

Exploring engineering faculty conceptions about doctoral writing

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Abstract

This study examines how engineering faculty conceptualize the purposes and functions of doctoral writing. Writing is central to doctoral education, yet faculty perspectives on doctoral writing in engineering remain underexplored. Guided by the Academic Literacies Framework, we conducted thirteen semi-structured interviews with engineering faculty at a large, public research-intensive university. Interviews explored faculty views on doctoral research writing and supervision and were analyzed using a hybrid thematic approach that combined deductive and inductive coding. Three conceptions of writing aligned with prior findings from the social sciences: epistemic, instrumental, and communicative. Three additional conceptions emerged as distinctive to engineering: socialization, funding acquisition, and advancement of the field. These findings illuminate how engineering research cultures shape expectations for doctoral writing and have implications for faculty development and doctoral supervision.

Introduction

Recent advances in generative artificial intelligence (GenAI) have resurfaced discussions about what counts as writing, who counts as a writer, and how to assess writing (e.g., [1], [2], [3]). In higher education, these discussions have centered on topics of authorship, academic integrity, and skill decrease [4], [5] [6]. While these conversations are necessary, it is important to step back and interrogate a more foundational question: How do experts understand the nature and purpose of writing? Without a clear account of what the role of writing is in a field, debates about whether, when, or how GenAI should be used could become detached from disciplinary values and practices.

This question about the nature and purpose of writing is particularly relevant in doctoral-level engineering education, where writing plays a central role [7], [8]. Engineering doctoral scholars are expected to produce written products, including dissertations, journal articles, conference papers, and grant proposals. Each of these individual products have multiple purposes, including demonstrating technical competence, positioning doctoral scholars' work within disciplinary conversations, and addressing how the work impacts broader societal needs. However, writing in engineering has often been framed as a skill of secondary importance rather than a complex epistemic and social practice [9], [10]. Prior work suggests that writing in engineering is both indispensable and under-theorized [10], [13]. Existing research has documented undergraduate and graduate students' writing challenges, beliefs, and instructional gaps (e.g., [14], [15]). However, less attention has been paid to the assumptions that underpin these practices. Assumptions about writing shape how it is valued, evaluated, and supported in engineering doctoral education [11], [12], and may influence doctoral scholars' experiences with advising, feedback, and review processes beyond the development of the written product. Furthermore, faculty conceptions of writing (i.e., what faculty believe writing is for, how it functions in knowledge production, and what counts as writing) remain underexplored. Understanding these conceptions can enable more grounded and responsive development of expectations for GenAI in doctoral education, doctoral program assessment, advisor feedback practices, and the kinds of doctoral support students receive.

In this study, we examine how engineering faculty conceptualize writing at the doctoral level. We focus on exploring the purpose faculty attribute to writing, and the roles of writing in

professional development. By identifying such conceptions, we aim to provide a picture of the various ways writing is understood in the field, lay a foundation for ongoing debates about writing, and inform discipline-specific approaches to support writing development.

Theoretical Framework

This study is situated within the Academic Literacies framework, which conceptualizes academic writing as a socially situated, epistemically complex, and power-laden practice [16], [17]. Rather than treating writing as a set of transferable skills, this framework emphasizes that writing is embedded in disciplinary cultures, institutional structures, and identity formation processes [18].

The Academic Literacies framework is often described through three overlapping layers: study skills, academic socialization, and academic literacies. The study skills layer focuses on surface-level features such as grammar, structure, and formatting, often framing writing difficulties as individual deficits [16], [19]. The academic socialization layer emphasizes learning disciplinary conventions and genres, viewing writing as a process of induction into academic communities [17]. The academic literacies layer encompasses both prior layers while foregrounding issues of power, identity, and meaning-making, highlighting how writing practices privilege particular forms of knowledge and ways of being a scholar [18].

This framework provides a foundation for examining research writing in engineering doctoral education. While the framework was developed for higher education in general, its core facets address the complexities of engineering doctoral education. These facets become visible in engineering contexts, where writing is embedded in laboratories, research groups, and industry-connected projects, where writing mediates relationships among technical work, funding structures, and professional identity [20], [21]. Guided by Academic Literacies, this study attends to how faculty conceptions of writing reflect and reproduce these disciplinary and institutional contexts, rather than treating writing as a neutral or purely technical activity.

Writing in engineering Doctorates

Engineering represents a distinctive disciplinary context for writing due to its collaborative research structures, technical focus, and strong connection to applied problem-solving and seeking funding [22], [23], [24]. In engineering doctoral programs, writing is central to degree completion and professional advancement in the form of research articles, dissertations, and fellowship applications. In these contexts, writing is not only a record of completed work but a mechanism through which research agendas, resources, and professional opportunities are made possible. However, writing is often framed as a tool for documenting completed research, rather than as an integral component of knowledge construction [25], [26].

