Research Article

Quantification of Engineering Disciplinary Discourse in Résumés: A Novel Genre Analysis With Teaching Implications

—Gracemarie Mike Fillenwarth, Mary McCall, and Catherine Berdanier

***Abstract*—Background:** *Undergraduate engineering students often receive insufficient support when crafting résumés. Most notably, there is often a lack of disciplinary-specific instruction and a lack of emphasis on the persuasive function of résumés. Ultimately seeking to strengthen instructional materials, this study investigates a way to quantify the quality of engineering résumés, focusing specifically on the use of disciplinary discourse.* **Research questions:** *How do engineering résumés exhibit disciplinary discourse? How can disciplinary discourse be quantified as a way of promoting strong engineering résumé writing and professional development skills?* **Literature review:** *This project builds on research exploring the qualities of effective résumés. It extends on work establishing disciplinary differences in desired résumé qualities, as well as work characterizing résumé writing as an opportunity for professional identity development. Grounded in activity theory, this project seeks to elucidate the "rules" of effective engineering résumés at the lexical level.* **Methodology:** *This project analyzed a corpus of 31 engineering résumés through both qualitative and quantitative means. Résumés were initially ranked via a rubric, then coded for disciplinary discourse according to the American Association of Engineering Societies' Engineering Competency Model. Disciplinary discourse scores were then analyzed through descriptive statistics.* **Results and conclusion:** *Significant differences in the use of disciplinary discourse were found among strong, moderate, and weak résumés. Though these results are not generalizable due to the small corpus size, they indicate that disciplinary discourse may be a fruitful area for future research on résumés and the development of pedagogical materials.*

Index Terms*—Communication, disciplinary discourse, engineering résumés, identity, professional development.*

As undergraduate engineering students begin their transition to the professional world, résumés serve a crucial gatekeeping function. More than a record of activities, this high-stakes document seeks to persuade readers of a student's achievement, expertise, and, as a result, competency as an aspiring engineer. Despite the importance of résumés in applications for co-ops, internships, research experiences, and jobs, a number of problems may impede students' ability to maximize the effectiveness of their résumés.

First, when not adequately contextualized, the rhetorical function of résumés can be overlooked; while students generally understand that their résumés play a critical role in decision-making processes by potential employers, the implications of résumés as persuasive documents are not always emphasized. That is, while students may have a general sense of what a "good résumé" should include, the specifics required to meet the needs of engineering audiences—such as practicing engineers, engineering recruiters, or engineering faculty—may not be considered in depth.

A second problem is that even if they have an awareness of their readers, engineering students may not have the disciplinary acculturation to understand what types of information best present their credentials. First-year and second-year engineering students who carry heavy course loads, who may still be navigating the transition from high school, and who may still be coming to terms with what engineering *is* probably lack a clear awareness of the qualities, behaviors, and competencies expected by résumé readers.

Engineering students who seek or receive information on how to write a résumé may encounter problems with obtaining sufficient assistance. Introductory courses in English or

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Practitioner Takeaway

- Undergraduate engineering students often do not receive sufficient disciplinary-specific instruction about résumé writing, particularly emphasis on the résumé's persuasive function.
- We devised a way to quantify the quality of engineering résumés, focusing specifically on the use of disciplinary discourse, and produced "rules" for effective engineering résumés at the word level.
- We found significant differences in the use of disciplinary discourse among strong, moderate, and weak résumés.

engineering programs often help students develop professional writing and résumé writing skills, but the information presented in these contexts is often based on adisciplinary, nonengineering-specific knowledge (with résumé advice often coming from the generalized "business" world). In other cases, instruction may focus more on form over content (for example, the use of parallel structure, action verbs, or bulleted lists).

Outside the classroom, writing centers and other writing support services often provide students with résumé writing assistance, but individual centers may not be set up to offer disciplinary-specific guidelines targeted toward engineering students. While writing center scholarship related to generalist versus specialist tutoring often advocates the benefits of discipline-specific writing support [1]–[3], especially in the case of engineering writing [4], suggestions like genre-specific tutor training are advised to mitigate the challenges of pairing students with specialist tutors [5].

In this paper, we seek to address the problem of disciplinary résumé instruction while simultaneously operationalizing the process of résumé writing in the development of engineering identity through discourse. This research theorizes engineering résumés through the lens of activity theory as a subset of Vygotskian Sociocultural Theory. Through this theoretical framework, we establish the résumé not as an acontextual document that should adhere to generalized adisciplinary guidelines, but rather as a document situated within a system of activity with particular disciplinary rules and expectations. We specifically focus on disciplinary discourse, seeking to understand how choices made at the word and sentence level reveal a writer's integration into the engineering discipline. We argue that the process of résumé development has the potential to help students learn the disciplinary values of engineering and their employers, teach students how to shape their engineering résumés to correspond to the disciplinary values of their employers, shape how students view themselves professionally as engineers, and ultimately guide the choices students make in their professional development.

Considering engineering résumés in this light, we present a genre analysis study designed to elicit a greater understanding of the characteristics of successful U.S. engineering résumés through quantitative and qualitative methods. In this study, a corpus of résumés was first evaluated using a rubric designed for engineering résumés; the résumés were then coded quantitatively using the American Association of Engineering Societies' (AAES) Engineering Competency Model as an *a priori* coding mechanism. The numerical nature of the model was harnessed to "score" engineering discourse, and the statistical comparisons between qualitatively strong, moderate, and weak résumés indicate the ability to measure disciplinary discourse. Based on this preliminary data, we argue that disciplinary discourse may be an effective lens through which to develop interventions in the professional development of early-career engineering students—interventions that can make résumé writing a transformative experience of identity development for undergraduate engineering students.

Literature Review

In this section, we describe past studies of résumés, examining trends in research. We look particularly at studies related to business, STEM, and technical communication fields, with a particular focus on studies exploring résumé ranking by industry professionals and studies with pedagogical implications.

As a document that blends both disciplinary knowledge and writing practices, résumés are one form of written communication that can help to reveal some similarities between disciplines with respect to professional identity formation and

representation. A review of scholarship related to résumés across five major journals in technical communication (*Technical Communication*, *Technical Communication Quarterly*, *Journal of Technical and Business Communication*, *Journal of Technical Writing and Communication*, and IEEE *Transactions on Professional Communication*) reveals an interesting trend: Résumé-specific research was prevalent in the 1990s and then dropped off until a recent uptick in the 2010s.

Earlier topics related to résumés included an overview of the genre [6]–[9] and its components such as references [10]; attention to design principles [11]; focus on writing quality [12], [13]; and an analysis of varying perceptions between recruiters, teachers, and students [14], [15]. More recent résumé-focused research considers writing for the web [16], [17]; résumé writing practices in China [18]; and the sources that students turn to for résumé advice [19], trends that reflect the growing influence of digital writing and globalization on professionalization. Scholarship on résumés in STEM education follows a similar trend, with topics in the 1990s on market preparation for students and using résumé assignments in revisions to engineering curricula [20]–[24]. In the 2000s and 2010s, attention shifted to career pathways for minority students in STEM and the study of leadership competencies in job descriptions for entry-level engineering positions [25], [26]. Randazzo [19] provides a recent, comprehensive review of scholarship on résumés across additional disciplinary fields including business communication, career development, and applied psychology.

