



How Do Engineering Education Graduate Students Perceive and Negotiate Disciplinary Expectations in Academic Writing?

Athena Lin (Graduate Student)

Athena Lin is a PhD student in the School of Engineering Education at Purdue University and an NSF Graduate Research Fellow. She received her B.S. in Materials Science and Engineering from the University of Illinois at Urbana-Champaign. Her research interests center around engineering ethics education and preparing students for responsible engineering practice.

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Introduction and Background

Academic writing is an important aspect of graduate education. To succeed in their programs, graduate students must learn to communicate their research in a way that resonates with other scholars in their field [1]. In other words, they must write in a way that aligns with the expectations of their field. In engineering education, graduate students come from varied disciplines, and many are new to the field. They may find that the expectations around academic writing in engineering education differ from prior experiences in other disciplines.

Transitioning from a technical engineering disciplinary background to engineering education research can be challenging due to differences in what counts as appropriate and valid research designs [2]–[4]. Engineering disciplines tend to utilize more uniform methods and have more clearly defined standards of research rigor in contrast to education research, which comparatively has lower levels of consensus around standards of research rigor [2], [3]. To make rigorous research criteria more explicit, education researchers often define theoretical assumptions and ground their work in theory [2]. Because the need to explicate theory is not as explicit in engineering fields, researchers transitioning into engineering education research may not be familiar with how to situate their work using theoretical frameworks. This shift is one of the conceptual challenges Borrego [2] identified among engineering faculty learning to conduct education research. Other challenges included framing research questions, measuring constructs, valuing qualitative and mixed methods approaches, and finding interdisciplinary collaborators [2]. In addition to facing these conceptual challenges, researchers who transition from engineering to engineering education research may also experience a shift in their academic identities [4] and their epistemological beliefs, such as what they view as appropriate and valid research designs [3].

Though there has been prior research investigating this transition among faculty [2]–[4], there has been comparatively less research to understand how graduate students experience the transition from engineering disciplines into engineering education research. Moore et al. [5] studied graduate students' transitions into engineering education and argued that the epistemological and ontological shifts of this transition created challenges in learning how to write within their new discipline. Engineering education research has different expectations around the structure of academic arguments, which can be challenging for students to navigate when they enter the discipline as a new researcher [5]. To help students navigate this disciplinary transition and develop effective writing practices, it is important to understand how students perceive and negotiate expectations around academic writing.

Study purpose

This study aims to understand how graduate students in engineering education learn about and experience academic writing. While Moore et al. [5] focused on developing graduate students' argumentation skills, this study explores academic writing as a social practice and the expectations that influence writing as a social practice. This study uses academic literacies theory

to understand how graduate students in engineering education experience the social practice of academic writing.

Academic literacies theory

Academic literacies theory adopts a social and cultural perspective to writing, as opposed to a cognitive approach, and views writing as a social activity deeply connected to institutional and disciplinary contexts [1]. In this way, academic literacies theory differs from other popular models for studying academic writing. In contrast to the skills model, which emphasizes writing as a cognitive skill, academic literacies theory views writing as a socially situated practice and privileges practice over text [6]. By focusing on practice instead of text, academic literacies theory can help uncover disciplinary expectations around writing and how these expectations shape writing practices [6]. In this way, academic literacies theory is similar to the academic socialization model of writing, which also situates writing within a disciplinary community. Unlike the academic socialization model, academic literacies theory also considers the influence of institutional contexts on writing practices [6]. Furthermore, academic literacies theory aims to illuminate issues of power and identity in enforcing disciplinary writing practices and conventions [7].

In academic literacies theory, writing practices develop within a disciplinary community. These writing practices include developing familiarity with literature, learning to write for a particular academic audience, and understanding how research is conducted within the discipline [6], [8]. Writing skills may not necessarily transfer across disciplinary contexts; instead, they adapt based on expectations in new disciplines and departments. Expectations around academic writing are tied to epistemologies of the field and dictate what counts as knowledge [9]. Thus, learning to write in a new discipline involves understanding how meaning is constructed in that discipline and adapting to the literacy practices of that discipline [10].

