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Teaching vs. Research: An Approach to Understanding Graduate Students' Roles through ePortfolio Reflection

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In this work, we examined the problem of preparing future faculty (graduate students) regarding their development in multiple roles, focusing on students in science and engineering disciplines. The purpose of the presented research was to address the questions, "Do graduate students believe that their current experiences align with the roles they will perform in their academic careers?" and "How do graduate students' perceptions of their professional roles change during the process of constructing portfolios?" We used the theoretical lens of role identity to guide this work; academic careers are typically categorized in terms of teaching, research, and service, which can be mapped as professional identity roles. We conducted a survey and focus groups with participants working through an ePortfolio development curriculum. Our findings suggest that there is a perception of misalignment between current and future roles, and that the construction of ePortfolios can be utilized to promote reflective practices leading to changed perceptions of those roles.

Graduate students are required to balance a variety of roles while completing their education and preparing for their careers (Cast, 2003; Sweitzer, 2009). Further complicating this phase, the graduate years are a transitional time that is critical to constructing professional identities and personal development. However, it is not clear how well students are able to balance their roles or how well graduate programs support the development of different roles, especially in the transition from PhD experiences to professional roles in academia. Our goal is to answer the following research questions about this critical phase in student development:

1. Do graduate students believe that their current experiences align with the roles they will perform in their academic careers?
2. How do graduate students' perceptions of their professional roles change during the process of constructing portfolios?

In order to address these research questions, a previously developed survey (Kajfez & McNair, 2014) was distributed and analyzed to measure student perceptions of professional role identities in academia. Grounded in role identity theory, the survey elicits students' perceptions of their current roles in academia and the future roles they believe they will have after graduation. After taking the survey, the students participated in an ePortfolio experience in which they specifically explored their various roles and then shared their impressions in a focus group. The results of the survey and the focus groups allow for an examination of graduate student development to better understand these formative experiences.

Literature Review

The theoretical concept of role identity stems from a combination of social and identity theory, in which "who you are is derived from social memberships" (Ashforth, 2001, p. 26). Such relational identities, which are based on both an individual's personal and social selves, "are role-based personas complete with goals, values, beliefs, norms, interaction styles, and time horizons" (Ashforth, 2001, p. 51). When a role is adopted, salient characteristics of that role (as instituted by social groups and perceived by individuals) are also incorporated to inform the sense of self, including one's sense of belonging in professional organizations (Whetten & Godfrey, 1998). Thus, role identities are reflexive in nature. Enacting a role does not necessarily require accepting that identity as self-defining; however, the navigation and transition between roles does involve an adjustment of personas and sometimes involves internalizing an altered self-concept.

Academia as an organization provides a hierarchical role structure that requires members (especially faculty) to construct their profession from a variety of roles (e.g., researcher, teacher, advisor, administrator). In graduate school, students work in a transitional state where they are experimenting with a variety of these identities, roles, and behaviors (Colbeck, 2008). This preparation for academia can require daily role transitions that are critical but poorly understood (Denecke, Kent, & Wiener, 2011). As students navigate possible roles, they start to "articulate a narrative thread that connects possibly disparate experiences into a coherent story about themselves" (Ashforth, 2001, p. 8). Digital portfolios or *ePortfolios* are tools that can help students shift from this implicit mode of development to an explicit process of self-understanding through the reflective practice of creating a shared representation of one's professional self. The ePortfolio curriculum we have developed, for example, is designed to help graduate students and their advisors curate professional trajectories (McNair & Garrison, 2012, 2013a). Our work also aims to better understand

these transitions to ensure that we are properly preparing graduate students for their futures.

We recognize that many graduate students are preparing for future roles outside of academia that will require a unique level of preparation. The present work is situated within the mission of the Preparing Future Faculty (PFF) program, which has noted a trend of discontinuity between the PhD experiences and the professional culture of academia (de Weert, 2009; DeNeef, 2002; Gaff, Pruitt-Logan, Weibl, & Participants in the Preparing Future Faculty Program, 2000; Golde & Dore, 2001). In the future, we hope to examine trajectories beyond the academic career path; however, at this time those additional paths are beyond the scope of this work. Additionally, within science and engineering disciplines, which place emphasis on research in both student and faculty roles, there is a unique balance that needs to be explored, so we focus this work on the roles of researcher and teacher to begin this examination (Kajfez & McNair, 2014; McNair & Garrison, 2012).

Graduate Students as Researchers and Teachers

Identity has been explored in a plethora of ways. The notion of identity as a human development concept was proposed by Erikson: "Identity helps one to make sense of, and to find one's place in, an almost limitless world with a vast set of possibilities" (Schwartz, 2005, p. 294). Researchers in the fields of psychology and sociology have since built on Erikson's work through research projects and theory generation (e.g., Marcia, Waterman, Matteson, Archer, & Orlofsky, 1993). Despite this growth, there are still gaps in the literature related to the use of identity concepts in science and engineering fields. Most of the research regarding identity in these areas focuses on the identity of undergraduate students (Beam, Pierrakos, Constantz, Johri, & Anderson, 2009; France, Pierrakos, Russell, & Anderson, 2010; Matusovich, Streveler, & Miller, 2010; Nicholls et al., 2007; Tate & Linn, 2005). There has been little examination of the construct regarding graduate students in engineering and science. Our research aims to fill that gap.