Although the digital and global age has shaped the ways in which the rhetorical nature of the résumé is studied, an early and persistent interest in the genre has been identifying similarities and differences between how industry professionals, writing instructors, and students approach composing this type of document. McDowell's [15, pp. 182–183] survey of 87 recruiters, 34 teachers, and 19 students who completed the assessment of college résumés and cover letters questionnaire indicated that all three groups agreed about résumé and cover-letter length (one page) and on the importance of proofreading. The ranking of résumé categories, though, revealed more incongruity: While recruiters believed that job objectives/career goals and employment history are more important, instructors assigned this ranking to educational history [15, p.188].

Similar findings were echoed in Harris's [14, p. 254] co-op approach to a résumé assignment in which he asked local personnel managers of two industrial firms to comment on his students' résumés. Harris noted that he and the managers were in consensus about "careless and unclear writing," but that the managers were "more sensitive to points related to their specific corporate needs." This early research shows that while generic résumé "rules," such as page count and avoidance of mechanical errors, can be easily agreed upon, more nuanced disciplinary expectations can result in divergence between disciplinary and nondisciplinary values.

A reliance on these generic rules might also make industry professionals who have little to no background in writing instruction feel more comfortable in assessing résumés. In their study of 18 campus recruiters who analyzed 72 fictitious mechanical engineering résumés, Charney and Rayman [13, pp. 46–47] concluded that these recruiters typically prefer relevant work experience as well as error-free résumés. In fact, these recruiters valued mechanics so highly that they gave higher ratings to résumés with low-relevance work experience but error-free mechanics than to those with more relevant experience but mechanical errors [13, p. 47]. Even though identifying mechanical issues over stylistic ones may be easier for those with less experience in evaluating writing, the absence of grammatical errors may be viewed as a reflection of the applicant's professionalism and attention to detail. Overall, the recruiters did "give considerable weight to writing quality" [13, p. 51] and ultimately considered "the primary function of a résumé to be demonstrating communication skills" [13, p. 50].

It is also important to consider, though, how this same genre can reflect disciplinary differences when it comes to professionalization via writing. In a follow-up study, Charney et al. [12] analyzed how 47 business recruiters evaluated 36 fictitious marketing résumés compared to the engineering recruiters' responses to engineering résumés within the previous study and found that the two groups overall had different writing preferences. While both sets of recruiters valued résumés that reflected relevant work experience and were error free, the engineering recruiters were more sensitive to the types of elaborations of project and professional experience than the business recruiters. More specifically, the engineering recruiters expressed preference for title or method elaborations—those that described the name of a

project and its application of an engineering design or concept—than purpose elaborations that communicated what the project set out to do [12, p. 58]. This preference is likely due to the importance that engineering disciplines place on the "elegance, efficiency, and efficacy of the design and its execution" as opposed to the purpose of the device or object itself [12, p. 60]. On the other hand, "formulating the purpose of a marketing study is a crucial part of the work of the marketing researcher" [12, p. 60], which is a strong reason for why the marketing recruiters valued résumés' purpose elaborations more highly.

When Charney et al. [12, p. 70] asked business writing students to evaluate the marketing résumés and technical writing students to assess the engineering ones, they found that both sets of students' ratings tracked the recruiters' evaluations in their respective discipline. Thus, although the recruiters' résumé writing values differed, this study reflects how students can become attuned to the particular rhetorical maneuvers of their professional discourse communities [12, p. 70]. Such progression is not an easy achievement, though, especially with the multiple and often conflicting sources of information related to résumé writing that students seek out. Randazzo [19] specifically studied these sources of advice via surveys, interviews, and focus groups with 86 undergraduate students and 20 career counselors and instructors. Her findings indicate that academic sources (e.g., instructors, career counselors, and writing center tutors) are the most popular avenue of support, followed by nonacademic sources (such as family, friends, classmates, and bosses), web material, and textbooks [19, p. 283].

Although many students saw the internet as a free source of information, relevant with respect to résumé trends, and often more available than instructors and managers, they also noted the higher possibility of receiving conflicting information and finding generic résumé examples [19, pp. 285–286]. The fact that fewer students consulted textbooks due to concerns of outdated information, irrelevance of the content to their field, and generic templates was particularly notable given that many of these students were recruited from professional and technical writing courses [19, pp. 286–287].

Particularly noteworthy to professional and technical writing instructors are the two factors that influence how students assess a source's credibility: relevance and contradiction. The students in Randazzo's [19, p. 284] study believed a source to be less credible the less relevant it was to their field or the more contradictory it was compared to other sources. Randazzo [19, p. 288] argued that these perceptions of credibility can have troubling outcomes for technical communication instructors because "educators who do not have experience in a student's career field can lose credibility." While an industry resource may have more relevant professional experience than an academic one, Randazzo [19, p. 288] noted that that students (especially those from working-class backgrounds) may have less access to them. In addition, these sources may be less likely to direct students' attention to the rhetorical aspects of résumés such as audience analysis, research, analysis, and critical thinking. Consequently, Randazzo [19] proposes a "reimagined" résumé assignment that asks students to conduct both primary and secondary research as they construct their job documents. This approach would allow students to build professional networks, reflect on conflicting résumé advice, and, in turn, become better evaluators of these suggestions, and see their writing instructors as credible sources of rhetorical information [19, p. 289]. She views such an assignment to be empowering for students because it involves synthesizing and evaluating both general and industry-specific résumé advice, while legitimizing the rhetorical expertise of their instructors.

Our study continues and extends both past and more recent research on résumés like Randazzo's by considering how résumé writing can be a form of professional identity formation for undergraduate engineering students. By crafting a discipline-specific résumé, students not only "learn to write" by developing their résumés according to the expectations of their specific engineering discipline, but also "write to learn" in the sense of honing their professional identity as engineers. Such expectations go beyond adhering to typical résumé style and formatting guidelines to being attentive to how one persuasively conveys engineering expertise and experience through coursework, projects, and professional development.

Charney and Rayman [13, p. 48] discuss whether title, purpose, or method elaborations of academic or professional experience are more rhetorically appropriate, and conclude that method elaborations "provide more evidence of the writer's abilities as an engineer." Similarly, our genre

analysis of the résumés from undergraduate engineering students to advanced professional engineers seeks to identify types of ethos-building moves to argue how students can persuasively construct these living documents to position themselves as emerging professionals in their field. By presenting one method of analyzing the disciplinary discourse present in industry-specific résumés and its connection to the articulation of a professional persona, we offer another pedagogical application similar to Randazzo's that can be adopted by technical writing instructors to support students' résumé-writing practices.

Theory

This section describes the theoretical background that guides our study. We first discuss more generalized concepts of Vygotskian Sociocultural Theory (VST) and Activity Theory as ways of analyzing disciplinary activities. Then, we narrow our focus to language, specifically focusing on "disciplinary discourse" as a measure of disciplinary identity.

Vygotskian Sociocultural Theory/Activity Theory VST is the analytical basis for this paper. It posits that human cognition is facilitated and mediated through social activities, contexts, and tools. A subset of VST is activity theory, through which cognition and learning can be studied as the result of a person's interactions with her or his physical and social surroundings. An activity system is comprised of subjects acting through internal or external mediating artifacts or tools to generate an object relevant to a larger community. Rules govern the interactions between subjects and objects, and the divisions of labor (roles) govern the ways in which community members interact with the object [27].

In this study, the activity of interest is the argumentation about engineering experience within engineering résumés. The subject of interest is the engineer who writes the résumé. Engineers use tools (the computer, writing knowledge) to create a résumé (object) that is relevant to a broader scientific and professional community, specifically, those community members who have the power to hire students or who are judging the merit of the engineers. Engineers must follow the rules of résumé writing and the expectations of the engineering community to convince the résumé reader that they have merit and would add value in a future job or position. Through the engineering résumé writing activity, the outcome of the system is either a job or a favorable judgment of engineering achievement.