Methods

This study explores how graduate students experience disciplinary writing practices within engineering education research. Specifically, this qualitative study addresses the following research questions: What do engineering education graduate students perceive as disciplinary expectations around academic writing? How do these expectations inform their own writing practices?

With approval from the Institutional Review Board, I conducted semi-structured, hour-long interviews with six graduate students in an engineering education department about their writing practices and their perceived expectations of academic writing in the field. I focused on one department so I could understand the writing expectations embedded within the localized context of a single department and more broadly within the field of engineering education. In this department, graduate students take foundational courses that cover several topics related to academic writing including writing mechanics and style, constructing arguments, searching for relevant literature, and developing theoretical frameworks. Many of these foundational courses culminate in scaffolded writing assignments that allow students to practice writing scholarly documents with formative feedback from peers and instructors.

Drawing from academic literacies theory, my data sources include interviews rather than writing excerpts. Through interviews, I could center students' experiences with academic writing rather than their writing abilities. The purpose of the interviews was not to evaluate students' writing skills but rather to understand their perceptions of academic writing in their field and how these perceptions informed their writing practices. This focus on writing practices over excerpts is a departure from other studies on graduate writing in engineering (e.g., [1], [11]) but a hallmark of academic literacies theory, which privileges practice over text [7].

The interview protocol was designed to understand a range of students' perceptions of and experiences with academic writing. The protocol included questions about students' writing practices (e.g., What tasks are part of your writing process?), questions about their perceptions of academic writing (e.g., What separates academic writing from other forms of writing?), questions about writing within their field (e.g., How would you describe the expectations around writing in your field? Where did you learn these expectations?), and questions about writing feedback (e.g., What kind of feedback on your writing do you find most helpful?).

I transcribed the interviews, pseudonymized participants, and then analyzed the data using thematic analysis [12]. Through thematic analysis, I generated inductive codes and interpreted them through the lens of academic literacies theory. I coded instances where students described their beliefs and perceived expectations around academic writing and how these beliefs shaped their own writing practices. I then interpreted these coded passages using academic literacies theory to construct themes around how students made sense of disciplinary writing practices, including whether they internalized these expectations into their own writing practices.

Findings and Discussion

Academic writing is intertwined with research and what counts as disciplinary knowledge

Graduate education trains students to conduct research within their discipline, including how to formulate research questions, design research studies with strong theoretical and methodological foundations, and communicate and disseminate their work [11], [13]. Academic writing is a central aspect of the research process. In other words, academic writing is inherent to the process of discovering and constructing knowledge within a discipline.

The participants in this study recognized the central role that academic writing plays in the research process. For example, Sophia, a third-year graduate student, described the following: "The nature of academic writing is so intertwined with the research process itself. That's what distinguishes it from creative writing or other forms of writing." Sophia expresses a belief about the epistemological nature of academic writing – that academic writing is informed by the research process. Academic writing is distinct from creative writing and other types of writing because it relates to processes of inquiry that discover and construct knowledge within one's discipline.

Students also differentiated academic writing from creative writing by how claims are substantiated in each form of writing. For example, Morgan, a fourth-year graduate student, explained:

I think the biggest difference is in the claims and what counts as substantiation. In a fiction world, I say the claim and then the evidence is just more stuff I make up. Generally, in academic writing, if I make a claim, I need evidence. That evidence is going to look like other literature, or logic, or things that are outside of just myself in my own head. (Morgan)

Morgan expresses that academic writing, in contrast to creative writing, requires substantiated claims supported by valid forms of evidence. In research, this often includes citing literature, as Morgan mentions, or empirical data, as Nathan, a first-year graduate student, describes: “Academic writing requires more structure in the sense that you need to create a case based on data that you’ve collected.” Nathan views academic writing as a process of constructing arguments based on empirical data. In both instances, Morgan and Nathan express a shared belief about the kinds of evidence that are required to corroborate claims in academic writing.