To frame our work, we have specifically chosen to view graduate student identity through the researcher and teacher roles. We recognize that graduate students may have additional roles beyond these two (e.g., student, parent, spouse) and that academic professions involve roles in service and lifelong learning. However, teaching and research roles are the most salient demands on academics and often are the two that are the most at odds. For example, Aydeniz and Hodge (2011) studied the development of teacher identity through a case study focused on a professor in biology. They directly observed the tension between teaching and research, using Sfard and Prusak's (2005) view of identity, in which they "equate identity with the stories that individuals tell, in this case, about their teaching and the expectations that they must meet in order to be successful as professionals" (Aydeniz & Hodge, 2011, p. 168). Through an interview and observations with the professor, they learned that a professor's role is often composed of both a researcher and a teacher component, where the researcher identity often overshadowed the teacher identity due to institutional circumstances and expectations impacting the participant's career trajectory. Accounts such as this support the need to start with an examination of researcher and teacher roles within graduate students.

Much of graduate school, especially in engineering, is related to developing students into researchers. Despite this focus, there is little systematic research about this process and how to accomplish it effectively as a student or how to support students through this process as an advisor. Similarly, there is even less work that examines the alignment between graduate experience and post-graduation careers. Regardless of the lack of information, there are a few examples of research that we can build on to support our work regarding the researcher role. The first is an article by Crede and Borrego (2012) that studied research groups as a key element to graduate development in engineering. Through ethnography-based observations and interviews that led to a survey, they determined that research group size and advising directly influence student learning and professional development. With this in mind, it is essential to consider interactions in these types of environments when exploring graduate student roles. Harrison (2008) also explored graduate student researcher identity development, focusing on the field of counseling through an examination of his own personal development. He, too, found that the student-supervisor relationship, or advising, is highly impactful, again indicating that interactions with others directly influence development and growth.

Much of the current literature about graduate students in teaching roles in engineering is focused on graduate teaching assistant (GTA) development programs or GTA evaluations and assessments (e.g., Cox et al., 2011; Matusovich, Lee, Janeski, & Winters, 2011). While these articles are important to the engineering landscape, they tell us little about graduate students' experiences teaching across institutions or about graduate student teacher development. Outside of engineering, Olsen (2008) examined the transition from student to teacher in an English department. His work reveals that novice teachers often reach back to past experiences to identify with their new teacher role. This reliance on models may, however, be problematic. For example, Brownell and Tanner (2012) argued that

pedagogical changes currently needed in education may be impeded if instructors model their approaches on the traditional methods of their own teachers. Jarvis-Selinger, Pratt, and Collins (2010) examined the transition from pre-service teacher to practicing teacher, focusing on participants' levels of commitment to teaching. Exploring perceptions and expectations, they report that discussions of the transition assist teachers' development and recognition of their new roles. While they are outside of engineering as a field, these studies point to ways to ease the developmental transition from student to teacher.

To truly understand the graduate student to academic transition, these roles within the researcher and teacher identities must be studied in parallel. Our work aims to do that, while also considering current and future perspectives.

Impacts of Reflective Practice via Digital Portfolio Construction

As readers will recognize, an ePortfolio can be defined simply as a collective digital storage space of a person's work artifacts providing authentic, valid, and reliable evidence (Carroll, Calvo, & Markauskaite, 2006) that is constructed in a non-random, purposeful manner and provides reflections to emphasize knowledge, competencies, and/or skill sets possessed by the creator (Paulson, Paulson, & Meyer, 1991). By engaging in the process of collecting, categorizing, and reflecting on artifacts, the creator establishes a "digital identity or persona" (Clark, 2010, p. 29). In educational settings, many researchers and practitioners agree that students should include work that has been collected, selected, and reflected on by the student, which helps the author of the ePortfolio feel ownership of their product (Cole, Ryan, & Kick, 1995).

These fundamental affordances have been explored further in terms of professional preparedness through integrative thinking and identity construction. Integrative thinking is a synthesis of different elements that results in a creative, holistic combination that is greater than the sum of its parts; in this research, the influence of different graduate student roles is a reflection of integrative thinking (McNair & Garrison, 2013b).

As an educational goal, integrative thinking focuses on the ability to manage complexity and problem solving, and thus helps students make connections between ideas and experience to prepare for non-uniform professional roles (American Association of Colleges and Universities [AAC&U], 2012). Integrative thinking has been developed as an affordance of ePortfolios at the University of Michigan by Melissa Peet, who has built on the AAC&U's work to establish six dimensions of integrative learning as a foundation for a conceptual model informing her portfolio process, Integrative Knowledge Portfolio Process (IKPP). The IKPP was established "in order to create a pedagogy and technology to help students know and articulate what they have learned at UM" (Peet, 2011, p. 12), particularly in terms of how their learning was valuable to them and how they would apply it in their careers.

Closely related to these goals is the work of Turns and her team, who have explored and developed portfolio studios for undergraduate engineering students and observed patterns of self-authorship and professional identity construction (Kilgore, Sattler, & Turns, 2013; Sattler & Turns, 2015). In these settings, students develop as self-authoring individuals while navigating their learning development and, furthermore, are able to make connections between experiential and academic learning, resulting in heightened awareness and preparation for their professions.