The junction of interest under study is the "Rules" portion of activity theory [27]: Applicants must address the criteria ("rules") of the résumé such that they achieve an interview or job offer. Many engineering communication instructors may teach the "rules" of engineering résumé writing from the point of view of general résumé formatting rules, based on business templates, or on general, adisciplinary guidelines. However, we posit that there may also be disciplinary expectations and "rules" for engineering résumés that arise from the engineering community about which the communications community may not be aware. Therefore, a more thorough understanding of these (potentially implicit) rules for engineering résumés will guide instructors in teaching engineering résumé writing to engineers in ways that will be most helpful to them as future engineers.

Disciplinary Discourse Given the complexity of academic and professional disciplines, we identify the concept of "disciplinary discourse" as a tangible measure of an engineer's identification with the discipline of engineering. Bazerman explored the connection between language and disciplinarity in the 1980s, demonstrating that the disciplinary activity of writing is intimately tied to a discipline's epistemological values [28]–[30]. Though Bazerman [28, p. 362] notes that examination of texts alone "gives no firm evidence about the actual intentions of the authors and the actual understanding of the readers," he argues that analyses of disciplinary discourses "reveal the intentions and meanings available in the text," as authors writing for disciplinary audiences must navigate "the object under study, the literature of the field, the anticipated audience, and the author's own self." The most successful texts, Bazerman [28, p. 363] argues, are those that "establish a workable balance" among these four contexts, thereby aligning the documents with the expectations of the discipline for which it is written.

The dependency of writing on (and reflective of) disciplinary values has been connected to the idea of tacit knowledge [31], and many scholars have sought to explore and uncover the implicit though vital "rules" that make disciplinary discourses effective. One particularly prolific area of study is genre analysis, in which researchers analyze the "moves" and "steps" that writers in a field or discipline make in different genres. Springing in large part from Swales's work, research that

examines the characteristics of various academic genres and the process by which writers learn these genres abounds. Researchers in English for specific purposes and English for academic purposes have especially embraced the close study of texts to make visible the ways that texts are constructed and have meaning within various disciplines. While originally this research sought to assist non-native English-speaking undergraduate students by demystifying academic writing conventions used in the college classroom, these fields' research has broadened, now including the study of academic disciplines as a whole [32, p. 1].

In continuing to refine genre analysis, researchers have called attention to the fact that genre mastery within a field of study "includes more than knowledge about textual structures" [33, p. 234] or conventions. Rather, genre mastery emerges from "taking on the discipline's identity" [33, p. 234]. Taking this claim further, Hyland stressed that language use is not only an indicator of one's identity within a particular discipline but constitutive of it. He claimed that "individuals identify themselves, and are identified by others, largely through their use of a language," meaning that "we are what we write. An engineer is an engineer because she or he communicates like one and the same is true for biologists, historians, and linguists" [34, p. 25].

Extending Hyland's views, we argue that the discursive elements of engineering résumés serve as indicators of engineers' identification with their discipline. Following researchers who have examined disciplinary discourse at the level of language use—for example, [35]–[38]—we examine the discursive moves that résumés writers make in the field of engineering. Focusing our analysis, particularly on lexicon, we explore how writers' adoption of "disciplinary discourse" may reflect their awareness of the "rules" by which engineering operates as a discipline. We posit that engineers who enact these "rules" through their lexical choices display a stronger sense of identification with the discipline of engineering, and we seek to develop an understanding of how this knowledge may be operationalized to guide undergraduate engineering students' professional development through résumé writing.

Given previous research and this theoretical orientation, this study of a corpus of 31 engineering résumés addresses the following research questions:

RQ1. How do engineering résumés exhibit disciplinary discourse?

RQ2. How can disciplinary discourse be quantified as a way of promoting strong engineering résumé writing and professional development skills?

Methods

In this section, we describe the methods we employed in investigating disciplinary discourse within engineering résumés. First, we discuss our methods for recruiting participants and building a corpus of engineer résumés for analysis; we also provide demographic information on participants who contributed to the corpus. Next, we describe the two methods of analysis that we employed to assess the overall quality of the résumés and measure the level of disciplinary discourse present in these résumés. Within this discussion, we describe our use and modification of the AAES Engineering Competency model, which served as a coding schema. We provide examples of the way that we employed this model in our analysis of disciplinary discourse.

Participants, Recruitment, and Corpus

Résumés were collected from engineers at a variety of stages in their careers through snowball sampling methods [39]. After obtaining Institutional Review Board approval, we sent a recruitment email to division chairs of the American Society for Engineering Education, asking them to forward our research request email to the members of their divisions. The email included a link to an online survey, which asked participants to fill out demographic information, complete a brief questionnaire about their engineering preparation, and upload their current engineering résumé. The recruitment text sent asked all participants to forward our link and recruitment email to other engineering professionals or engineering students. A total of 135 people responded to the survey.

After scrubbing the data to eliminate respondents who did not upload résumés and those who uploaded a curriculum vitae instead of a résumé, we obtained a corpus of 31 engineering résumés. Within this corpus, 12 résumés came from engineering undergraduate students and seven were submitted by engineering graduate students. Of the practicing engineers who submitted résumés, three hold bachelor's degrees, three hold master's degrees, and seven hold Ph.D. degrees. In total, 17 of the submitted résumés came from

women, which is overrepresentative of engineering (averaging around 20% women across disciplines and educational levels) [40]. We did not quota sample for experience level, engineering discipline, gender, or any other demographic.

Analysis Methods Data were analyzed through two different methods to best understand the ways in which engineering students and professionals construct their résumés. First, a rubric analysis was conducted on the résumés within the corpus to "rank" them according to a previously validated rubric for résumé analysis and grading (adapted by the University of Iowa's College of Engineering) [41]. This rubric was selected because it was one of the few readily available on the internet that was specifically intended for an engineering audience, and included criteria for both technical language and design aspects within its criteria. Although other rubrics exist, most are not engineering specific or do not incorporate both technical and nontechnical aspects of résumé writing and design principles into the criteria. The résumés were ranked according to this rubric into three strata: 12 were "strong résumés" (achieving mostly "3s" on the résumé evaluation rubric), 10 were "moderate résumés" (achieving mostly "2s"), and 9 were "weak résumés" (achieving mostly "1s" according to rubric criteria).

This method of assessing the quality of the disciplinary discourse within engineering résumés was incomplete, because the rubric criteria remained vague in terms of exhibiting mastery of engineering skills and knowledge, leaving it to students or evaluators to decide how much is enough. This level of analysis brought us to the same point that we had established in the literature review: That a variety of resources show "best practices" for résumé writing but ultimately rely heavily on an adisciplinary interpretation of quality that hinges on design and arrangement of the résumé.

As a result, we posited that the "density" of engineering activities and language would be higher in strong résumés and, therefore, that the arguments within engineering résumés should be coded according to disciplinary discourse patterns. Genre analysis, as a subset of content analysis methods, was selected as the method to understand the purposeful rhetorical "moves" within an engineering résumé. The theoretical underpinnings for content and genre analyses stem from the idea that concepts or patterns identified over a corpus have significance or legitimacy to the discourse community that they represent [42].