In addition to making substantiated claims with appropriate evidence, students named other disciplinary expectations of academic writing. Eli, a third-year graduate student, said: “Academic writing has certain outcomes that need to be accomplished in order for it to be considered legitimate... Academic writing has a solid methodology and framework guiding it, and a well-crafted research question.” In this quotation, Eli lists elements of research designs as expectations of academic writing that must be met to be considered legitimate within his field.

These examples demonstrate ways that students recognize the interconnections between academic writing and the research process. Because academic writing is part of the research process, academic writing embodies epistemological beliefs about what constitutes knowledge in their field, how this knowledge is constructed through research, and how this knowledge should be communicated. Through learning disciplinary expectations about academic writing, students also learn what counts as knowledge within their field [9]. It is important to acknowledge epistemological beliefs around academic writing because they illustrate the stakes of learning and adhering to disciplinary expectations. They convey what one’s discipline will accept as legitimate contributions to knowledge. Thus, learning to write academically is also a process of learning how to make valid contributions to one’s field.

Academic writing embodies disciplinary expectations that are learned from others

Graduate students’ writing practices develop within their disciplinary community and evolve as they learn what is expected of them. Learning these disciplinary expectations involves engaging with others in their discipline, including their advisors, or through reading the work of scholars in their field. Many of the participants in this study recognized the value of reading articles in their field. For example, Sophia describes how she learns from the structure and style of other scholars’ work:

When I write a paper, I'll go and look for similar articles in both the topic and style. I'll look for other articles in the journal I'm interested to publish in. Or if I'm writing a qualitative piece using thematic analysis of interviews, I'll try and find other articles that use that method to look at how they present results. I've learned a lot from reading other articles and how other scholars in my field write and how they present ideas and how they structure arguments. (Sophia)

Sophia describes seeking out articles in her field for inspiration and models elements of these articles in her own writing. By reading published work, students discern disciplinary expectations within a particular genre or type of research paper that then informs their own work. Through learning from other scholars' work, students recognize ways of writing, such as how to present results or structure a paper, that will resonate with scholars in their field.

Another way that students learn disciplinary expectations about writing is through feedback. For graduate students, advisors are an important source of feedback because they often review students' writing outputs. In addition to their advisors, students seek feedback from peers, such as through writing groups. Participants in this study recognized the central role of feedback in improving their writing. Oliver expresses this belief when he says:

Writing is one of those things where the only way you pick up on it is you just keep doing it. You have to constantly be writing and constantly getting feedback and constantly going through that cycle of write, feedback, write, feedback, write. It's tough going through those, but I don't think there's any better way to do it and you have to get the feedback. And sometimes you get the feedback where you turned this black and white page into your professor, and it comes back and looks like it's on red paper. It's the sort of process where you just have to keep doing it to get better at it. (Oliver)

Oliver recognizes the importance of formative feedback in shaping his writing practice and improving his work. He learns from this iterative process of practicing writing and getting feedback from others. Feedback communicates to students what is expected of their writing and allows them to revise accordingly. Learning to integrate feedback into one's work is an example of how students internalize disciplinary expectations into their own writing practices. Learning to respond to feedback is also an important part of peer review processes and engaging in academic discourse with other scholars in one's field.

These examples emphasize ways that academic writing is constructed as a social practice. Students learn how to write as members of their discipline and research tradition. They learn by engaging with scholarship in their field and receiving feedback from experienced researchers. Students then internalize what they have learned into their own writing practices.

Academic writing involves negotiating disciplinary expectations

Graduate students need to understand disciplinary writing expectations so they can write in a way that is valued in their field. On the other hand, writing can also be deeply personal and a way to express one's beliefs. Thus, graduate students must learn how to write in a way that remains true to themselves and will also be recognized and accepted within their field. A difficult tension

arises when students feel compelled to make choices about their writing that conflict with their conceptions of themselves and what they value. In these situations, students must negotiate how to say what they want while making sure what they write will be recognized within their field. Nygaard [14] refers to these situations as sites of negotiation, which are times when students have to negotiate competing external demands with their personal goals. These negotiations influence the process of writing and producing written documents.