Methods

This study addresses the following research questions by employing data collected from a survey and focus groups. The survey was informed by role identity theory, and the focus groups were conducted at each institution after students completed ePortfolios:

1. Do graduate students believe that their current experiences align with the roles they will perform in their academic careers?
2. How do graduate students' perceptions of their current and future roles change during the process of constructing portfolios?

ePortfolio as Intervention in Graduate Student Professional Development

We used the P2P ePortfolio curriculum (McNair & Garrison, 2013a) in this study to guide students in constructing professional online portfolios. This program followed the guidelines for integrative and applied learning as one of the essential learning outcomes set forth by the AAC&U and also considered the context of graduate school, focusing on engineering and science students pursuing academic goals that include both research and teaching. By asking students to include components of teaching, research, and other academic themes in their ePortfolios, we considered not only cross-curricular and cross-contextual integrations but also the ability to manage multiple and sometimes conflicting role identities.

Specifically, the P2P program encouraged reflective practice in graduate students as they constructed professional identities as both researchers and teachers. We developed the process and assessment

protocol to guide students through building a portfolio and to encourage their development through integrative thinking. The curriculum divides the process of creating a professional ePortfolio into weekly tasks that students can complete through self-paced or externally structured settings. A fundamental part of the process is feedback provided by both peers and faculty.

As they created a professional portfolio, students were asked to upload evidence of and write narratives about their accomplishments in distinct categories, such as research and teaching, as well as other components of the careers they were preparing for. Each piece of evidence that students uploaded typically documented a specific professional accomplishment. Students were then asked to write narratives to pair with their uploaded evidence. These narratives not only provided helpful background on the circumstances of the accomplishment but also spoke to what the students learned through the process. Finally, students were asked to reflect on their pages and write *meta-narratives* to provide readers with holistic views of themselves as professionals. Through these assignments, we endeavored to engage students in integrative and reflective practices of self-assessment that encourage "dialectical thinking, metaphorical thinking, building a metalanguage, and developing common ground" (Seabury, 2002, p. 51).

As discussed above, researchers have taken different approaches to exploring graduate student identity, integrative thinking, and reflective practice. Our research supplements these past studies through a quantitative and qualitative examination of graduate student identity, in which we purposefully focus on the roles of teacher and researcher. To further define our perspective, we explored graduate students' perceptions of these roles today and in the future. Specifically, we examined (1) the actual roles they hold as current graduate students; (2) the roles they desire to hold as graduate students and in their future careers; and (3) the roles they believe they are expected to hold as current graduate students and in their future careers. The survey we developed (described in the next section) provided a quantitative measure of these dimensions. Furthermore, we believe that building professional portfolios is a useful reflective practice that may facilitate integrative thinking and help graduate students construct balanced professional identities as future faculty. We explored student experiences in this regard through qualitative data gathered in focus groups and driven by questions about the impact of reflective practice on professional identity through ePortfolio construction. By exploring professional roles in these ways, we are able to understand better the nuances among actual, desired, and expected roles both today and in graduate students' future careers.

Participants and Settings

Our study participants were science and engineering graduate students at four R1 institutions who volunteered to complete a survey and participate in focus groups while working through the P2P ePortfolio curriculum. The focus on science and engineering graduate students is due to the need to develop critical teaching and learning skills that will impact faculty careers (Jamison & Lohmann, 2009), which conflicts with how doctoral programs emphasize research, especially in science and engineering programs (Borrego, 2007; National Science Board, 2007). Across the institutions, a variety of science and engineering disciplines were represented by a total of 47 individuals in the participant pool, with the greatest disciplinary variation occurring at Site #3. Although we did not perform any analysis based on the gender or age of the participants, we did collect this information in order to illustrate what our participants in this study were like. The participants were evenly split between female (n = 23) and male (n = 24) graduate students, while the majority of participants (59.6%) were in the 26-30 age range.

The P2P portfolio curriculum was used at all four schools, including the same online curriculum, assessment rubrics, and expert feedback. However, the circumstances of implementation and motivation differed between schools. As shown in Table 1, differences included duration, compensation, course credit, and setting. Demographic data revealed no major differences between settings, and ethnic identity information was not collected due to IRB concerns about indirect identification, due to low numbers of underrepresented populations.

The implementation efforts were coordinated by local personnel at all sites with support from P2P staff, with three implementations taking place in university-wide, teaching focused, professional development programs and one taking place in a department-required teaching practicum course. One cohort of students was paid, and one cohort received course credit for participation, while others received no compensation. Students were encouraged to select their own portfolio platforms, and they used a variety of technologies to construct their portfolios, ranging from a rudimentary open source course management tool, to public tools such as Google and WordPress, to commercial platforms such as Digication.