More specifically, in the résumé setting, each résumé entry (e.g., position title or employer) and corresponding descriptions are selected by the writer because the writer thinks that it represents an important attribute about his or her professional aptitude or identity to the employer. Therefore, employing a genre-based model of content analysis is a natural step in understanding the underlying reasoning patterns of engineering résumé writers.

The coding scheme was developed from existing literature on the attributes and definitions of engineering from the AAES "Engineering Competency Model" for engineers [43]. The six-tier model demonstrates the technical and nontechnical skills required for engineers, ranging from Tier 1: personal effectiveness competencies to Tier 6: job specific competencies. Examples of each tier are provided in the model, and summarized in Table I. This model was used as an *a priori* coding schema and was adapted to include further activities that emerged from the engineering résumé data set (with adapted elements in bold). For example, the engineering competency model did not address activities such as teaching, grant writing, or global competencies—areas that are central to the roles of engineers in both industry and academe. The engineering résumés were coded to agreement on all classifications by the three researchers on the project.

The résumés were coded at the phrase or idea level according to "tier," as the attributes in the résumé matched competencies in the engineering competency model. For example, a résumé demonstrating "Leadership of a team of 10 engineers" would be assigned a code of 6 (because leadership falls within Tier 6 competencies), whereas a mention of "Strong interpersonal skills" was given a code of 1 (because those skills fall within Tier 1 competencies). Lists of coding languages or programming and software skills were separately coded as being individual attributes, because they show disciplinary knowledge and familiarity with the essential tools of an engineering profession. Three examples of our coding mechanism are shown in Figs. 1–3.

An unintentional effect of the AAES coding schema was that generic and nonspecific résumé entries and language tended to involve lower tier skills, while the entries that demonstrated strong disciplinary skills (while often "showing" nontechnical skills simultaneously) fell within higher tiers due to their specificity and demonstration of engineering skills. Therefore, the

TABLE I
ENGINEERING COMPETENCY MODEL FROM THE AAES [43]

Coding Score	Tier	Description and Examples (Researcher Additions in Bold)
1	Tier 1: Personal Effectiveness Competencies	Interpersonal skills; integrity; professionalism; initiative; dependability and reliability; adaptability and flexibility; lifelong learning
2	Tier 2: Academic Competencies	Reading; writing; mathematics; science and technology; communication (verbal, written, **visual**); critical and analytical thinking; basic computer skills; **school-related research skills**
3	Tier 3: Workplace Competencies	Teamwork; client/stakeholder focus; planning and organizing; creative thinking; problem-solving and decision-making; seeking and developing opportunities and solutions; working with tools and technology; scheduling and coordinating; checking, examining, and recording; business fundamentals; **(general) teaching**
4	Tier 4: Industry-Wide Technical Competencies	Foundations of engineering; design; manufacturing and construction; operations and maintenance; ethics; business, legal and public policy; sustainability and societal/environmental impact; engineering economics; quality control and quality assurance; safety; health; security and environment; **general research competency; ability to write grants; publish internal reports; global competency**
5	Tier 5: Industry/Sector Functional Areas	Competencies to be specified by company representatives; **Demonstration of specialized expertise; industry-specific research; teaching at university level as expert; obtain advanced degrees; obtain industry-specific funding; member of professional societies; note research advisor (vetting to professional community)**
6	Tier 6: Job-specific Competencies	Occupation-specific requirements; management competencies; staffing; informing; delegating; networking; monitoring work; entrepreneurship; supporting others; motivating and inspiring; developing and mentoring; strategic planning and action; preparing and evaluating budgets; clarifying roles and objectives; managing conflict and team building; developing an organizational vision; monitoring and controlling resources

[Note: Excerpt is the "Skills" portion of the Résumé]

- Computer: **LabVIEW, SolidWorks**, PowerPoint, Microsoft Excel, Word, Publisher, and **Visual Studio**
- Laboratory: Waste water treatment, TCLP tests, safety measures, titrations, documentation
- Communication: Strong public speaking, presentation, and writing skills. Presented for clients in EPICS I & II and Environmental Field Session.

Tier 2: Academic competencies (underlined)

Tier 3: Engineering-specific competencies (boldfaced)

Fig. 1. Excerpt entry from an engineering undergraduate student résumé demonstrates a coding example with several lower tier codes in one entry.

"tier codes" simultaneously worked as a quantitative scoring mechanism and as a qualitative measurement technique. As an example, the tier codes in Fig. 3 sum to a total score of 16 for the entry, whereas the tier score for example 2 is 116. Qualitatively, this makes sense: Just by reading the text in the examples, the density of high-level technical disciplinary discourse is much greater in Fig. 2. Our method of coding and easily quantifying the qualitative data based on the AAES tiers affords the ability to easily quantify the qualitative dataset [44] to measure disciplinary discourse.

The tier codes were summed over the document, and then divided by the total number of codes, the total number of entries, the number of categories in the résumé, and the number of pages in the résumé to provide average disciplinary "densities" in the engineering résumés as a function of these variables. This is proposed to be the "Disciplinary Discourse Density" measure, where the calculations are performed as follows:

Overall Disciplinary Discourse Density = *Sum* of Tier Codes/# Total Codes
Entry Disciplinary Discourse Density = *Sum* of Tier Codes/# Resume Entries
Page Disciplinary Discourse Density = *Sum* of Tier Codes/# of Pages in Résumé

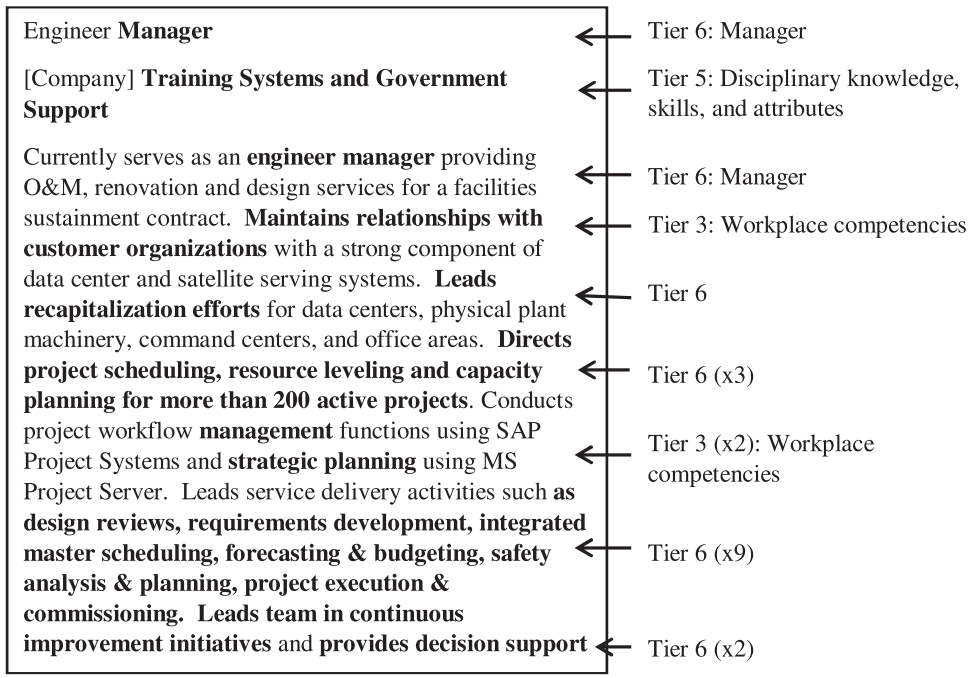

Fig. 2. Excerpt entry from an M.S.-holding industry-employed engineering résumé demonstrates coding example with several high-tier codes in one entry.