The graduate students in this study described sites of negotiation they had experienced in their writing practices, particularly around choosing their writing voice and generating writing outputs. These experiences represent instances when students felt that disciplinary expectations for their writing conflicted with their own goals. Navigating these tensions involves weighing what is valued in their disciplinary writing with who they are as a researcher and a writer.

Negotiating expectations around voice. Choices around voice allow writers to express their point of view. In academic writing, choices about voice also involve how much to insert one's presence into their writing. For example, passive voice tends to obscure the presence of the researcher more than active voice does. Many of the participants in this study described negotiating disciplinary expectations around voice in academic writing. This negotiation can be challenging because there can be disciplinary standards that govern how one should write and what voice one should adopt when they write.

Since academic writing is intertwined with the research process, choosing which voice to use is also a choice about how visible to make one's presence as a researcher. Oliver explains how he perceives expectations around when it is appropriate to use active versus passive voice:

In academic reports, where you're talking about a methodology or a method, you want to use passive voice, because the idea is that it's the method that's the star, not you. But there are also parts of academic writing where there is some level of active voice. I think that's a shift from previous years and previous decades where that wasn't the case, especially in science. I've seen in recent years where they're starting to say, you can be active in your abstract, you can be active in your conclusions, you can be active in these little parts, but once you start talking about the methods, once you start talking about the results, that's when you switch to passive voice. (Oliver)

Oliver describes learning to write methods in technical reports in passive voice to obscure the role of the researcher. He also perceives that expectations around writing in passive voice are changing to allow researchers to make themselves more visible with the use of active voice. Oliver's observations about scientific writing are consistent with positivist epistemologies that dominate engineering research. The use of passive voice in scientific writing reinforces the notion that there is an observable, measurable, and objective reality [5].

When students transition from engineering disciplines into engineering education research, they observe more widespread use of first-person voice in academic writing. For example, Nathan noticed that many papers he read in engineering education research were written in first-person:

In technical writing, it's very much in third person and mentioning what was done without inserting yourself into the conversation. And reading a lot of papers this semester

from engineering education researchers written in first person, that's been really surprising and nice to see. Because when you're a child, that's the way you write. You write in first person, you write about what happened around you. And then that's kind of stripped away from you, in technical writing when you get to college or high school or later stages. (Nathan)

Nathan reflects on learning to write in third person in engineering and notes that the use of first-person voice is more acceptable in engineering education research. This shift in voice reflects different epistemological beliefs in engineering education research compared to engineering research. While engineering research tends to embody positivist assumptions about reality, arguments in engineering education research tend to view reality as socially constructed. To account for this subjective reality, engineering education researchers may use the first-person voice to make their positionality explicit in their writing [5].

The use of first-person voice is especially prominent in qualitative research, which emphasizes the role of the researcher in constructing meaning from empirical data [5]. Julian, a second-year graduate student, describes negotiating voice and communicating his presence in his writing:

I'm also part of the research. I am another actor inside the research. And I can be part of this discussion in the writing... I like qualitative research. I like the idea of putting my own voice there in a document. When I read the researchers who use first person pronouns, I'm very interested in that. And I try to imitate that to improve my own writing when reading them. (Julian)

Julian wants to make himself visible as part of the research he is conducting. He connects this to his interest in qualitative research and reading papers that are written in first person. Julian feels connected to qualitative inquiry and views it as a research paradigm that aligns with how he wishes to express his ideas.

These examples illustrate how students negotiate their voice and presence as a researcher within their writing. The participants in this study registered more prevalent use of first-person and active voice in engineering education research compared to their prior experiences in other engineering disciplines. They also recognized that this shift in voice was related to different research paradigms in engineering education. By seeing the use of first-person voice modeled in published articles, students broadened their conceptions about what types of voice were acceptable within their field. Some students resonated with these changes and incorporated the use of first-person voice into their own writing.