Table 1
Participants' School Descriptions

	Duration	Stipend	Course credit	No. of Participants	Implementation
School 1	One term	No	Yes	10	Portfolio required, all participants in a teaching practicum course that awarded 20% of course grade for completing portfolio according to a rubric standard
School 2	One term	No	No	12	Portfolio voluntary, all participants part of teaching practicum course, mixed science and engineering disciplines, majority engineering
School 3	One term	No	No	14	Portfolio voluntary, two in-person portfolio program meetings, mixed science and engineering disciplines
School 4	Two terms	Yes	No	11	Portfolio voluntary, two in-person portfolio program meetings, mixed science and engineering disciplines, majority engineering

Survey Instrument Development

In a separate study employing multiple experts and a pilot study with individuals outside of the population, the authors (Kajfez & McNair, 2014; Louis & McNair, 2011) developed a survey to measure graduate students' belief conditions about their preparation for the professoriate. The survey was tested for validity and reliability using an iterative process that involved expert review of the questions and constructs, piloting the survey with a large cross-disciplinary population, revising the survey questions, then piloting once again with a new population. The entire survey design process helped to ensure reliability and content validity. All of the 60 items were Likert-type scale responses with seven choices (1 = *strongly disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, 7 = *strongly agree*); the seven-point scale was chosen so that higher reliability could be obtained while allowing for more variability in individual responses. The final survey took approximately 20 minutes to complete and measured student responses on five belief conditions (current actual role, current desired role, current expected role, future desired role, and future expected role) and three identities (researcher, teacher, lifelong learner) for a total of 15 dimensions. Due to the emphasis in science and engineering fields on core roles, the data analyzed here only includes results from the responses relating to teacher and researcher identities. For a copy of the survey questions, please contact the authors.

Belief conditions are a person's perceptions of their role identities from different perspectives. For example, students were asked about their roles as researchers in terms of both their present situation and future career. The belief conditions measured five perspectives, asking participants to situate themselves in both their current roles and their potential future roles, and in terms of their current actual experience, experience they desire currently and in future roles, and experience that they perceive is or will be expected of them (see Table 2).

The ultimate goal was to compare differences and similarities between items to uncover disparities between graduate students' perceptions of what they are currently doing and what they expect to be doing in their future professions.

Data Collection

We collected quantitative survey data to measure the alignment of student perceptions with their roles in graduate school and their future careers. In order to interpret these results and to explore the impact of ePortfolio work on professional identity, we also conducted focus groups. By collecting both quantitative and qualitative data, we were able to explore our findings looking for both breadth and depth.

Survey data collection. The survey was distributed via email to participants at the four sites who participated in a course that employed the P2P curriculum (approximately 90 total students, with a strong response rate of approximately 50%). The data collection period lasted four weeks. The survey was completed by participants prior to starting the P2P program in order to obtain a baseline measurement of students' perceptions of their professional identity roles at their institutions.

Focus group data collection. Focus groups were conducted in-person at each institution by the same trained moderator, using the same semi-structured format based on the roles students explored while constructing their ePortfolios (for a copy of the focus group protocol, please contact the authors). Each focus

Table 2
Teacher and Researcher Belief Conditions

Condition	Description
Current Expected	How students perceive others' expectations of their current roles (e.g., teachers, advisors, administrators); external requirements
Current Desired	How students want to inhabit the roles (can conflict with expected)
Current Actual	How students perceive their actual work within the roles (what they are actually doing)
Future Expected	How students perceive they will be expected to fill their roles by others in their future work environment (e.g., teachers, advisors, administrators)
Future Desired	How students want to inhabit the roles in their future work environment (can conflict with expected)

group consisted of six to 12 students and lasted for 60-80 minutes. The sessions were audio-recorded, and the researcher took field notes.

Data Analysis

Survey data analysis. The survey analysis followed six steps designed to discover patterns between teacher and researcher roles at the four sites.

In Step 1, we analyzed the entire set of student data to find an overall mean for each belief condition for each role identity. The survey contained 15 survey questions that focused on teacher identity and 15 that focused on researcher identity. There were three questions on each belief condition within each role. The results of the three questions that constitute each belief condition were averaged to find an overall mean value for each individual institution.

In Step 2, the means for each school were plotted on radial figures to enable a visual inspection of students' perceptions of teacher and researcher identity role alignment. Each school was plotted on a radial figure; one was for teacher identity roles, and one was for researcher identity roles.

During Step 3, the teacher and researcher figures were then visually inspected to determine differences between schools and between current and future perceptions within each school.

Next, in Step 4, we confirmed our visual findings through an ANOVA test in order to determine whether or not there were statistically significant differences between schools within certain belief conditions for each identity role.

For Step 5, we performed a set of two-tailed *t* tests ($\alpha = 0.05$) to determine the belief conditions that had statistically significant differences between current and future perceptions at each school. The null hypothesis for each of these tests was that the participants at the schools did not differ in their perceptions of their current and future work.

Finally, in Step 6, once we determined that there were statistically significant differences between schools within the teacher role, we performed a set of two-tailed *t* tests (with $\alpha = 0.05$) to determine which institutions were different in which belief conditions. The null hypothesis for each of these tests was that participants in each school did not differ in their perceptions of the belief condition in question.

Focus Group Analysis

Focus group sessions were transcribed by the authors and qualitatively coded by topic categories that were informed by our underlying research questions. Specifically, we looked for patterns of responses regarding professional identity roles categorized by themes addressed in the students' ePortfolio projects (i.e., research, teaching, service, and lifelong learning). Our first step was to organize the discussions by topic; we then developed subdivisions according to patterns in and across each topic discussion. At this point, we checked the level of pattern grouping with an outside researcher, and then finally wrote out themes and iteratively revised this level of meaning among the three members of the research team.

