Résumés in the Development of Undergraduate Engineering Identity: A Genre Analysis with Teaching Implications

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Abstract – Undergraduate engineering students are often instructed to write engineering résumés working from models that come from different fields. As part of a project to develop stronger disciplinary instructional materials for engineering résumé writers, this study investigates a way to quantify the quality of engineering résumés based both on established rubric methods and on a new "scoring" mechanism by which significant differences in the types of disciplinary discourse enacted strong, moderate, and weak engineering résumés. This study is guided through Activity Theory, such that the "rules" of writing an engineering résumé are mediated not only by the general design, content, and style principles of written and visual communication, but are also mediated by the community in terms of what language and activities are most demonstrative of engineering expertise. Findings indicate that a blended approach to scoring engineering résumés may be a promising way to investigate the problem of teaching and evaluating engineering discourse by non-engineering faculty.

Index Terms – Engineering résumés; communication; professional development; engineering identity

INTRODUCTION

Undergraduate engineering students often are underprepared to proactively develop professional skills, especially in their early years when they carry heavy course loads and are still navigating the transition from high school (and in some cases, the transition to education in another language or culture). Writing centers and affiliates, and sometimes introductory courses in English or Engineering programs, often help these students develop professional writing and résumé writing skills, but not much is published in traditional résumé writing tutorials or textbooks about what a "good" engineering résumé in the U.S. should look like at the undergraduate level. Our presentation responds to this gap by describing the results of a genre analysis study to address this neglected area in professional development for early-career engineering students.

After discussing previous research conducted on résumés in engineering, this paper theorizes engineering résumés through the lenses of Vygotskian Sociocultural Theory, Activity Theory, and Landscape of Practice Theory. Each of these theories help to establish the résumé not as an acontextual document that should adhere to generalized, adisciplinary, guidelines, but rather as one that is situated within a system of activity with particular disciplinary rules and expectations.

Considering engineering résumés in this light, this presentation next discusses a study designed to elicit a greater understanding of the characteristics of successful American engineering résumés through quantitative and qualitative methods. In this study, a corpus of résumés was ranked using an engineering rubric and coded according to adherence to the Engineering Competency Model. The findings of these analyses give greater insight into the differences between stronger and weaker engineering résumés, and this paper proposes that interventions be developed for undergraduate engineering students based on this data.

LITERATURE REVIEW

While Writing Across the Curriculum (WAC) indicates pedagogical and curricular writing support in courses other than those traditionally in English, Writing in the Disciplines (WID) focuses on disciplinary-specific writing instruction [1]. Consequently, WAC or "writing to learn" encourages students to engage more deeply with course content through reflections, blogs, or other writing prompts and WID or "learning to write" introduces students to the rhetorical writing processes of their particular major. Before actually supporting (or applying) writing across the curriculum, WAC and WID advocates must first consider how to localize "writing to learn" or

"learning to write" to the disciplinary practices of other fields. Otherwise, WAC goals can conflict with the epistemological values of these fields and ultimately fail.

Résumés are one form of written communication that can help to reveal some similarities between disciplines with respect to professional identity formation and representation. In their study of 18 campus recruiters who analyzed 72 fictitious mechanical engineering résumés, Charney and Rayman [2] conclude that these recruiters typically prefer relevant work experience as well as error-free résumés (p. 46-47). 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 those with more relevant experience, but mechanical errors [2, p. 47]. While identifying mechanical issues over stylistic ones may be easier for those with less experience in evaluating writing, the absence of grammatical errors can also be viewed as a reflection of the applicant's professionalism and attention to detail.

Overall, the recruiters did "give considerable weight to writing quality" [2, p. 51] and ultimately considered "the primary function of a résumé to be demonstrating communication skills" [2, p. 50]. These preferences are also reflected in résumé guidelines within current technical writing textbooks as well as in internships and co-ops and entry-level engineering positions within the U.S. One ad for an R&D Engineering Intern through Indeed.com stresses "excellent verbal and written communication" while another ad for an Engineering and Construction internship expects "an ability to effectively communicate orally and in writing" from interested applicants. The same qualifications apply to entry-level job ads for Project and Product Engineer positions.

It is also important to consider, though, how this same genre can also reflect disciplinary differences when it comes to professionalization via writing. In a follow-up study, Charney et al. [3] 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 both 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 [3, 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 [3, p. 60]. On the other hand, "formulating the purpose of a marketing study is a crucial part of the work of the marketing researcher" [3, p. 60], which is a strong reason for why the marketing recruiters valued résumés purpose elaborations more highly.

