the sense that when you say this is wrong, it I don't know, it's harder to kind of say

> I'm right and you're wrong, because they might be right and I might be wrong . . . It's more like we're on equal terms, so I would more like be discussing an issue as opposed to just taking a red pen and saying, no, you know.

Looking outward, looking inward. On the surface the previous quote represents how Eric reported experiencing challenges associated with peer review. However, this quote demonstrates Eric's deeper engagement, looking inward to provide feedback based on his values and beliefs, while also considering others' values and beliefs. This quote represents how he described grappling with understanding others' perspectives within the context of providing feedback that would help them improve their writing, while also remaining true to his own viewpoint—a marker of a self-authoring individual along the interpersonal dimension.

Peer review: Interacting with others in new ways. Some students desired deeper feedback; however, they were still able to leverage the peer review by seeing how others approached constructing a preparedness portfolio. Anna described giving feedback as beneficial because

> You can learn a lot about other people, just like about their experiences, which is cool, and also like if you see how they structure or organize something in a certain way and you really like it, you can use it, too. It can be helpful if you're like unsure about how to organize something.

David also described how giving feedback provided him with an opportunity to see how others approached constructing a preparedness portfolio. In addition, he recognized how this process contributed to his ability to edit others' work:

> Oh, it's I learned I got some good ideas for what I wanted to show, not necessarily in specific but just how people threw things together, and it's always nice to have editing practice. It's a good skill to have.

Looking outward, looking inward. From David and Anna, we can begin to see that their experiences in peer review align with how a self-authoring individual would approach interacting with others in peer review. It is promising that these students recognized peer review challenges, which begins to connect to a mindset of a self-authoring individual. As Baxter-Magolda (2001) noted, the bridge toward self-authorship begins with an awareness. In the above quote, we can see Anna and David looking inward and becoming aware of challenges associated with peer review.

Concluding Remarks

This study explored the question, "If and in what ways do students report experiencing the construction of a preparedness portfolio in a portfolio studio as an opportunity to develop into self-authoring individuals?" This study investigated this question by examining students' reports of their experience in this ePortfolio activity through the lens of self-authorship, specifically looking for instances where their language mapped onto movement from looking outward to looking inward. The empirical findings suggest that these students experienced the construction of a preparedness portfolio in a portfolio studio as supporting and challenging their development toward self-authorship. The empirical findings presented here imply that students' descriptions of their experiences in this ePortfolio activity were personal, diversified, and aligned with the three developmental dimensions (i.e., cognitive, intrapersonal, and interpersonal).

This work demonstrates the possibility of using self-authorship to understand the impact of an activity and to assess how others can approach such an endeavor to understand their own activities and pedagogies in new ways. In this work, we mapped self-authorship onto ePortfolios to appreciate the significant nature of ePortfolios, specifically preparedness portfolios in a portfolio studio. Characteristics of this specific instantiation of ePortfolios that map onto a self-authorship support mechanism are: scaffolding activities; validating students' process; and understanding students' reactions. For more details about these elements, see Turns et al. (2012).

This ePortfolio activity also has the potential to support and challenge student development through processes of trusting, building, and securing an internal voice—one bridge to self-authorship, as described by Baxter Magolda (2008). This is done through mechanisms such as scaffolding decisions about portfolio content; providing a safe environment; and engaging students alongside one another and in self-evaluation. This study extends the research (e.g., Baxter Magolda, 2004b; Meszaros, 2007; Pizzolato, 2003, 2004, 2005) about how to construct educational practice to support student development; the extension is to a new pedagogy (i.e., preparedness portfolios and portfolio studios) and a new discipline (i.e., engineering education).

The findings of this research provide empirical-based evidence to support the use of ePortfolios in learning. While others (e.g., Taylor & Haynes, 2008) have used self-authorship as a theoretical perspective to guide curriculum development in which ePortfolios were an outcome, to our knowledge our study is the first empirical demonstration that ePortfolios offer an opportunity to support students' development toward

self-authorship. This study demonstrates the broad applicability and usefulness of self-authorship as a perspective to guide educational practice and assess educational endeavors.

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Appendix
Survey and Interview Questions