Prior research indicates that engineering writing emphasizes precision, technical accuracy, and representational clarity, shaping both faculty expectations and instructional practices [21], [27]. Undergraduate engineering education often underprepares students for advanced research writing, leaving doctoral students to navigate complex rhetorical and epistemic demands with limited explicit guidance [28], [29]. As a result, doctoral students frequently struggle to articulate their contributions, narrow their scope, and position their work within the literature [24], [30], [31].

Although recent studies have highlighted variation in students' writing practices and challenged deficit-based views of engineering writing [14], [32], considerably less research has examined

how engineering faculty themselves understand research writing, particularly at the doctoral level. Addressing this gap is essential, given faculty's central role in shaping writing expectations and supervisory practices.

Faculty Conceptions of Writing

Within doctoral education broadly, faculty conceptions of writing can influence doctoral students' experiences and publication pathways [33], [34]. Research on academic writing increasingly emphasizes that writing practices are shaped not only by institutional norms or student abilities, but also by how faculty conceptualize the nature and purpose of writing (e.g., [35], [36]). Faculty conceptions of writing play a central role in shaping expectations, evaluation criteria, and writing support in higher education [28], [33]. Moreover, faculty conceptions influence whether writing is treated primarily as a product to be corrected or as a process to be supported [37], [38]. Importantly, faculty often hold multiple conceptions simultaneously, shifting their emphasis depending on context and task. For example, Moon and colleagues [38] identified four faculty profiles (i.e., Idealist, Writer, Traditionalist, and Utilitarian). These profiles captured the relationship between writing beliefs and classroom practices. In their study, faculty who view writing as incompatible with STEM content use no classroom writing despite valuing it professionally, while writers, who view writing as integral to knowledge construction, regularly incorporate writing activities to promote conceptual understanding. Despite these insights, much of the existing research has focused on general academic contexts or undergraduate education, leaving faculty conceptions of research writing at the doctoral level, and particularly within engineering, relatively underexamined.

In this study, we focus specifically on research writing (i.e., writing about research). Whether composing journal articles, dissertations, or conference papers, research writing functions as the primary vehicle through which doctoral students demonstrate expertise, secure recognition, and progress toward degree completion [39], [40]. In engineering and other STEM disciplines, research writing often occurs without formal writing instruction. Faculty frequently serve as informal mentors, offering feedback through advising and manuscript revisions, but not always articulating the rhetorical or conceptual dimensions of writing [12]. Consequently, students may struggle to understand what constitutes successful research writing, especially when feedback is focused more on surface-level correctness than on knowledge-building or communication strategies [41], [42]. These challenges in doctoral writing development are deeply connected to how faculty understand and conceptualize the writing process itself.

Prior studies have identified different ideas about research writing among faculty. González-Ocampo and Castelló [37] distinguish between instrumental, epistemic, and communicative ideas of writing. An instrumental view sees writing mainly as a technical skill focused on correctness, structure, and following disciplinary rules. Writing is valued as long as it results in clear and suitable academic texts. In contrast, an epistemic view sees writing as a tool for learning and building knowledge, emphasizing its role in shaping ideas, developing arguments, and deepening understanding. A communicative idea is that writing is a social activity through which researchers share knowledge, connect with disciplinary communities, and build scholarly identities.

Importantly, González-Ocampo and Castelló developed this framework in the context of social science doctoral education. In the present study, we used their framework as an initial guide to examine faculty conceptions of writing in engineering doctoral education, allowing us to explore how these ideas manifest within a disciplinary context characterized by different research practices, funding structures, and expectations around writing. Specifically, in this study, we examined faculty members' conceptions of writing in engineering. We particularly focused on writing at the doctoral level, which is often associated with research writing. We have the following research question:

1. What are the conceptions of *doctoral writing* among engineering faculty?

Method

Researcher Positionality

The first author approached this study of doctoral writing in engineering from a background in educational psychology and professional interaction with engineering faculty and doctoral students. Although not trained as an engineer, this positioning provided familiarity with disciplinary writing practices while maintaining analytic distance to examine conventions that often remain implicit. As a woman of color in U.S. academic contexts and a scholar writing in English as a second language, the researcher was attentive to how linguistic and cultural norms shape participation, evaluation, and legitimacy in doctoral education. The second author supported this work as part of on-going discussions of the implications of the results for doctoral students, research groups, and faculty. As an engineering education scholar with all her degrees in engineering fields, the second author experienced doctoral writing supervision at the intersection of engineering and engineering education, providing both an insider and outsider perspective on the results. Further, in her experiences as a doctoral advisor, a graduate program director and an instructor of doctoral-level research methods courses, she has engaged in many discussions with students, faculty, and administrators about the purpose of writing in doctoral engineering education. These perspectives and experiences provided a lens for considering the diversity of experiences of faculty and students, as well as how the results can both support and shape graduate engineering education in the future.