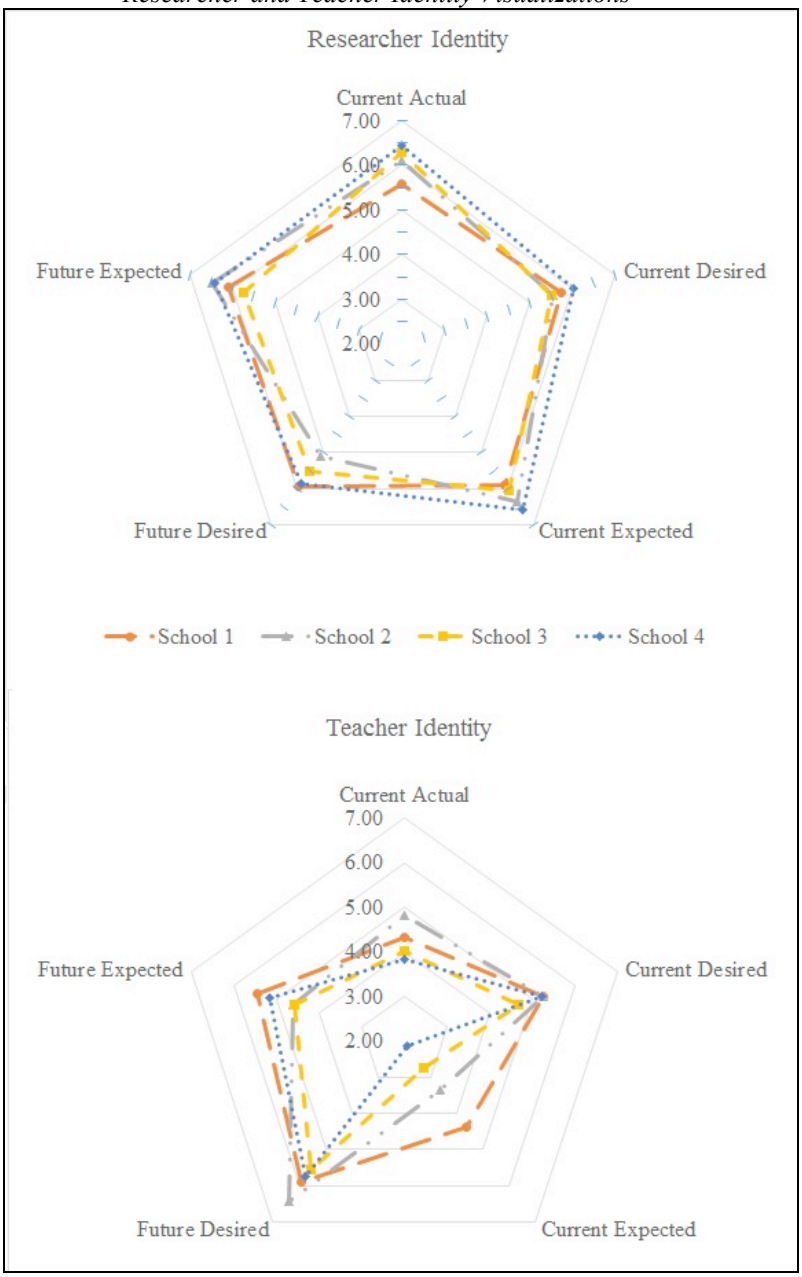
Results and Discussion

The results of the survey and focus group discussions are explained below. The quantitative results indicate a misalignment between graduate students' perceptions of their current preparation and their future careers. The misalignment is further reflected by focus group discussions about the difficulties posed when creating integrative narratives.

Survey Results: Differences Between Schools and Between Researcher and Teacher Role Identities

Teacher and researcher identity roles. The mean results of the survey were best illustrated as radial figures that highlight balance as alignment (Figure 1): the researcher identity (top radial) was visually more balanced between students' current belief conditions

Figure 1
Researcher and Teacher Identity Visualizations



and what they perceive will happen in their future workplace as academics. On the other hand, the teacher identity (bottom radial) was visually unbalanced, showing misalignment between the current perceptions and future-focused desires and expectations.

As we theorized from visual inspection of Figure 1, there were no statistically significant differences between researcher group means, as determined by one-way ANOVA, $F(4, 15) = 3.023$, $p = 0.052$). However, the teacher group means resulted in statistically significant differences, as determined by one-way ANOVA, $F(4, 15) = 14.387$, $p > 0.001$. Table 3 shows the statistically significant differences between schools within different belief conditions.

The results of the t test indicated the cases where the null hypothesis that the participants at both schools had the same perceptions of that belief condition should be rejected. All of the results listed in Table 3 are statistically significant (as indicated by p values in the far right column). For example, in Table 3, participants

Table 3
Significant Two-Tailed t *Test Results Between Schools*

	Between				
Belief condition	School A (*M*, *SD*)	School B (*M*, *SD*)	*t*	*df*	*p*
Current Actual	School 2 (4.81, 0.89)	School 3 (4.00, 1.31)	1.99	71	.003*
	School 2 (4.81, 0.89)	School 4 (3.82, 1.65)	2.01	48	.004*
Current Expected	School 1 (4.37, 2.44)	School 3 (2.74, 1.42)	2.02	41	.002*
	School 1 (4.37, 2.44)	School 4 (2.12, 1.36)	2.02	43	.000*
	School 2 (3.36, 1.84)	School 4 (2.12, 1.36)	2.00	64	.002*
Future Expected	School 1 (5.45, 1.21)	School 2 (4.64, 1.64)	2.00	63	.026*
	School 1 (5.45, 1.21)	School 3 (4.60, 1.58)	2.00	68	.012*
Future Desired	School 1 (5.90, 0.84)	School 2 (6.42, 0.65)	2.00	54	.008*
	School 2 (6.42, 0.65)	School 3 (5.55, 1.45)	2.00	59	.001*
	School 2 (6.42, 0.65)	School 4 (5.76, 1.28)	2.01	47	.010*

at School 2 (M = 6.42, SD = 0.08) and School 4 (M = 5.76, SD = 1.28) exhibited a statistically significant difference (p = 0.010) in their perception of their teacher identity within the Future Desired belief condition.