Interview	**Developmental dimension targeted**
01. What are your chief take-aways from this experience?	All
02. Thinking back on your experience with portfolio development this quarter, what was the most surprising thing about it?	All
03. What was the most rewarding thing about it?	All
04. What was easy or enjoyable about creating your portfolio?	All
05. What was the most challenging or unpleasant thing about creating your portfolio?	All
06. Please describe the aspects of your portfolio you like the most.	All
07. Please describe the aspects of your portfolio that you like the least, besides the Catalyst or Google formatting limitations.	All
08. How would you change your portfolio if you worked on it more in the future?	All
Learning environments	
09. What expectations did you have when joining the portfolio studio? Did your experience align with these expectations? Please explain.	All
10. In what ways was the portfolio experience different from the rest of your undergraduate coursework?	Cognitive
11. In what ways was the portfolio experience similar to the rest of your undergraduate coursework?	Cognitive
12. What is your view of an ideal classroom environment that is conducive to your needs? In this environment, what is the role of the educator? What is the role of the student? How do you feel when the educator evaluates you or your work?	Cognitive, Interpersonal
13. Did the portfolio studio align with this view? If yes, please explain how? If no, how could it better align?	Cognitive
14. People have said that working on the portfolio influences how they view the courses they have taken or plan to take. Is this true for you?	Cognitive
15. How useful was working on portfolio in regard to current coursework, future plans?	Intrapersonal, Cognitive
16. How does creating a portfolio compare to other things you have done?	Cognitive
Interactions with others	
17. Describe your interactions with peers in the portfolio studio.	Interpersonal
18. Describe your experiences with peer review, both receiving and giving feedback. What did you gain from these activities?	Interpersonal
19. How do you deal with encounters with people who hold different views from yourself?	Interpersonal
20. During the portfolio studio, did you encounter people who held views different from yourself? If yes, how did you handle the situation? If no, how would you hypothetically handle the situation?	Interpersonal

21. Do you think that you handle these types of situations (encountering people with different views) differently since participating in the portfolio studio?	Interpersonal
22. Generally, do you think the portfolio activity has better prepared you to work in teams?	Interpersonal
23. Do you think the portfolio has made you more open to others' ideas?	Interpersonal
24. Often when working in groups, people offer up ideas that the group does not take up; has this happened to you? Please explain the situation, your attitude, and feelings. Do you think this portfolio experience has influenced how you would respond to such situations in the future?	Interpersonal
25. Describe a time you were advised to take a certain course of action, but didn't agree with this path and wanted to take another path. Do you think this portfolio experience has influenced how you would respond to such situations in the future?	Interpersonal
26. Describe a situation when you felt like you were being pulled in different directions. Do you think this portfolio experience has influenced how you would respond to such situations in the future?	Interpersonal
Decision-making	
27. Think about the various experiences that you revisited or reflected on during this term. Select one that stands out to you, and tell me about it. What was the experience, and what types of thoughts did you have while you were revisiting or reflecting on it?	Intrapersonal, Cognitive
28. Describe the decision-making process of choosing a specific artifact. How did you decide on the artifact? Why this artifact over other artifacts?	All
29. In retrospect, are you surprised by any of the artifacts you included in the portfolio? Tell me a little more about that.	Cognitive, Intrapersonal
30. In a situation where information is not clear cut, how do you go about making a decision? OR How do you make decisions in the face of conflicting information?	All
31. What was the most important decision you made while developing your portfolio? What was the decision? What were your options? Are you pleased with the decision?	Cognitive, Intrapersonal
Dilemma	
32. Please describe a dilemma you have faced in life. Describe how you experienced the dilemma, who was involved, and how you handled it. If you were to face the same dilemma now (after the portfolio experience), do you think that you would respond differently?	Intrapersonal, Interpersonal
Thinking process	
33. Did this professional portfolio activity get you to think? If yes, please explain in what ways. If no, explain why not.	Cognitive
34. Has this experience led you to think differently about or approach other learning experiences at the university in new ways? Explain.	Cognitive
35. People have said that working on the portfolio makes them think differently. Is this true for you?	Cognitive
36. Do you believe that your experience creating a portfolio has resulted in a change in your values, beliefs, opinions, or expectations? Please explain.	Cognitive

37. Tell me a story about one of the most significant learning experiences you had while here at the UW. What was it about this experience that made you identify it as one of your most significant learning experiences? What did you learn? Why do you think you learned so much? How do you think you will use what you learned in the future? Who was involved in the experience, and what were their roles?	All
38. What do you see as the relationship between knowledge and truth?	Cognitive
Future and preparedness	
39. Do you intend to complete a major in engineering?	Cognitive
40. If someone were to read your portfolio, would they think you were ready to work in industry or to attend graduate school?	Cognitive, Interpersonal
41. In your opinion, would the artifacts and annotations in your portfolio convince others of your readiness for industry or graduate school?	Cognitive, Interpersonal
42. In your opinion, would your professional statement convince others of your readiness for industry or graduate school?	All
43. Some students report learning about themselves and even being impressed by their accomplishments (gaining confidence); did this happen to you? Please explain.	All
44. Sometimes we've heard that creating the portfolio creates tensions between what one wants to do and what one should do. While creating the portfolio, did you experience any tensions like this one? Please explain.	Interpersonal
Comfort level	
45. Students have described having different comfort levels with the portfolio process and studio; could you talk about your comfort level? What made you comfortable? What made you uncomfortable? How did you get over the discomfort?	All
46. Have you experienced other situations where the comfort level was similar to the portfolio? If yes, could you explain the situation, what you did, what was different, the same?	All
Closing	
47. Did the portfolio contribute to your sense of empowerment? Please explain.	Intrapersonal
48. Is there anything else that you think is important for me to know to understand how you experienced the portfolio studio?	All