Research Design

We conducted semi-structured interviews to explore faculty conceptions of research writing supervision and research writing. We analyzed the interviews' content following a hybrid thematic analysis [43], to identify the main themes on the topic of research writing supervision. Hybrid thematic analysis is an approach that integrates deductive, theory-driven codes with inductive, data-driven coding to identify and develop themes grounded in both existing frameworks and participants' meanings. Although the primary focus of the present study was to capture faculty's conceptions about research writing, in some cases these conceptions were articulated through reflections on their own writing supervisory practices.

Participants

Participants were 13 engineering faculty members at a large research-intensive institution in the Northeastern United States. Three professors were in Aerospace, and two were in Engineering Science. There was one professor from each of the following engineering subfields: Industrial,

Mechanical, Environmental, Electrical, Biomedical, Chemical, and Acoustics. Six faculty were full professors, and seven were assistant professors. See Appendix A for more details.

With respect to gender, seven professors identified as women, and the rest identified as men. Furthermore, seven of the faculty identified as White or Caucasian, four as Hispanic or Latine, one as Indigenous, and one as Asian.

Regarding language background, seven participants reported English as their first language, while six reported English as their second language. Two of the faculty who reported English as their second language indicated they could write for scientific or research purposes in their first language as well.

Data Collection

Data were collected through one-on-one semi-structured interviews conducted either in person or via videoconferencing, depending on participant preference. Interviews lasted an average of about 30 minutes. Participants were informed of the study's purpose and provided informed consent prior to participation.

The interview protocol included open-ended questions designed to elicit faculty perspectives on the purpose, role, and meaning of research writing in engineering doctoral education. Questions prompted participants to reflect on writing in the context of journal articles, dissertations, and other forms of research communication common in engineering. Guided by the Academic Literacies framework, questions were intentionally framed to move beyond technical skills and textual features to surface how writing is understood as a disciplinary, epistemic, and socially situated practice. Participants were asked to reflect on the meaning of scientific writing in their field, the role writing plays within their scientific community, how research writing differs from other forms of academic writing, and what genres of research writing are most common in their discipline. Additional questions probed faculty views on the purposes of scientific writing, how writing practices have evolved over time, and what counts as good scientific writing in engineering. See Appendix B for all questions related to conceptions of writing.

While the broader interview protocol also included questions about writing supervision, only responses related to conceptions of research writing were analyzed for the present study. All interviews were audio-recorded and transcribed verbatim. Transcripts were anonymized, and pseudonyms were assigned by the researchers.

Data Analysis

Interviews were coded using a hybrid thematic analysis [43], which allowed us to engage prior findings while remaining open to discipline-specific ways of conceptualizing writing. First, recordings were listened to, and transcripts were read thoroughly while annotating in margins and documenting initial reflections on paper. Then, in vivo codes were generated directly from participants' language, identifying all segments related to faculty understanding of research writing. For example, we initially had a code label "accepted by academics", which originated from Dr. M sharing that "You have to write in order to be accepted into the academic cluster; if you don't, your research will never be known, and you as a scholar will not be recognized."

Initial in-vivo codes were clustered into González-Ocampo and Castelló's [37] three previously identified conceptions (i.e., instrumental, epistemic, communicative), the analytical framework for the study, with excerpts that presented conceptual challenges highlighted. Some codes did not fit the pre-established categories and were placed in separate categories. In particular, we developed new discipline-specific categories based on the context and content of the quotes. We ended with ten categories (See appendix C). Among these 10 categories, we noted that two of them were technically fitting for the original *communication* conception (i.e., accepted by academics and be cited), because it included the socialization part of writing. However, when discussing with an external educational psychology faculty, we agreed that the roles of these two categories were different. Therefore, we separated socialization from communication. Socialization practices represent the broader institutional and cultural processes through which students are inducted into disciplinary communities, while communication goals are more specific and task-oriented. Finally, the categories were grouped into themes that represented distinct, non-overlapping conceptions of research writing.

Results

Our initial analysis of engineering faculty conceptions of writing was guided by the framework established by Gonzalez Ocampo and Castelló [37], which identified *instrumental*, *epistemic*, and *communicative* conceptions of writing. As we analyzed faculty interviews, these established themes were clearly present, but additional themes emerged, expanding our understanding of how engineering faculty conceptualize writing in their discipline. Specifically, six key themes emerged regarding how engineering faculty conceptualize the role and purpose of writing in their field: *instrumental*, *epistemic*, *communicative*, *socialization*, *funding acquisition*, and *advancement of the field*.