Table 4 shows the t-test results for participants at each school, conducted to determine if there was any significant difference in their current and future perceptions of the teacher identity (the researcher identity yielded no significant results). For example, participants at School 1 exhibited a statistically significant difference (p = 0.041) in their perception of their teacher identity between the Current Desired (M = 5.27, SD = 1.73) and Future Desired (M = 5.90, SD = 0.84) belief conditions, indicating a misalignment between their program and their career (i.e., what they want to be doing now is different than what they want to be doing in the future).

In summary, there were significant differences in terms of current and future perceptions of the teacher identity. There were also significant differences between the schools but in different belief conditions. This finding (i.e., that current and future belief conditions are not consistent across institutions) indicates that there are wider issues to be addressed in preparing future faculty.

Focus Group Results: Graduate Student Perceptions of Preparing ePortfolios for Academic Professions

As described in the Methods section, data analysis of the focus group discussions were divided into topics and subdivisions using an iterative, multi-coder process. The primary topics followed the categories that students worked on in their ePortfolios (i.e., research, teaching, service, and lifelong learning), and we also included questions about how students represented their overall professional identity within their digital presence, where we asked students about the benefits and challenges of constructing professional ePortfolios for their academic careers. Responses described in this section are grouped under six topics: Overall Identity, Research, Teaching, Service, Lifelong Learning, and the role of Reflection in constructing an ePortfolio.

Overall identity. Students saw the task of an integrated ePortfolio as one of constructing a holistic professional identity. For example, one student characterized the process of creating his ePortfolio as requiring a "kind of high-level muse" to produce "a broad picture." Another student commented on putting together the different pieces for a professional audience:

> I thought it was really good just to have something to make you think about these kinds of things . . . I spent a lot of time sitting around thinking about how I wanted to . . . come across to, I don't know, a potential employer or person like that to actually give some thought to how someone else sees your research and you know, other things about you like your teaching and things like that. What kind of a . . . overall impression it creates and how much of that you can even convey on a computer screen.

While platforms such as LinkedIn were also invoked, students agreed that the process of combining not only research but also service, teaching, and lifelong learning resulted in reflecting on and presenting this type of holistic, overall professional identity. This included reflecting on the purpose of these roles as well, as articulated by a student who also maintained other professional online sites: "But, this information about service and lifelong learning, this is, I would think, including them has made me think about these things and their purpose." By working toward an integrated, overall professional identity, students also noted that gaps would appear:

Table 4
Two-Tailed t *Test Results Between Current and Future Teaching Roles*

		Between				
		Current (*M*, *SD*)	Future (*M*, *SD*)	*t*	*df*	*p*-
School 1	Desired	5.27, 1.73	5.90, 0.84	-2.11	41	.041*
	Expected	4.37, 2.44	5.45, 1.21	-1.79	39	.081
School 2	Desired	5.28, 1.47	6.42, 0.65	-4.26	48	.000*
	Expected	3.36, 1.84	4.64, 1.64	-3.11	69	.003*
School 3	Desired	4.69, 1.84	5.55, 1.45	-2.36	78	.020*
	Expected	2.74, 1.42	4.60, 1.58	-5.68	81	.000*
School 4	Desired	5.24, 1.60	5.76, 1.28	-1.45	61	.153
	Expected	2.12, 1.36	5.18, 1.47	-8.78	64	.000*

> It led me to think about things I can do in the future. I haven't done much with service right now but in the next two years I might do some things I might actually put over there. So it was like good to know these things.

This experience, then, revealed possibilities for future work, and as part of this process, began to connect points on a professional timeline.

Comments on the individual sections of the ePortfolio project also revealed concerns about professional identity and audience. Students characterized the task of writing to an audience as a difficult and central question: audiences included current advisors and professors, potential employers, peers, and friends. The categories suggested in the portfolio curriculum appeared as "a burden and a kind of checklist," but students also commented that it "was nice to have a to-do list," to be able to "see the whole thing at once," and to "identity gaps to work on in the future." The idea of an amorphous audience prompted students to "spend time thinking about how I come across," "how someone else might see my research and teaching," and how to manage "overall impression formation." The challenge was seen as "how to build a narrative" and "how to talk about accomplishments" in a way that "you can show this portfolio to the whole world." As one student summarized, "You have to find a balance."

Research. Many students thought that the research part of their portfolio would be a quick and easy "cut-and-paste" activity but discovered that they needed to "build a narrative," "take the time to translate it to English," make it "comprehensible to the layman," and integrate it with other categories. They also needed to deal with change; two examples included "connecting 10 years of research from undergraduate to PhD work" and communicating "the beginning of a research program that will likely change in the next few years." Finally, the concern of communicating technical research to a broad audience was a particular focus.