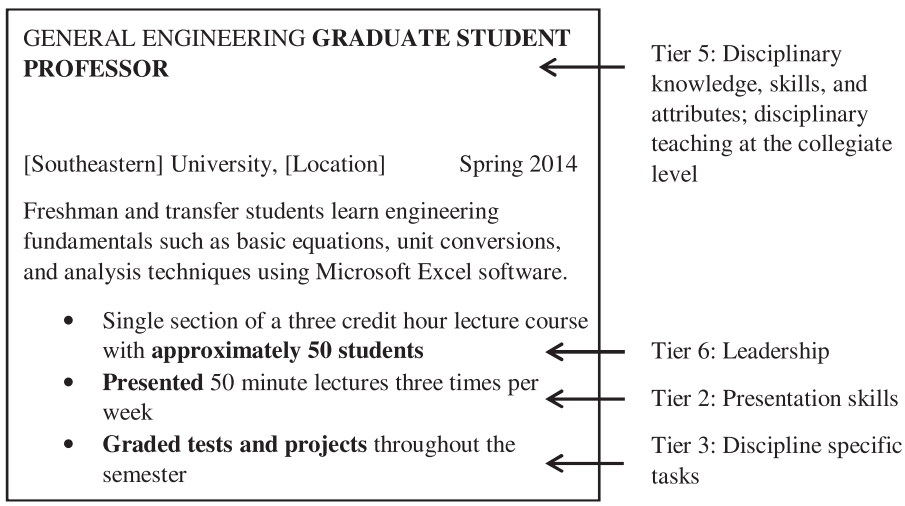

Fig. 3. Excerpt entry from a Ph.D. engineering student résumé demonstrates a coding example with a mix of high- and low-tier codes in one entry.

Although this numerical model may be a nontraditional way of showing the underlying patterns in textual data, especially in the engineering and professional communication research and practice community, we assert that this is a new way to describe and quantify the disciplinary discourse present in an engineering résumé. Simple statistical tests calculate the effect size of the differences between the groups of engineers.

Though the corpus of 31 résumés is appropriate for qualitative data, it is prohibitively small for a quantitative study. As a result, our statistical results should be taken as preliminary data, and uncovered trends should be tested in the future with a large enough sample of engineering résumés to confirm statistically significant differences between the categories. However, in the meantime, the findings suggest that using such a "density" measurement is a way of measuring engineering résumé quality using a combination of a traditional

TABLE II
DISCIPLINARY DISCOURSE DENSITIES OF STRONG ENGINEERING RÉSUMÉS

Participant	Overall Discourse Density	Entry Discourse Density	Page Discourse Density
Senior Undergraduate	3.5	12.4	247.0
Engineering Analyst (PhD)	3.8	10.9	111.8
Junior Undergraduate	3.2	12.4	198.0
Senior Undergraduate	3.4	16.5	181.0
Senior Undergraduate	2.7	11.3	169.0
Senior Undergraduate	3.2	17.4	244.0
Asst. Eng. Professor	4.6	12.8	112.0
PhD Grad Student	3.4	12.5	187.0
Design Manager (MS)	4.7	16.6	228.5
Firmware Engineer (PhD)	3.5	18.9	265.0
Senior Undergraduate	3.4	13.6	163.0
Senior Undergraduate	3.3	11.9	214.0
Average	**3.6**	**13.9**	**193.4**
Standard Deviation	**0.54**	**2.56**	**47.64**

résumé rubric with genre analysis to interpret the disciplinary discourse density.

RESULTS

In this section, we describe the results of our study. As previously mentioned, this study involved the coding and analysis of a corpus of 31 résumés submitted by a range of individuals from the first-year engineering student through the retired professional engineer. Our goal with this study was to answer our research questions:

RQ1. How do engineering résumés exhibit disciplinary discourse?

RQ2. How can disciplinary discourse be quantified as a way of promoting strong engineering résumé writing and professional development skills?

The results of our analysis are shown in Tables II–IV. The separate tables show the attributes of the strong, moderate, and weak engineering résumés (per the initial rubric analysis) such that the different distributions in disciplinary discourse density can be seen between them. The attributes of participants are shown in the tables to show the breadth of experience levels demonstrated by the participants. The data also confront the misconception that a "strong" engineering résumé is only achieved by expert-level engineers: In fact, there are both expert-/professional-level engineers and undergraduate engineering students, and engineers from both academe and industry in each of the three levels of résumé quality. Thus, there is not a tendency for a "good" résumé to come only from students or from professionals. Rather, a strong résumé is one that best highlights one's achievements and proficiency with disciplinary content. The tables show the various disciplinary discourse densities for the résumés.

The overall disciplinary discourse density (i.e., the average tier level of the résumé per code attributed) does not differ significantly among the three different categories. This finding reflects the fact that the corpus contained very long résumés filled with many low-scoring codes and shorter résumés with higher scoring codes that, on average, balance out in each of the categories. This finding was interesting but not particularly compelling because it did not quantify the distinct "quality" changes among the résumés in the three categories.

The average tier level for each entry in the résumés differs only slightly between strong and moderate quality résumés, and between moderate and weak

TABLE III
DISCIPLINARY DISCOURSE DENSITIES OF MODERATE ENGINEERING RÉSUMÉS

Participant	Overall Discourse Density	Entry Discourse Density	Page Discourse Density
Adjunct Prof./ retired NASA Engineer	5.1	12.0	140.3
Eng. Professor	3.9	7.2	72.3
PhD Grad Student	3.5	12.2	207.0
Senior Undergraduate	3.3	7.9	119.0
Associate Eng. Professor	4.1	13.4	89.0
Senior Undergraduate	2.6	10.3	82.0
PhD Grad Student	4.5	17.9	269.0
Engineering Teacher (terminal BS degree)	5.0	18.4	129.0
Engineering Analyst (terminal BS degree)	3.7	7.2	49.3
PhD Grad Student	3.2	9.4	106.3
Average	**3.9**	**11.6**	**126.3**
Standard Dev.	**0.76**	**3.86**	**63.03**

TABLE IV
DISCIPLINARY DISCOURSE DENSITIES OF WEAK ENGINEERING RÉSUMÉS

Participant	Overall Discourse Density	Entry Discourse Density	Page Discourse Density
Eng. Professor (terminal Master's)	5.3	7.3	114.0
Asst. Eng. professor	3.7	11.5	88.0
Junior Undergraduate	2.6	6.5	71.0
Associate Eng. Professor	4.6	4.6	52.0
PhD Grad Student	4.6	16.2	81.0
Senior Undergraduate	4.1	7.4	111.0
Senior Undergraduate	2.4	6.9	76.0
Senior Undergraduate	2.4	5.5	60.0
Assistant Eng. Professor	3.8	8.9	71.3
Average	**3.7**	**8.3**	**80.5**
Standard Deviation	**0.99**	**3.35**	**19.82**

résumés. This finding was more aligned with our initial hypothesis and expected results, because it shows that, on average, each entry exhibits higher levels of disciplinary discourse in the stronger engineering résumés. Although differences were noted, as shown in Table V, because of the small sample size, those differences did not manifest at a statistically significant level.