When Charney, Rayman, and Ferreira-Buckley [3] 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 evaluations of the recruiters' in their respective discipline (p.70). 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 [3, p. 70].

Our study continues—and updates—such work by considering how résumé writing can be a form of professional identity formation for undergraduate engineering students. By crafting this type of document, students not only "write to learn" in the sense of honing their professional identity as engineers, but they also "learn to write" by developing their résumés according to the expectations of their specific engineering discipline. Such expectations go beyond adhering to typical style and formatting résumé guidelines to being attentive to how one persuasively conveys their engineering expertise and experience through coursework, projects, and professional development. Charney and Rayman [2] 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" (p. 48).

Similarly, our genre analysis of the résumés from undergraduate engineering students to advanced professional engineers seeks to identify similar types of ethos-building moves to argue how students can persuasively construct these living documents to position themselves as emerging professionals in their field.

Given this literature review, this study of our corpus of 31 engineering résumés will address the following research questions with the goal of developing undergraduate engineering professional development through résumé writing:

1. How do engineering résumés exhibit strong levels of disciplinary discourse within engineering résumés?
2. Is there a way to quantify disciplinary discourse within engineering résumés as a way of promoting strong résumé writing and professional development skills?

THEORETICAL FRAMEWORK

This section describes the various theoretical frameworks through which American résumés can be analyzed.

I. Vygotskian Sociocultural Theory and Activity Theory

Vygotskian Sociocultural Theory (VST) bases the analysis for this work, which 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 people's interactions with their physical and social surroundings. An *activity system* is comprised of *subjects* acting through *internal or external mediating artefacts or tools* to generate an *object* relevant to a larger *community*. *Rules* govern the interactions between the subjects and objects, and the *divisions of labor (roles)* govern the ways in which community members interact with the object [4].

In this study, the activity of interest is the argumentation of engineering experience within engineering résumés. The subject of interest is the engineer writing the résumé, and as such, the activity theory schematic [4] represents the subject's point of view. Engineers use tools (the computer, writing knowledge) to create the résumé (object) that is relevant to a broader scientific community, specifically, those community members that have the power to hire students or 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 recipient of the résumé 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 judgement of engineering achievement.

Based on the research questions, the junction of interest is the "Rules" portion of Activity Theory [4]: Applicants must address the criteria ("rules") of the proposal such that they are awarded the fellowship. Analysis of engineering résumés by engineers at various stages of their careers will lend insight into the enactment of "rules" for writing engineering résumés that are valid in the eyes of the engineering community.

Many engineering communication instructors may teach the "rules" of engineering résumé writing from the point of view of general formatting rules for résumés, based on business templates or general guidelines. However, we posit that there may also be disciplinary expectations and "rules" for engineering résumés from the engineering community of 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 the ways that will be most helpful to them as future engineers.

II. Identity and Landscape of Practice Theory

The concept of identity is multi-faceted and allows for a wide array of definitions and approaches. Wenger [5] describes identity as "a layering of events of participation and reification by which our experience and its social interpretation inform each other" (p. 151). While Wenger [5] initially states that identity is created as "a lived experience of participation in specific communities" (p. 151), Wenger-Trayner et al. [6] expand upon this concept to show how complex relationships between communities of practice form a landscape of practice that is involved "not only in practicing the occupation, but also in research, teaching, management, regulation, associations, and many other relevant dimensions" (p. 15).

Given this network of connections, a landscape is political, involves numerous practices that can be complementary and at odds with one another, and has boundaries. Such a concept can help to make better sense of the experiences of both identification and dis-identification that students and professionals can have during their journey across the landscape of practice within their particular field of engineering.

METHODS

I. Participants, Recruitment, and Corpus

Engineering résumés were collected from engineers at a variety of stages in their career through snowball sampling methods [7]. After gaining IRB 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 some demographic information and a brief questionnaire about their engineering preparation, and to upload their current engineering résumé. The recruitment text sent asked all participants to forward our link and recruitment email to any other engineering professionals or engineering students. A total of 135 people responded to the survey.

After cleaning the data for respondents who did not upload résumés, and who uploaded curriculum vitae (CVs) instead of résumés, we obtained a corpus of 31 engineering résumés. Within this corpus, 12 résumés came from engineering undergraduate students, 7 from engineering graduate students. Of the practicing engineers who submitted résumés, 3 hold Bachelor's Degrees, 3 hold Master's Degrees, and 7 hold Ph.D.s. Of the submitted résumés, 17 came from women, which is overrepresentative of engineering (which averages around 20% women across disciplines and educational levels). We did not quota sample for experience level, engineering discipline, gender, or any other demographic.