In Table 1, we characterize each conception in terms of its role, or what writing is understood to do in engineering practice, and its focus, or the aspects of writing that faculty emphasize. For example, an instrumental conception frames writing primarily as a vehicle for recording technical information, whereas an epistemic conception emphasizes writing as a means of developing and refining ideas. For example, an instrumental conception frames writing primarily as a vehicle for recording technical information, whereas an epistemic conception emphasizes writing as a means of developing and refining ideas.

Table 1. Expanded Conceptions of Doctoral Writing in Engineering (Adapted from González-Ocampo & Castelló)

Category	Aim	Role	Focus
Epistemic	To promote learning processes and enable knowledge construction (within the writer)	Writing as a tool for learning and self-regulation.	The writing process and the development of writing regulation strategies.
Communicative	To promote research communication and dissemination of findings.	Writing as a tool to share ideas.	The process of adjusting linguistic and discursive mechanisms to communicate knowledge.

Instrumental	To produce good and appropriate academic texts.	Writing as a technical skill focused on the final written product.	Linguistic and discursive skills, text characteristics, and conventions.
Socializing	To help scholars build their disciplinary identities and integrate into their academic communities.	Writing as a means of acculturation and becoming a member of a discipline.	Adopting the language, discourse, and practices of a specific community.
Advancement of the Field	To contribute to the progress and development of a discipline. (outside of the writer)	Writing as a means to share discoveries and generate new knowledge.	The contribution of new knowledge and insights to the field.
Funding Acquisition	To secure resources and support for research endeavors.	Writing as a persuasive tool to articulate needs, propose solutions, and demonstrate the value of research.	Clearly articulating the need for funding, the proposed research, and its potential impact.

Instrumental

Faculty frequently described writing in engineering as having a fundamental instrumental purpose. This conception views writing as a technical skill focused on producing clear, correct, and conventionally structured texts. It emphasizes accuracy, formatting, and adherence to disciplinary norms, often treating writing as a means of documenting research processes and results rather than as a tool for learning or critical engagement. More specifically, an instrumental perspective focused predominantly on products rather than processes, viewing writing as a general skill transferable across contexts, in line with the study skills component of academic literacies. Dr. K, connected clarity in writing as a way to enable other researchers to replicate the work:

“(writing) should have a good flow, good connection of ideas, clear sentences, no ambiguity, very little ambiguity, clear description of methods where somebody can actually go and replicate the experiment and hopefully get the same results.”

A key characteristic of the instrumental conceptions is viewing writing as a product with general linguistic expectations and commonly focusing on the accuracy of the methods used.

Epistemic

Beyond its instrumental function, many faculty members recognized writing's epistemic role in knowledge construction and learning. Writing is viewed as a cognitive and reflective process that supports learning and the construction of the writer's knowledge. Faculty described how the act of writing itself facilitates deeper understanding and helps organize thinking. Dr. L reflected on their own writing practices, highlighting the essential role writing literature reviews has played in their own learning, which eventually impacted the writing for subsequent manuscripts:

"I think the process of writing does help you learn things better. [...] And I think at the very beginning I said, want to learn? When I want to learn something, I force myself to write a review paper."

Overall, this conception emphasizes writing as a tool for learning and self-regulation, with the writing process itself contributing to knowledge development and intellectual exploration.

Communicative

Faculty also viewed writing as a fundamental communicative tool for sharing discoveries with the broader scientific community. The emphasis is on clarity, audience awareness, and rhetorical strategy. This conception focused on writing as a means to disseminate findings and contribute to collective knowledge. Dr. K described writing as part of a scientific endeavor to make science available to everyone. Because of this, writing should consider the audience and adapt a storytelling approach:

"I think that's the main reason that we, at least my group writes papers, is to share our discoveries with others. I think as a scientist, one of our responsibilities is to share our science with other people. If we're not doing that, then I don't think we're fulfilling our mission really, because it's an opportunity for other people to learn. [...] So in terms of papers, I think I talk with students in my group a lot about telling a story."

However, a tension did rise in terms of what is shared with the world, while Dr. G, was reflecting on the role of writing, in terms of the communication of only the positive outcome, rather than all outcomes:

"All of these topics never worked in the past, and they won't work, but people are now doing it. [...], Why? Because we don't publish work that is not successful when trying to do research. You're trying to find something new, and then this idea comes across, and then no one has published it, because it didn't work, but you don't know about it because there is no report."

This tension highlights an unresolved aspect of the communicative conception in engineering: while writing is framed as a responsibility to share knowledge, norms around publication privilege successful outcomes, limiting opportunities to communicate uncertainty, failure, and negative results.