The most interesting result occurs with the statistically significant differences that occur at the page level (calculated through a two-tailed Student's *t*-test) measuring the overall sum of the tier scores per résumé page, between the strong and moderate and moderate and weak categories with large effect sizes (indicated by the Cohen's d scores). A summary of the results is shown in

TABLE V
STATISTICAL SIGNIFICANCE OF AVERAGE DATA FOR STRONG, MODERATE, AND WEAK ENGINEERING RÉSUMÉS

Strength of Résumé	Strong (SD) N = 12	Moderate (SD) N = 10	Weak (SD) N = 9
Mean Overall Disciplinary Discourse Density	3.6 (0.54)	3.9 (0.76)	3.7 (0.99)
Mean Entry Disciplinary Discourse Density	13.9 (2.56)	11.6 (3.86)	8.3 (3.36)
Mean Page Disciplinary Discourse Density	193.4* (47.6)	126.3 (63.03)	80.5** (19.82)

*Between strong and moderate: $p = 0.01$, Cohen's d = 1.20
**Between moderate and weak: $p = 0.05$; Cohen's d = 0.98

Table V. The mean page disciplinary discourse density for the strong engineering résumés (i.e., the average disciplinary discourse tier per page of a résumé) is $\overline{x}$ = 193.4 (SD = 47.5) compared with that of the moderate résumés $\overline{x}$ = 126.3 (SD = 63.03). The difference between the two is statistically significant ($p = 0.15$; d = 1.20). Similarly, the difference between the moderate and weak categories is also statistically significant ($p = 0.05$; d = 0.98).

Because of the study's small sample size ($N = 31$) and the exploratory nature of this particular research, these statistical results cannot be generalized to the engineering community at large. However, the significant differences between the disciplinary discourse density scores in the strong, moderate, and weak engineering résumés indicate that this may be a fruitful area to continue exploring, working further to quantify engineering discourse and use of disciplinary rhetoric within engineering résumés.

DISCUSSION

In this section, we discuss the results of our research in light of the literature on résumés, and we interpret our findings through activity theory. We also describe the implications of this paper for educational interventions and general pedagogical approaches. Finally, we discuss limitations of this project and offer suggestions for future work.

Relationship of Findings to the Current Literature The findings from this genre analysis are consistent with Charney and Rayman's [13] and Charney et al.'s [12] previous research on engineering résumés. More specifically, this study's findings that Tier 1 and Tier 2 codes appeared throughout the corpus mirror Charney and Rayman's [13] findings on the preference of engineering recruiters for error-free résumés. Our findings give more insight into why Tier 1 and Tier 2 skills are, in fact, important: They contribute toward the development of the engineer's ethos by showing mastery of the foundational skills upon which specialized engineering skills are built. Regarding Charney et al.'s [12] findings, the present study illuminates the reasons that engineering recruiters prefer résumé entries that pinpoint particular engineering concepts or skills. The competencies appearing in Tiers 4–6 exhibit advanced experience in and understanding of the nature of engineering work.

This study illustrates that the most successful engineering résumés, regardless of the writer's level of experience, exhibit the writer's proficiency at each tier of the engineering competency model. Though the lower tiers are necessary to establish basic personal competencies, by themselves, they are not enough to convey a candidate's expertise and preparedness for an engineering position. Résumés featuring a higher concentration on entries in the upper tiers led to a higher disciplinary discourse density and, consequently, a level of rigor that is likely to appeal to recruiters. As was seen in many of the higher scoring résumés, a single entry could receive multiple codes depending on how it was worded. These findings suggest that résumé writers can be more successful if they work to embed multiple competencies within each item on their résumé.

Relationship of Findings Through Activity Theory and Landscape of Practice Theory The rubric analysis for this study shows that level of engineering experience alone is not enough to

distinguish among strong, moderate, and weak résumés, as each category included résumés from undergraduate engineering students to highly experienced professionals. Drawing on activity theory, we theorize that the strength of a résumé lies in the adoption of the typically unspoken "rules" of engineering résumés. While these "rules" are wide ranging and include facets of résumé creation such as choice of experiences included, organization, and visual design, this study suggests that disciplinary discourse, or the lexical choices a résumé writer makes, can also be considered as part of the "rules" that characterize a successful engineering résumé.

As activity theory posits, these "rules" for writing a successful résumé are not necessarily acquired naturally or even with experience. Although a weak scoring résumé does not necessarily indicate a lack of engineering proficiency, it does suggest the possibility of a writer's lack of deep integration into the activity system of engineering. That is, some résumé writers may lack awareness of how to articulate their proficiencies to other engineering professionals in language that is recognized or valued by those professionals. In some cases, this failure to adhere to the "rules" of engineering résumés may be perceived as indicating a lack of understanding of the principles, values, and expectations that characterize the field of engineering. To use Hyland's argument that "we are what we write" [34, p. 25], our findings suggest that those who do not use the discourse that engineers use or do not follow the "rules" of engineering activities may potentially struggle to make a persuasive case for their proficiency as engineers.

Considering these findings from an educational perspective, we believe that this research points to the value that an explicit discussion of résumés through the lens of disciplinary discourse and other generic "rules" might have for aspiring engineers. Especially during the complex and time-intensive transition from engineering student to practicing engineer, the candid discussion of the competencies and proficiencies embodied by successful practicing engineers may be helpful for students as they both seek to convey the value of their experiences and plan future professionalization activities. A particular focus on language's role in the development and articulation of identity may aid students in creating more effective résumés. By helping students to understand the language (and, therefore, the values) of engineering activity systems, educators may be able to assist students in their transition into the engineering community.

While this study was based in activity theory, our findings illuminate an opportunity in the future to also view the task of résumé writing through landscapes of practice theory. The résumé's embedded goal of persuasively arguing one's disciplinary expertise also holds promise in connecting Wenger–Trayner et al.'s [45] concept of landscapes of practice to career preparation. This idea builds upon Wenger's original description of communities of practice, which characterizes the process of learning as community (belonging), practice (doing), meaning (experience), and identity (becoming) [46, p. 5]. People often belong to many communities of practice that can range from the home to the workplace and include academic disciplines, sports teams, clubs, and other social interest groups.

Formed by a constellation of complex relationships between individual communities of practice, a landscape of practice reflects a person's knowledge of his or her profession that is accumulated "not only in practicing the occupation, but also in research, teaching, management, regulation, associations, and many other relevant dimensions" [45, p. 15]. Similarly, a résumé can demonstrate a student's engagement in and understanding of a particular engineering landscape of practice through the thoughtful development of the document's typical categories, such as education (e.g., pursuit of an engineering degree and completed specialized courses), course projects (e.g., demonstration of engineering principles in design-based classes), teaching experience (e.g., work as a teaching assistant for engineering courses), and extracurriculars (e.g., involvement in discipline-specific organizations and professional associations). Through résumé writing, students become involved in acts of engagement, imagination, and alignment—or modes of identification [45, p. 28]—that help them assess their landscape of practice and their position within that landscape.

Development of Educational Interventions and Implications for Instructors Overall, the findings of this study illustrate that the effectiveness of engineering résumés does not lie solely in the quality of an engineer's experiences, adherence to generic résumé writing "rules," or to correct grammar and mechanics. Rather, the success of a résumé is related to the writer's ability to convey his or her qualifications in a way that matches the rules, values, and needs of a disciplinary audience. This study suggests that educators and those involved in professionalization

can use the résumé as an opportunity to help students further integrate themselves in their engineering activity systems or landscapes of practice. Ideally, educators in this position would use résumés to help students learn more about the fields they seek to enter, while also motivating them to gain experiences that would be valuable to them in their future careers.