However, students were more confident in communicating their research than in the categories of teaching, service and lifelong learning. For example, one student said that he was

> not sure that all of this information would be helpful in applying to academic jobs. They might not be interested in some of the stuff . . . [they will be interested] just purely in the publications or the research aspect.

Another student saw value in the portfolio process but also stated precautions about how to communicate research effectively:

> It helps you to reflect and helps you create a lot of ideas that you wouldn't have had otherwise. But other people might not read. In engineering and sciences, people are more precise. Ideally, you take reflection and turn it into something more precise.

Other students recognized the value of an integrative approach in constructing an ePortfolio and discussed how including sections on their roles in research could be productively supplemented with information on teaching, service, and lifelong learning. For example, one student who had expected to be able to copy-and-paste from an old research website instead found herself dealing with the concept of a professional narrative:

> But now with this there's a structure and there's a format and there's guidance of like, well, this is how you build a narrative and this is how you talk about an accomplishment and so I thought that was really useful.

Part of this student's endeavor involved dealing with "bad experiences," and in dealing with this challenge she realized that "I can build a narrative and I don't necessarily have to put a focus on this thing I didn't

want to talk about. I can still mention it but I don't have to make it the centerpiece." In fact, she ultimately built a narrative that spanned ten years of research experience, "So eventually, I got it. I built a narrative and I think I did well in that." Through the experience of constructing an ePortfolio, students attempted to connect various experiences back to their research trajectories, managed experiences and expectations, and used a variety of approaches to envision themselves in the eyes of multiple audiences.

Teaching. Students also struggled with presenting their teaching experiences, even though three of the school sites were focused on preparing students for teaching through practicum-style experiences. They drew from GTA experiences that were "structured," and they used pre-prepared teaching philosophies for evidence. Also, they hoped that "this teaching experience might be important even for a job that might not involve as much teaching." They valued their teaching but were not always sure how much of teaching to emphasize. For example, one student who planned to apply to both industry and academic jobs worried about impressions on potential employers:

> Personal experiences are not as welcome: who are you to talk about yourself? I've been hesitant to want to talk too much about myself openly. In some ways, you're in a stronger position if people know you less. And so you give that up by being open. So, if you talk about how much you love teaching and the people at that company are thinking, "Oh no, it's one of those guys who loves teaching." You can tailor your resume, but not so easily your website.

On the other hand, a student planning on an academic career stated:

> If you're in a job interview and they ask you, tell me about a time when you had a successful teaching experience . . . this is a way to actually think about this for a while before you actually respond. And you can put it out there in a way that people can read that and get to know who you are in an interview style rather than just a resume.

Reflecting a more integrated perspective, one student noted that when writing about "the career and life and teaching philosophy—it was hard to differentiate." Again, the challenge of presenting their professional selves to different audiences was central to the activity of constructing an ePortfolio.

Service. Service was a category that varied widely across students—some had extensive service and had to make decisions about whether it was lifelong learning and/or teaching. One student ended up creating "a new category" that combined teaching, service, and outreach. Other students found that service was a gap in their work as a professional. One student found minimal evidence of service but noted that building the portfolio "led me to think about things I can do in the future." Another student eventually identified several types of service experiences, but stated that "I just had to sit and think and think and think and think."

Students also worried about the stereotypes that might result if they shared certain kinds of service, such as gender and religion stereotypes. Service enters into a personal realm, and one student worried about being stereotyped as a "Bible Belt Christian dude" if he included the service he did associated with his church. In general, students noted that the category of service was less well-defined and more personal; most students placed a high value on service as an activity, but perspectives differed on how much service was connected to their careers.

Lifelong learning. Writing about lifelong learning also prompted students to struggle with the inclusion of their personal life, which in turn prompted reflection on what not to include. In turn, these conversations led to some of the most interesting perceptions about the professional culture of the workplaces that awaited them.

For example, one student "debated intensely" about including her wedding picture, which she valued because it was high quality but also because the wedding was in a building that was related to her work. She described the struggle as difficult:

> Because it's a wedding picture. [laughs] But I wanted to include it because I got married at a really cool place [that relates to my career]. So, it's, you know, relevant. And I debated, do I put it? Do I not put it?

One member of the group added the suggestion, "You could always just Photoshop the color of the dress" only partly in jest, and the students continued to discuss her dilemma in terms of balancing her "real life" and the perceived judgment of the professional community. She concluded,

> I just . . . I mean I'm a girl, right? I was thinking, it's like, well, of course, it's a woman. Of course she is talking about her wedding. Duh. But it's like, I, I ended up just picking one of the main pictures that our photographer put in his blog and everything because it's a wide shot and you can see the [building and equipment], and I'm this tiny thing in the picture.

Then, another student expressed a different perspective on academic professional culture:

> The other thing that brings up is like, if it's for something that people who are trying to hire you for professor jobs and they see that picture and like, crap, we're going to have to hire her husband too. The whole two-body problem thing.

None of the students in the group denied that professional culture could be a detrimental force in portfolio choices.

This pattern of subjugating the personal to the professional self also appeared in other discussions about lifelong learning. Another woman also worried about gender stereotypes in her choice for lifelong learning: she was a cook and cake decorator who used these skills to help student organizations with fund-raising events, but she worried that these skills wouldn't look as "interesting" or "impressive" to a male-dominated engineering community.