Socialization

Initially, socialization was tied to communication. However, faculty recognized writing's role in professional acculturation and identity formation within the discipline was conceptualized separately from writing being purely to communicate results. Writing as a process of socialization is understood as a vehicle for professional acculturation, a set of genre-bound practices through which emerging scholars learn, perform, and ultimately inhabit the norms, values, and identities of their disciplinary community. By publishing in recognized venues, adopting the field's rhetorical conventions, and increasing publication currency, writers gain visibility and legitimacy. That is, they signal that they "belong" to the field and are qualified to participate as full members of the scholarly network. Dr. A, a professor in Industrial engineering, highlighted how the desire to be accepted by the community could result in an obsession with citations:

“What you would like to do for your paper is for others to cite it. So that is why there is this obsession among scientists about citations. It’s important because you want your work to be read, and if nobody cites you, it’s probably because nobody reads you.”

Thus, the focus is on forging an academic identity and securing a place within the community’s hierarchy and networks, not on transmitting findings.

Funding acquisition

Faculty acknowledged the pragmatic role of writing in securing research funding. This conception frames writing as a persuasive tool for articulating research needs and demonstrating value to funding agencies. Attention, therefore, centers on aligning arguments with agency priorities, showcasing preliminary evidence of capability, and demonstrating an efficient use of requested funds. Thus, success is measured less by knowledge dissemination and more by the writer’s ability to translate ideas into financially supported work that sustains labs, personnel, and institutional prestige. While our study considers research writing distinct from grant writing, competitive grant proposals rely on a track record of publishable results. Successful funding, in turn, finances the experiments, personnel, and infrastructure that yield the next publishable study. Dr. E, Professor in Aerospace engineering, highlighted this clearly:

“So, if nobody's interested in answering the questions, nobody's going to pay you. You can't hire a graduate student, you can't buy the lab equipment, you can't travel to a conference, you can't do much. You can't even buy your computer to run codes. So we've tried to engage the students in the writing of proposal in addition to documenting of the work.”

Additionally, in this comment, Dr. E described funding-related writing as both part of their own professional responsibilities and as a skill doctoral students must gradually learn.

Dr. F, Professor in Environmental engineering, mentioned that funding is a driver to find the needs in research, highlighting how writing for funding requires different skills than traditional academic writing, emphasizing persuasion, stakeholder engagement, and practical impact:

“So we were always looking for, okay, where is the need? And then the next part of the research I to get the funding, to be able to do that work”

Together, these accounts illustrate how funding-oriented writing requires engineering doctoral students to navigate rhetorical demands that extend beyond traditional research reporting, reinforcing writing’s role as a strategic and institutional practice embedded in broader research environments.

Advancement of the field

In this conception, writing is a means of advancing disciplinary knowledge by sharing discoveries and establishing the significance of the research contributions. In particular, Dr. G, said:

"There has to be a contribution. That's the unique property of scientific writing - it moves the field forward."

However, in order to contribute to the field, it is important to put the research into context, Dr. L added:

"But as researchers, we have to put our work into the context of what happened before, be able to defend why what we are doing is even interesting or useful and novel."

The focus of this conception is on how writing facilitates the contribution of new knowledge and insights to the field, positioning the individual researcher's work within the broader context of disciplinary advancement. This perspective reinforces the collective nature of scientific knowledge and the role writing plays in building upon previous work to extend understanding in engineering disciplines.

Conceptions are interrelated

It is important to note that these categories of writing conceptions are not mutually exclusive but rather interrelated and often complementary. Eventually, all the categories are intertwined and related to some degree. Faculty frequently held multiple conceptions simultaneously, drawing on different aspects as context and purpose changed. For instance, writing that advances the field (e.g., advancement conception) often requires clear methodological documentation (e.g., instrumental conception) while simultaneously constructing new knowledge (e.g., epistemic conception). Similarly, persuasive writing for funding acquisition frequently builds upon communicative aspects of writing while also demonstrating potential contributions to the field. Figure 1 illustrates that faculty members commonly held multiple conceptions of research writing. Faculty held at least two conceptions, whereas no faculty mentioned all six. Moreover, Drs. C, J, K, and G held the same combinations of conceptions (i.e., advancement of the field, communicative, and instrumental), even though they taught at different departments and had different ranks.

Dr. H, associate professor in Aerospace engineering, clearly articulated the interconnectedness between communicative, socializing, and advancement of the field conceptions:

"I mean it's critically important not just how you communicate the research results, but also how you speak to the community, warn them of potential problems, also present excitement for new ideas that come out. Scientific papers do not always need to be readable by the larger community"

In this excerpt, Dr. H describes writing as more than simply reporting results. When they refer to "speaking to the community," they emphasize that research writing is directed toward a specific disciplinary audience with shared expectations and norms. Their focus on "warning" readers about potential problems highlights writing as a way for engineers to signal risks and guide how findings should be interpreted. At the same time, the idea of "presenting excitement for new ideas" points to writing as a means of shaping how new contributions are received and valued.