For example, our findings suggest that research-based educational interventions can be developed and employed at the undergraduate level to help both professionalize students and enhance their abilities to communicate their skills in a way that resonates with prospective employers. We propose that such an intervention can take place in the form of a module or workshop for undergraduate engineering students. During this intervention, the engineering competency model would be presented to students, and students would spend time reflecting on the various tiers of expertise the model represents. Next, students would revise their résumés, attempting to make each unit correspond to as many tiers as possible, with a special emphasis on presenting their experience in a way that corresponds to higher-level tiers. Students would then reflect on their achievements and future goals, and devise plans for future professional development activities. (See [47] and [48] for additional information and examples.) These are by no means the only ways that this model for quantification of disciplinary discourse can be applied, and we are interested in hearing others' application in research or in practice of the ideas presented here.

Finally, our results indicate a new way in which both nonengineering faculty and engineering faculty without pedagogical training in writing can effectively teach disciplinary discourse to engineering students. Similar to Randazzo's [19] "reimagined" résumé assignment, this approach places the focus on coaching students on how to critically analyze and adopt language demonstrative of engineering expertise, a method that may be especially effective as a way to legitimize technical writing instructors' rhetorical expertise. In fact, technical writing instructors may find it helpful to integrate this study's scoring mechanism with Randazzo's [19] proposed assignment by asking students to apply their analysis of primary and secondary résumé resources to the practice of incorporating appropriate disciplinary discourse into their résumés. As the major tool for this practice, the AAES engineering competency model, was developed with insight from professional engineers in industry, engineering students should be more wholly convinced of the worth and value of this model in learning to write résumés. Similarly, the quantification of the discourse in résumés will likely be of interest to engineering students who may often feel like the teaching and grading of writing is subjective and based only on qualitative methods.

Conclusion

Our findings augment previous research on the preferences of engineering recruiters by providing additional insight into what distinguishes between weaker and stronger engineering résumés. Furthermore, it illustrates that theoretical lenses such as VST and activity theory carry weight when considering the genre of résumés from a disciplinary perspective. We present a method for quantifying disciplinary discourse in engineering, showing that statistically significant differences in the disciplinary discourse densities were found in excellent, moderate, and weak résumés. At the level of pedagogical practice, our findings support the development of interventions aimed at assisting students in their professionalization as engineers, and the use of quantitative disciplinary discourse for résumés will be of significant help to technical communication faculty who teach engineering students.

Limitations This study has several limitations. First, its small size limits the generalizability of our findings as discussed in the Results section. Furthermore, the use of the engineering competency model does not take into account typos, mechanical errors, or other problems, such as inappropriate content, within a corpus of résumés. Therefore, this model should not be seen as a substitute for a rubric that critically analyzes a résumé's strengths and weaknesses, but rather as a supplementary method of analyzing use of engineering discourse.

Furthermore, many engineering companies (especially large companies) use algorithms to initially filter résumés upon submission to online application systems. Each company's algorithm is different. We do not consider these algorithmic definitions of disciplinary discourse in this study; rather, we focus on the disciplinary discourse as perceived by a human reader. Résumés including higher levels of disciplinary discourse would probably pass more easily through screening algorithms, as the writer deliberately includes stronger

verbiage relating to engineering skills, especially focusing on technical expertise and leadership.

Other limitations of this study involve the engineering competency model. Though this model includes a wide range of activities involved in the work of engineers, we found that it lacks many competencies that typical engineers, especially those working in academic, global, or research-based contexts, might possess. For this study, we decided by consensus to add activities, such as teaching and global experience, to the model, selecting their location within the tiers based on our assessment of the "worth" of these experiences in the engineering field. Future work in this area might seek to expand the model using a more empirical approach.

Finally, the engineering competency model focused our attention strictly on the content of the corpus of résumés, leaving us unable to quantify the way that résumé design contributes to an engineer's credibility. Though these qualitative aspects were considered in the rubric analysis part of our research (sorted into excellent, moderate, or weak categories), the competency model itself was designed only to categorize competencies. Although it is unlikely that an engineer would not be hired based on the lack of an innovative design, this focus on content over design obscures how résumés crafted with a sensitivity to reader-centered design may indicate an engineer's creativity, innovation, and awareness of users—all skills that would be valued in a prospective engineer. Similarly, an exceptionally cluttered, disorganized, or otherwise visually displeasing résumé may reduce its effectiveness in certain contexts, as these issues might lead to frustration or, more significantly, a reviewer's sense that an engineer has yet to develop competency in communication.

Future Work Given the promising results of our study for new ways to assess résumé quality, future study is well warranted. Future work can fall under two main categories. First, this research should be replicated using a larger corpus of résumés from an even more diverse body of engineers to determine the validity of our findings, as well as to achieve statistical generalization to validate the concept. Current work is in progress to compare the disciplinary discourse density between résumés that are meant to be physically handled compared with résumés uploaded to job hunting websites such as Indeed.com. This, in combination with future work determining the ways in which disciplinary discourse applies within algorithmic screening procedures, will help us understand the automated interpretation of engineering résumés often used today. Work in this area may also seek to isolate demographics such as gender, native-speaker status, or discipline to determine how these factors may be associated with choices in disciplinary discourse and overall identity development.

Second, interventions based on our results can be developed and tested to determine the intervention's effectiveness as a pedagogical tool, both for improving résumé quality and aiding in students' development of professional engineering identities. Along with this paper, research should be done to measure recruiters' and other gatekeepers' responses to résumés exhibiting higher levels of disciplinary discourse. Altogether, this research will contribute to validating this approach to résumé analysis, with the ultimate goal of improving the quality of résumé-writing instruction and resources. In turn, this will help transform engineering students' experience of résumé writing into a powerful opportunity for communicative and disciplinary growth.

References

[1] S. Dinitz and S. Harrington, "The role of disciplinary expertise in shaping writing tutorials," *Writing Center J.*, vol. 33, no. 2, pp. 73–98, Fall/Winter 2014.
[2] J. Kiedaisch and S. Dinitz, "Look back and say 'so what': The limitations of the generalist tutor," *Writing Center J.*, vol. 14, no. 1, pp. 63–74, Fall 1993.
[3] L. K. Shamoon and D. H. Burns, "A critique of pure tutoring," *Writing Center J.*, vol. 15., no. 2, pp. 134–151, Spring 1995.
[4] J. Mackiewicz, "The effects of tutor expertise in engineering writing: A linguistic analysis of writing tutors' comments," *IEEE Trans. Prof. Commun.*, vol. 47, no. 4, pp. 316–328, Dec. 2004.
[5] K. Walker, "The debate over generalist and specialist tutors: Genre theory's contribution," *Writing Center J.*, vol. 18, no. 2., pp. 27–46, Spring/Summer 1998.
[6] R. Greenly, "How to write a resume," *Tech. Commun.*, vol. 40, no. 1, pp. 42–48, Feb. 1993.
[7] M. Morgan, "Teaching the resume as a technical document," *Tech. Commun.*, vol. 37, no. 4, pp. 436–438, Nov. 1990.
[8] C. Egan, "Writing résumés and cover letters," *IEEE Trans. Prof. Commun.*, vol. PC-24, no. 4, pp. 156–160, Dec. 1981.