Constructing a lifelong learning section also posed challenges that required students to draw on integrative thinking. Students noted overlaps between categories and struggled with the relevance of lifelong learning to potential employers. However, other students described the category of lifelong learning as relevant and were able to map personal activities to qualities that would be valued in the workplace. For example, one student explained,

> Writing about playing in a string quartet related to my professional life; it provided me a place for reflection about not only a way to relax and time to recharge, but also it allowed me to work closely with a group of people over a long period of time. It gave me a chance to show my personality rather than these canned profiles that everyone writes out.

Students also connected lifelong learning activities specifically to their roles as teachers who model professional life as well-rounded and grounded beyond academia. Finally, one student situated the importance of lifelong learning in terms of an overall professional identity:

> It's important for PhD students. We're supposed to be intellects, continually challenging ourselves with research but also outside of research in different areas. Learning a musical instrument or learning a different language. It shows you're interested in continually developing yourself.

To summarize, students struggled with bringing together different aspects of their personal and professional values as lifelong learning, and they found it difficult to determine how and whether to share these components with a professional audience; yet, this category of lifelong learning also resulted in the most integrative perspectives of role identity both within and beyond their academic contexts.

Reflection. In general terms, many of the students noted benefits from the process of constructing an ePortfolio, particularly the benefits of reflection. Students particularly saw reflection as a way to identify and understand accomplishments. As one student noted, this process was valuable not only for creating a website but also for learning how to present their accomplishments to potential employers:

> I look back and see wow, I did a lot of things, and know a lot of things, and have experiences, and it's nice to have thought about that before going to talk to someone and understanding how this teaching experience might be important even for a job that might not involve teaching. I think it is a useful exercise even if I don't use the webpage explicitly.

As seen in each of the categories, students continually reflected on their audiences, citing the importance of "focusing for a general purpose audience and a professional audience at the same time," worrying about "seeming arrogant," and the idea of providing your own "history . . . one step back from what we guard of our public persona." From the preponderance of such concerns, it is evident that the process of "curating" components of their professional and personal lives helped students create cohesive narratives and be more cognizant of their developing roles as professionals.

Concluding Remarks

This study explored the questions, "Do graduate students believe that their current experiences align with the roles they will perform in their academic careers?" and "How do graduate students' perceptions of their professional roles change during the process of constructing portfolios?" We analyzed quantitative results from a survey designed to measure students' perceptions of alignment between their current graduate experiences and their future careers, focusing on belief conditions about role identities as researchers and teachers. We also reported qualitative patterns from focus groups conducted with students who reflected on different components of their professions via constructing ePortfolios.

The survey findings suggest that misalignment exists in student perceptions of teaching role identities between current and future scenarios, while perceptions are more balanced in regard to research role identities. Furthermore, the quantitative results suggest that preparation of future faculty varies across institutions, even in programs that have developed practicum programs that explicitly seek to prepare students for academic careers.

The focus group discussions concentrated on students' responses to ePortfolio work that tasked them with providing evidence of accomplishments and with reflecting on multiple components of professional identity. Patterns from this data suggest that this process prompts students to engage in integrative thinking that involves processes of professional identity construction, which agrees with previous ePortfolio studies (Sattler & Turns, 2015; Turns, Sattler, Eliot, Kilgore, & Mobrand, 2012). The concerns highlighted by the students also show that they were engaged in a more cognizant "presentation of self" (Goffman, 1973), requiring communication that envisioned both their own goals and their multiple audiences.

This work also shows that graduate students can experience feelings of disconnection between their graduate experiences and their intended careers, even when those careers are in academia, and that constructing ePortfolios with multiple components can support reflective and integrative thinking that may mitigate that disconnect. In particular, students described positive outcomes from engaging in the challenge of writing narratives that incorporated experiences over time and accomplishments across roles. For example, creating portfolios that address the multiple role identities in their current and planned professional lives helped them identify and address gaps, discover and promote their strengths, and explore ways to balance their efforts and goals. As graduate students balance a variety of roles (Cast, 2003; Sweitzer, 2009), this type of practice and integration is important for both personal and professional development. The process also prompted them to consider their own professional image in view of large, amorphous audiences and to intentionally curate their digital presence.

These findings could be informative for graduate programs, especially those seeking to prepare future faculty. This misalignment of role identities between perceptions of graduate school and of future careers indicates that at the very least, graduate students experience feelings of lack of preparedness, which may indicate that graduate programs are not adequately preparing students for the roles their future careers will demand of them. We must ask whether we are disadvantaging future faculty and their students with programs in which current perceptions and future expectations are different. This national problem can be addressed at individual institutions but actually needs attention at the broader workplace level, as called for in the Boyer report on undergraduate education and the academic profession (Boyer, 1987; Boyer, Altbach, & Whitelaw, 1994) and supported in programs such as the National Engineering Teaching Institute (Felder, Brent, & Prince, 2015).

While practicum programs and research experiences help prepare graduate students for their roles as professors, activities like ePortfolios can enhance these experiences by giving students opportunities to envision possible selves and begin balancing their values and goals across roles of researcher and teacher. These types of reflective activities may even help students increase the quality of their work as graduate students and faculty and to examine productively ways to achieve work-life balance. The students in this study demonstrated that the ePortfolio process helps students examine struggles in ways that help them deal with imbalances along the way, making explicit the tacit assumptions of the profession and foregrounding internalized values and behaviors.

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