II. Analysis Methods

Data were analyzed through a variety of methods in order to best understand the ways in which engineering students and professionals construct their engineering résumés. First, a rubric analysis was conducted on the

résumés within the corpus in order to "rank" them according to previously validated rubrics for résumé analysis (adapted by the University of Iowa's College of Engineering for Engineering student professional development and career readiness) [8]. 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 technical aspects as well as design aspects within its criteria. Although other rubrics were considered, many were not engineering specific and did not incorporate both technical and non-technical 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 "3's on the résumé evaluation rubric), 10 were "Moderate résumés" (achieving mostly "2's") and 9 were "Weak résumés" (Achieving mostly "1's" 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 to decide how much is enough. The researchers 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 to be the method to understand the purposeful "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 has significance or legitimacy to the discourse community it represents [9]. More specifically, in the résumé setting, each résumé entry and descriptor is selected by the writer because they think it represents an important attribute about their professional aptitude or identity to the employer, so employing a genre-based model of content analysis is a natural step in understanding the underlying reasoning patterns of the engineering résumé writers.

The coding scheme was developed from existing literature on the attributes and definitions of engineering from the American Association of Engineering Societies (AAES) "Engineering Competency Model" for engineers [10]. The six-tier model demonstrates the technical and non-technical 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 1. This model was used as an *a priori* coding schema, and it was adapted to include further activities that emerged from the engineering résumé data set. For example, the Engineering Competency Model did not address activities such as teaching responsibilities, grant writing, global competencies, or global competencies--areas that are central to the roles of engineers in both industry and academia. The competencies listed in italics in Table 1 are the emergent codes that the researchers added to the Engineering Competency Model while employing it as a coding schema. The engineering résumés were coded by the three researchers on the project to agreement on all classifications. Any conflicting ideas were discussed with the full team until consensus was reached.

TABLE 1. ENGINEERING COMPETENCY MODEL [10]

AAES Engineering Competency Model		
Coding "Score"	**Tier**	**Description and Examples (researcher additions in italics)**
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*

AAES Engineering Competency Model		
		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

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 coded as a 6 (because it fell within Tier 6 competencies), whereas a mention of "Strong interpersonal skills" was given a code of 1 (because it fell within Tier 1 competencies). An unintentional effect of this coding schema was that generic and non-specific résumé entries tended to involve lower tier skills, while the entries that demonstrated strong disciplinary skills (while often "showing" non-technical skills simultaneously) fell within higher tiers due to their specificity and demonstration of engineering skills. Some engineering attributes, such as the lengthy lists of coding languages, programming and software skills that often are essential components of engineering training and résumés, were coded as being individual attributes, because they show disciplinary knowledge and familiarity with the essential tools of an engineering profession.

After coding all the elements within the résumés according to the Engineering Competency Model, basic descriptive statistics allowed the team to quantify qualitative data [11], and show patterns within the total genre analysis through numerical methods. The tier codes were summed over the document, and then divided by the number of codes total; the number of entries total; 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 such:

$$Overall\ Disciplinary\ Discourse\ Density = \frac{Sum\ of\ Tier\ Codes}{\#\ Total\ Codes}$$

$$Entry\ Disciplinary\ Discourse\ Density = \frac{Sum\ of\ Tier\ Codes}{\#\ Résumé\ Entries}$$

$$Page\ Disciplinary\ Discourse\ Density = \frac{Sum\ of\ Tier\ Codes}{\#\ Pages\ in\ Résumé}$$

While this numerical model may be a non-traditional way of showing the underlying patterns in textual data especially in the Engineering and Professional Communication research and practice community, the researchers posit that this is actually a way of "quantifying" the amount of disciplinary discourse present in an engineering résumé. Basic statistical analyses test the effect size of the differences between the groups of engineers. Although a corpus of 31 résumés is relatively large for qualitative data, it is quite small for a quantitative study, and therefore statistical results should be taken as preliminary data that should be tested in the future with high numbers of engineering résumés to confirm the findings. 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 résumé rubric with genre analysis to interpret the disciplinary discourse density.

RESULTS

The results of the analysis are shown in Tables 2-4 below, where the separate tables are sorted into strong, moderate, and weak engineering résumés 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. It also highlights the idea that a "strong" engineering résumé is only achieved by expert-level engineers: In fact, there are experts and professional-level engineers through undergraduate engineering students in each category, and engineers from both academia and engineer in each of the three levels of résumé quality. This shows that there is not a tendency for a "good" résumé to only come from students or from professionals, but that 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.