Finally, their comment that scientific papers do not need to be readable by a broader audience reinforces the view that writing primarily serves the needs of the disciplinary community and plays a central role in moving the field forward.

An example of the relation between epistemic conceptions and advancement of the field conceptions was described by Dr. A:

Scientific writing? Well, it means a contribution in a field of science that it's beyond the state of the art. So you need to, as part of your writing and the format of a scientific paper, it's always a review of the state of the art.

In this example, Dr. A highlighted that contributing to the field depends on first engaging deeply with existing research.

Figure 1. Distribution of Doctoral Writing Conceptions Across Engineering Faculty

	Advancement of the Field	Communicative	Epistemic	Funding Acquisition	Instrumental	Socializing
Dr. A						
Dr. B						
Dr. C						
Dr. D						
Dr. E						
Dr. F						
Dr. G						
Dr. H						
Dr. I						
Dr. J						
Dr. K						
Dr. L						
Dr. M						

Emergence of Artificial Intelligence

Although GenAI was not the main focus of our interviews, references to AI-enabled writing tools emerged in four of our interviews. Given the prominence of Gen AI in current debates about writing, we briefly describe these accounts as emergent observations.

Faculty discussions of GenAI arose primarily in three context 1) writing in a second language, 2) changes in writing practices over time, and 3) tension between GenAI supported writing as a mean for development versus efficiency.

In terms on GenAI and writing in a second language, Dr. C contrasted their doctoral training with current conditions, noting that support for learning to write about research in English depended also entirely on supervisors because “there were not tools like ChatGPT”. Extending on this notion of support for a second language Dr. A shared:

“I don't know if you want to get into that with the Chat GPT thing. It's a wonderful translator. That thing was actually this develop for translating from one language to other. So a foreign

student can write whatever in their own language, it returns it, and it gets pretty decent text in English”

Dr. I described using small language models to support reading through summarization, a step that helped them decide what to bring into their drafts: “we train language models on small sets of data, like research papers and things like that [...] And sometimes you can get a decent summary from that”. Highlighting the importance of corroborating all information, Dr. I shared that “you would definitely not want to take that as the truth. You'd want to go to the original research papers and check things out.”

Finally, Dr. M raised concerns on over reliance on AI supported learning, and how it could undermine the epistemic role of writing in learning and intellectual development. Dr. M described GenAI as a “Game changer” making it difficult to discern whose voice is present in a text. They expanded:

“I think that it [Gen AI] has brought something problematic. I don't believe it is necessarily for the benefit of those who use it, because writing is not only about dissemination, it is also about personal growth. It helps you organize your ideas and your arguments.”

Taken together, faculty reflected mixed opinions on the use of GenAI in writing. Given that these comments were not part of the formal thematic analysis, we present them only as illustrative observations and an opportunity to situate the implications of this work in the current context of higher education. Nonetheless, the fact that GenAI emerged in several interviews suggests that it is becoming part of ongoing conversations about writing in engineering doctoral education.

Discussion

Our analysis of engineering faculty conceptions of writing reflected similarities with the categories established by Gonzalez-Ocampo and Castelló [37], who identified instrumental, epistemic, and communicative conceptions of writing. Engineering faculty described these conceptions in discipline-specific ways that reflect the unique characteristics of engineering research and communication.

While the *instrumental, epistemic, and communicative* conceptions were evident in engineering faculty's conceptions of research writing, our analysis revealed additional conceptions that extend beyond their framework (i.e., socialization, funding acquisition, and advancement of the field). These conceptions reflect the unique priorities and writing practices in engineering disciplines.

The first extension was the *socialization* conception, which frames writing as a means of professional acculturation and identity formation within the discipline. While González Ocampo and Castelló [37] included the socialization aspect of research writing within the communicative conception, we distinguished between the two conceptions because the communicative conception focuses primarily on the dissemination of knowledge and research findings, whereas the socializing conception emphasizes identity formation and community membership. On the one hand, faculty who hold a communicative conception view writing as a means to share ideas. On the other hand, in the socializing role, writing serves as a means of integrating into the scholarly community and establishing one's professional identity as an engineer and researcher

The socialization dimension is consistent with frameworks that view professional identity as shaped through participation in communities of practice [44] and through the act of writing itself [45], [46]. It suggests that engineering faculty perceive writing as influential in shaping professional identity within their discipline and are explicitly aware of its role in students' identity development. At the same time, this conception is connected to broader institutional investments in engineering communication departments, centers, and courses that aim to connect writing instruction to disciplinary norms rather than treating writing as a generic skill [25], [47]. In this sense, engineering communication is best supported by helping learners recognize how particular ways of writing come to count as doing engineering work in specific contexts [48].