[9] B. Hunt, "The new you—Researched, résuméd, and rarin' to go," *IEEE Trans. Prof. Commun.*, vol. PC-24, no. 4, pp. 160–162, Dec. 1981.
[10] R. L. Lorentz, J. W. Carland and J. C. Carland, "The résumé: What value is there in references?," *J. Tech. Writing Commun.*, vol. 23, no. 4, pp. 371–377, 1993.
[11] D. J. Treweek, "Designing the technical communication resume," *Tech. Commun.*, vol. 38, no. 2, pp. 257–260, Apr. 1991.
[12] D. H. Charney *et al.*, "How writing quality influences readers' judgements of résumés in business and engineering," *J. Bus. Tech. Commun.*, vol. 6, no. 1, pp. 38–74, 1992.
[13] D. H. Charney and J. R. Rayman, "The role of writing quality in effective student résumés," *J. Bus. Tech. Commun.*, vol. 3, no. 1, pp. 36–53, 1989.
[14] P. G. Harris, "A co-op approach to writing résumés and letters of application," *Tech. Commun.*, vol. 39, no. 2, pp. 253–255, May 1992.
[15] E. E. McDowell, "Perceptions of the ideal cover letter and ideal resume," *J. Tech. Writing Commun.*, vol. 17, no. 2, pp. 179–191, 1987.
[16] J. B. Killoran, "The rhetorical situations of web résumés," *J. Tech. Writing Commun.*, vol. 39, no. 3, pp. 263–284, 2009.
[17] J. B. Killoran, "Self-published web résumés: Their purposes and their genre systems," *J. Bus. Tech. Commun.*, vol. 20, no. 4, pp. 425–459, Oct. 2006.
[18] X. Li, "A genre in the making—A grounded theory explanation of the cultural factors in current resume writing in China," *IEEE Trans. Prof. Commun.*, vol. 54, no. 3, pp. 263–278, Sep. 2011.
[19] C. Randazzo, "Where do they go? Students' sources of résumé advice, and implications for critically reimagining the résumé assignment," *Tech. Commun. Quart.*, vol. 25, no. 4, pp. 278–297, 2016.
[20] H. Sehitoglu and P. K. Saint, "Retraining laid-off engineers and scientists using an integrated curriculum: The project INTENT experience," *J. Eng. Educ.*, vol. 87, no. S5, pp. 549–554, Dec. 1998.
[21] R. W. Hendricks and E. C. Pappas, "Advanced engineering communication: An integrated writing and communication program for mechanical engineers," *J. Eng. Educ.*, vol. 85, no. 4, pp. 343–352, Oct. 1996.
[22] F. P. Incropera and R. W. Fox, "Revising a mechanical engineering curriculum: The implementation process," *J. Eng. Educ.*, vol. 85, no. 3, pp. 233–238, Jul. 1996.
[23] E. M. Lonsdale, K. C. Mylrea, and M. W. Ostheimer, "Professional preparation: A course that successfully teaches needed skills using different pedagogical techniques," *J. Eng. Educ.*, vol. 84, no. 2, pp. 187–191, Apr. 1995.
[24] R. C. Knox *et al.*, "A practitioner-educator partnership for teaching engineering design," *J. Eng. Educ.*, vol. 84, no. 1, pp. 5–11, Jan. 1995.
[25] S. P. Slovakacek *et al.*, "Minority students severely underrepresented in science, technology engineering and math," *J. STEM Educ.*, vol. 12, no. 1/2, pp. 5–16, Jan.–Mar. 2011.
[26] B. K. Hartmann and C. T. Jahren, "Leadership: Industry needs for entry-level engineering positions," *J. STEM Educ.*, vol. 16, no. 3, pp. 13–19, Aug./Sep. 2015.
[27] Y. Engestrom, *Learning by Expanding*. Helsinki, Finland: Orienta-Konsultit Oy, 1987.
[28] C. Bazerman, "What written knowledge does: Three examples of academic discourse," *Philosophy Soc. Sci.*, vol. 11, no. 3, pp. 361–387, 1981.
[29] C. Bazerman, "Scientific writing as a social act: A review of the literature of the sociology of science," in *New Essays in Technical and Scientific Communication: Research, Theory, Practice*, 1st ed., P. Anderson, J. Brockman, and C. Miller, Eds. New York, NY, USA: Routledge, 1983, pp. 156–184.
[30] C. Bazerman, "Literate acts and the emergent social structure of science: A critical synthesis," *Soc. Epistemol.*, vol. 1, no. 4, pp. 295–310, 1987.
[31] T. Gerholm, "On tacit knowledge in academia," *Eur. J. Educ.*, vol. 25, no. 3, pp. 263–271, 1990.
[32] K. Hyland and P. Shaw, "Introduction," in *Routledge Handbook of English for Academic Purposes*, 1st ed., K. Hyland and P. Shaw, Ed. New York, NY, USA: Routledge, 2016, pp. 1–13.
[33] D. Dressen-Hammouda, "From novice to disciplinary expert: Disciplinary identity and genre mastery," *English Specific Purposes*, vol. 27, no. 2, pp. 233–252, 2008.
[34] K. Hyland, *Disciplinary Identities*, 1st ed. Cambridge, UK: Cambridge Univ. Press, 2012.
[35] R. Ivanič, *Writing and Identity: The Discoursal Construction of Identity in Academic Writing*, 1st ed. Amsterdam, the Netherlands: John Benjamins, 1998.
[36] S. Parry, "Disciplinary discourse in doctoral theses," *Higher Educ.*, vol. 36, pp. 273–299, 1998.
[37] P. Matsuda and C. Tardy, "Voice in academic writing: The rhetorical construction of author identity in blind manuscript review," *English Specific Purposes*, vol. 26, no. 2, pp. 235–249, 2007.
[38] R. Maclean, "First-year law students' construction of professional identity through writing," *Discourse Stud.*, vol. 12, no. 2, pp. 177–194, 2010.
[39] A. Koerber and L. McMichael, "Qualitative sampling methods a primer for technical communicators," *J. Bus. Tech. Commun.*, vol. 22, no. 4, pp. 454–473, 2008.
[40] B.L. Yoder, "Engineering by the numbers," Washington, DC, USA: Amer. Soc. Eng. Educ., 2015.
[41] University of Iowa College of Engineering. (2015). Engineering professional development career resource manual. [Online]. Available: http://www.pageturnpro.com/University-of-Iowa-College-of-Engineering/67540-Career-Resources/index.html#10
[42] K. Krippendorff, *Content Analysis: An Introduction to Its Methodology*. Thousand Oaks, CA, USA: Sage, 2013.
[43] Amer. Assoc. Eng. Soc. Eng. (2016). Competency model. [Online]. Available: http://www.aaes.org/model
[44] A. Strauss and J. Corbin, *Basics of Qualitative Research*, vol. 15. Newbury Park, CA, USA: Sage, 1990.

[45] E. Wenger-Trayner, *et al.*, *Learning in Landscapes of Practice: Boundaries, Identity, and Knowledgeability in Practice-Based Learning*. London, UK: Routledge, 2015.
[46] E. Wenger, *Communities of Practice: Learning, Meaning, and Identity*. Cambridge, UK: Cambridge Univ. Press, 1998.
[47] C. G. P. Berdanier, M. McCall, and G. Mike, "A degree is not enough: Promoting engineering identity development and professional planning through the teaching of engineering résumé writing," presented at the IEEE Frontiers Educ. Conf., Erie, PA, USA, Oct 12–15, 2016.
[48] C. G. P. Berdanier, M. McCall, and G. Mike, "Résumés in the development of undergraduate engineering identity: A genre analysis with teaching implications," presented at the IEEE Prof. Commun. Conf., Austin, TX, USA, Oct. 3–5, 2016.

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