TABLE 2. 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**

TABLE 3. 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 4. 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**

As a whole, the Overall Disciplinary Discourse Density, that is, the average Tier level of the résumé per code attributed does not differ significantly between the three different categories. The average tier level for each entry in the résumés differs only slightly between strong and moderate quality résumés and not to a statistically significant level. A statistically significant difference occurs at the page level (calculated through a two-tailed Student's t-test), measuring the overall sum of the Tier

scores per page of résumé, between the strong and moderate and moderate and weak categories with strong effect sizes (indicated by the Cohen's d scores). The summary of the results is shown in Table 5.

TABLE 5. 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=0.015, Cohen's d=1.20 **Between moderate and weak: p=0.051; Cohen's d=0.98			

Statistically, because of the small sample size of the study (N=31) and the exploratory nature of this particular research, these statistical results cannot and should not be generalized to the overarching engineering community. 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

I. Relationship of Findings with Current Literature

These findings from this genre analysis are consistent with Charney and Rayman's [2] and Charney, Rayman and Ferreira-Buckley's [3] 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 [2] findings on the preference of engineering recruiters for error-free résumés. The findings of this study give more insight into why that Tier 1 and Tier 2 skills are in fact important: they contribute toward the development of the engineer's ethos by showing their mastery of the foundational skills upon which more specialized engineering skills are built. Regarding Charney, Rayman and Ferreira-Buckley's [3] findings, this study helps illuminate why engineering recruiters would prefer résumé entries that pinpoint particular engineering concepts or skills. Appearing in Tiers 4-6, these kinds of competencies exhibit advanced experience within the realm of engineering work.

Placing these findings in conversation with previous research, 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, these by themselves 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 be appealing to recruiters. As was seen in many of the higher scoring résumés, a single unit 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.

II. Relationship of Findings through Activity Theory and Landscape of Practice Theory

As the rubric analysis for this study shows, level of experience alone is not enough to distinguish among strong, moderate, and weak résumés, as each category consisted of résumés from undergraduate engineering students to highly experienced professionals. Consequently, the "rules" for writing a successful résumé are not necessarily acquired naturally or even with experience. While a weak scoring résumé does not necessarily indicate a lack of engineering proficiencies, it does suggest a lack of deep awareness of how to articulate those proficiencies to other engineering professionals. Considering these findings in terms of education and professionalization at the undergraduate level, these findings point to the value that a discussion of résumés as reflections of disciplinary discourse might have on students who are consciously working to create their identities within the landscapes of engineering practice they traverse, especially during the transition from engineering student to practicing engineer.

III. Development of Educational Interventions and Implications for Instructors

Overall, the findings of this study illustrate that the crafting of effective engineering résumés does not lie solely in the quality of an engineer's experiences, adherence to generic résumé writing "rules," or to displays of "correctness" in grammar and mechanics. Rather, the success of a résumé involves a writer to convey his or her qualifications in a way that matches with 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 the landscape of practice of engineering. 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 the future careers.

The findings of this study suggest that research-based educational interventions can be developed and employed at the undergraduate level to help both professionalize students and to enhance their abilities to communicate their skills in a way that resonates with prospective employers. The authors 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. Students would then 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.

IV. Limitations and Future Work

Several limitations exist for this study. First the small size of this study limits the generalizability of our findings as discussed in the results section. Further, 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 résumés strengths and weaknesses, but rather as a supplementary method of analyzing use of engineering discourse. Other limitations of this study involve the Engineering Competency Model. Though this model includes a wide range of activities involved in the work of engineering, we found it to lack many experiences that typical engineers, especially those working in academic arenas, might complete. For this study, we decided by consensus to add certain activities, such as teaching and global experience to the Model, based on decisions on location within the tiers on our beliefs on the "worth" of these experiences in the field of engineering. Future work in this area might seek to expand the Model through a more empirical approach.

Finally, the Engineer Competency Model focused our attention strictly on the content of the corpus of résumés, leaving us unable to quantify the way the design of résumés contributed to the credibility of an engineer. While 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.

Future work on this study 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 in order to determine the validity of this study's findings as well as to achieve statistical generalization for conceptual validation. Second, interventions developed based on this study's results can be tested to determine the intervention's ability to improve the quality of engineering students' résumés.

CONCLUSIONS

The findings of this study augment previous research on the preferences of engineering recruiters by providing additional insight into what distinguishes between weaker and stronger engineering résumés. Further, it illustrates that theoretical lenses such as Vygotskian Sociocultural Theory, Activity Theory, and Landscape of Practice Theory carry weight when considering the genre of résumés from a disciplinary perspective. At the level of pedagogical practice, the findings of this study support the development of interventions aimed at assisting students in their professionalization as engineers.

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