The second extension, *funding acquisition*, recognizes writing's pragmatic function in securing research resources. This perspective aligns well with the documented importance of funded projects in engineering doctoral training [49] and the influence of grant requirements on supervision [23], [50]. Identifying this conception highlights a practical aspect of engineering writing, its role in resource acquisition, which general writing theories may underrepresent, yet that resonates with descriptions of engineering doctoral education as grant-centric [51].

Prior research has shown that engineering doctoral students are predominantly supported through research assistantships tied to externally funded projects, and that funding stability strongly shapes students' agency, degree progress, and professional opportunities [51], [52]. Because securing funding is essential not only for sustaining doctoral training but also for success in tenure-track academic careers, faculty perceptions of writing as a tool for funding acquisition reflect broader structural conditions of the discipline. In this sense, writing for funding is closely linked to core supervisory responsibilities such as managing research projects, supporting students' progress, and integrating them into professional networks [53], [54].

At the same time, faculty accounts suggest that funding-related writing involves distinct rhetorical demands that differ from other forms of research writing. Unlike journal articles or dissertations, grant proposals require persuasive framing, alignment with funder priorities, and strategic articulation of significance and impact. These rhetorical expectations demand additional forms of expertise that extend beyond technical accuracy or clarity.

Finally, faculty emphasized the *advancement of the field* conception, viewing writing as a mechanism to actively move disciplinary knowledge forward, not just add to it. This is consistent with research linking scientific writing to problem-solving skills crucial for progress [55] and with broader conceptions of engineering communication that encompass diverse forms of knowledge-making [56]. This view goes beyond individual demonstrations of expertise by explicitly recognizing writing's role in collective knowledge progress.

Crucially, these conceptions are not mutually exclusive; rather, they are interconnected and complementary. This overlap aligns with existing research, which shows that writing constructs often intersect in practice [57] that individuals frequently hold multiple, even seemingly contradictory, beliefs about writing simultaneously (e.g., [58], [59]). The interconnectedness of these conceptions highlights that writing supervision in engineering is a complex, multilayered task that involves disciplinary, institutional, and identity factors [60]. It also captures the idea of academic literacies as multidimensional practices that resist simple categorization [18].

Moreover, although this study did not center on GenAI and writing, the emergence of this topic in some interviews highlights how current technological shifts are intersecting with conceptions about writing in engineering education.

Implications for Research

This study has several implications for future research on writing, supervision, and knowledge production in engineering. First, our findings suggest that research on engineering writing may benefit from attending more explicitly to the multiple functions writing serves, rather than treating writing primarily as a technical or communicative skill. While prior research has examined writing quality, genre knowledge, and communication effectiveness [32], [60], [61], our results highlight that writing is also deeply tied to epistemic processes, professional socialization, funding acquisition, and perceptions of contribution to the field. Future studies could examine how these conceptions are differentially emphasized across engineering subdisciplines, career stages, or institutional contexts, as well as how misalignments between faculty and student conceptions shape writing experiences and outcomes.

Second, these findings raise questions about how disciplinary values are reproduced through writing norms and publication practices. Faculty frequently described writing as a mechanism for advancing the field, but there are tensions related to what is considered publishable knowledge, such as the limited visibility of negative or null results. This suggests a need for research that interrogates how journal expectations, peer review practices, and funding structures implicitly privilege certain rhetorical forms and types of contributions.

Finally, the limited explicit attention to epistemic writing suggests the need for research that examines writing as a tool for learning and knowledge building in engineering doctoral education. Future studies could explore how graduate students engage in writing to make sense of literature, develop research questions, and refine ideas across different career pathways. As generative artificial intelligence tools become increasingly integrated into academic work, this line of research is especially timely, as such tools may reshape how students draft, revise, and externalize their thinking. Examining how GenAI intersects with epistemic writing practices can help clarify when these tools support learning and sense-making, and when they may risk narrowing writing to a purely instrumental activity.

Implications for practice

From a practice perspective, the results highlight the importance of supporting students in developing productive epistemic beliefs about writing, including seeing writing as an iterative and generative process rather than solely as a means of evaluation. As new tools such as generative artificial intelligence become increasingly integrated into academic work, research, and practice alike, researchers must consider how these tools intersect with epistemic writing practices and how they can be shaped to support learning without undermining the reflective and exploratory functions of writing.

More specifically, these findings suggest opportunities to strengthen doctoral engineering curricula by treating writing as a core part of doctoral training rather than as an optional skill. Writing plays a central role in learning, participating in the discipline, securing funding, and producing new knowledge. For this reason, doctoral programs may benefit from requiring writing-focused coursework that goes beyond technical correctness. Such courses could address

the different purposes of doctoral engineering writing, including learning through writing, communicating research, becoming part of the research community, and making strategic choices about audience and venue. Prior work has shown the value of teaching writing as a strategic and iterative process. For example, Berdanier's *So, You Have to Write a Literature Review* [62] emphasizes sense-making, positioning, and rhetorical decision-making rather than rigid templates. Framing writing instruction in this way may help doctoral students better understand how writing supports both their intellectual growth and their future careers in engineering.

Taken together, our findings point to a broader need to make the implicit dimensions of doctoral engineering writing more explicit. To support this, in Table 2 we summarized how the dimensions of doctoral engineering writing identified in this study can be translated into everyday supervisory practices. Rather than proposing new requirements or prescriptive models of advising, the table illustrates ways in which faculty can make writing expectations more explicit by drawing on practices many already use implicitly. Across dimensions, the emphasis is on helping students understand not only how to write, but what different writing tasks are intended to do. By making these mechanisms explicit, through modeling, conversation, and feedback, supervisors can help doctoral students navigate the rhetorical and strategic demands of engineering research writing more intentionally and with less reliance on trial and error.

Table 2. Suggestions for faculty to help doctoral students' writing development

Dimension of writing	Example actions supervisors can take
Instrumental	Give concrete feedback on organization, figures, clarity, and formatting; explain why certain structures are expected in journals or proposals
Epistemic	Encourage rough drafts, research memos, or outlines; motivate students to write to clarify what they know, what they don't, and what the next step is
Communicative	Discuss who the audience is for a given document; compare how the same idea is presented in a paper, a proposal, and a presentation
Socialization	Share examples of papers from senior researchers or lab alumni as role models; discuss why certain journals are appropriate for a given project; explain how claims, framing, and level of generality are adjusted depending on the target journal and audience
Funding acquisition	Explain how proposals differ from papers; discuss reviewer expectations and funding priorities; review examples of successful proposals; encourage students to contribute to writing research group proposals.
Advancement of the field	Ask students to explain how their work moves the field forward; connect papers to larger research questions or engineering challenges

Conclusion

Our findings highlight that engineering faculty conceptualize writing as far more than a technical skill, viewing it instead as a central practice through which knowledge is constructed, professional identities are formed, resources are secured, and the field advances. Reconnecting to

ongoing debates about writing and emerging technologies such as GenAI, our findings suggest that productive conversations about writing cannot begin with tools or policies alone. Rather, they require careful attention to how writing is understood and enacted within disciplinary contexts. Examining faculty conceptions alongside their supervisory practices and struggles is essential for understanding the full ecosystem of doctoral writing supervision in engineering, an ecosystem in which responsibility for writing development cannot be reduced to either student deficits or individual faculty shortcomings.

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Appendix

Appendix A

Faculty's Engineering Sub-fields and Ranks

Pseudonym	Engineering sub-field	Rank
Dr. A	Industrial	Full Professor
Dr. B	Engineering Science	Associate
Dr. C	Mechanical	Associate
Dr. D	Aerospace	Associate
Dr. E	Aerospace	Full Professor
Dr. F	Environmental	Full Professor
Dr. G	Electrical	Full Professor
Dr. H	Aerospace	Associate
Dr. I	Biomedical	Full Professor
Dr. J	Chemical	Associate
Dr. K	Acoustics	Associate
Dr. L	Aerospace	Full Professor
Dr. M	Engineering Science	Associate

Appendix B

Research Writing Guiding Questions

Main Question	Follow Up
In the context of your field, what is the meaning of scientific writing or writing about research?	What role does writing play in your scientific community How does it differ from other forms of academic writing? What are some common examples of research writing in your field?

In your opinion, what is the primary purpose of scientific writing in your field?	Has scientific writing in your field evolved over the years? If so, how? What do you consider to be good scientific writing?
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Appendix C

Initial Categories of Conceptions of Research Writing

Category	Example quote
Instrumental	“Writing papers has a structure that does not change much ... introduction, method, result, discussion—and you already know the length of each section ”
Epistemic	When you’re writing ... it really refines your thinking ; your ideas come together because of the act of writing.”
Communicative	“I think that’s the main reason that we ... write papers to share our discoveries with others. As scientists, one of our responsibilities is to share our science with other people.”
Accepted by academics	You have to write in order to be accepted into the academic cluster; if you don't, your research will never be known, and you as a scholar will not be recognized.
Vehicle of advancement of the field	We write so that other people can repeat what you have done in experiments or simulations ... and build upon it.
Being Persuasive	It’s almost all persuasive writing ... I have to convince you to build something a certain way or operate something a certain way.”
Disseminate for benefit of the people	“I think one of our responsibilities is to share our science with other people ... it’s an opportunity for other people to learn. ”
Show your work is credible and meaningful	You need evidence and justifications to support what you’re trying to do.”

Be cited	“There’s an obsession among scientists about citations —because if nobody cites you, probably nobody read you.” .
Get money	my objective is to get you to give me the resources to answer these few questions.