Negotiating expectations around academic writing outputs. Academic writing often focuses on research outputs, which is seen as a form of research productivity [14]. These research outputs can take on many forms, and each discipline may value academic writing outputs differently [14]. Graduate students learn what counts as productive academic writing within their discipline [13].

In this study, the primary research outputs that the participants discussed were conference papers, journal articles, and grant proposals. Students viewed grant proposals and journal articles

as the most valued forms of writing in their field and consequently recognized they also came with the highest set of expectations. As Oliver describes:

The expectations are definitely high when you are writing for grants and journal articles. There are a lot of expectations placed on you, especially for grant money. There's only so much that's given out every year. You have to have a very convincing argument as to why you should get funded... There is a lot of expectation on writing. If you don't do it the way that you're expected to do it, people call you out on it. You're expected to be able to write very well, especially if you want to do things like get money and get published.
– Oliver

In this quotation, Oliver recognizes that peer review processes for publishing and funding proposals reinforce expectations for how journal articles and grant proposals should be written. Academic research outputs are expected to conform to certain standards to be judged favorably.

Notions of research productivity are closely linked with notions of academic success [14]. Students' perceptions of what counts as productive writing can influence their choices about which research outputs to write and where to publish them. Their practices will also depend on how productivity is measured within their institutional and disciplinary context [14].

Students described feeling pressured to publish, but they did not have a clear understanding of how much they were expected to publish to be considered productive. As Morgan describes:

I think there is an expectation for graduate students of this progression of, you're first going to do a conference paper and get used to that, and then we're going to move you up to a journal paper. And from what I've heard, it doesn't seem like people have really settled on like a set expectation for the number. There's this general sense that you should be putting things out and they should look like this. But everyone is still kind of flexible on the exact numbers... People who don't have multiple papers I would imagine are a little bit more apprehensive of making sure they have enough. (Morgan)

Morgan recognizes that there is a general expectation that she should be writing conference papers and journal papers, but there is not a commonly accepted threshold for what is considered a sufficient number of publications. This uncertainty can be stressful for students who are wondering how much is "enough". Julian suggests that these concerns about having enough publications originate from wanting to secure future job prospects:

If I have more conference papers or journal papers, then maybe I could have a very good job later. That's one of the messages that I'm receiving right now. I guess that's something that we as students have imposed on ourselves, the idea that if we have more papers, we have more opportunities. (Julian)

Julian recognizes that the expectations to publish are self-imposed by students and reinforced by the pressures of finding a job after graduate school. These expectations are connected to students' beliefs that their job prospects will be influenced by the number of publications they have. These concerns around research productivity are prevalent throughout academia.

Academics face pressures to regularly publish their research [14], and students are not immune to these pressures.

Students also must decide how to negotiate expectations around their written research outputs. Though students acknowledged that certain research outputs are more valued than others in their field, some students resisted these expectations. For example, Julian expresses his wish that conference papers were more valued than journal articles:

I guess the most valuable are the journal articles. Because they give prestige to people... My problem is that journal papers are more for people who have passed some filters. It's like winning a game because you passed those filters. So it gives power to some specific people who are going to have the power to say, in engineering education, it's going to be this way. We are diverse, and conference papers are more an opportunity to see that diversity, and I prefer that than the journal papers. Conference papers are creating community more than creating prestige. I like that. (Julian)

Julian acknowledges that journal articles are what are valued most in his field, but he pushes back on this notion and expresses that conference papers are more personally meaningful to him because they emphasize community and are a better forum for hearing from diverse perspectives, not just the perspectives of those who have the ability to publish journal articles. Julian expresses a tension between which research outputs he believes are valued within his field and what he personally values. He values the contributions that conference papers make to his field and problematizes the relative prestige of journal articles.

Julian's quotation helps illustrate why it is important to understand how students negotiate expectations around research outputs. A perceived lack of productivity does not necessarily point to a deficit in a student but rather suggests that the student could be prioritizing other forms of academic contributions or less popular forms of dissemination that are not as clearly valued within their field [14].

Conclusions

Graduate school is a formative time for students to learn the expectations of their discipline, especially when students transfer into a new discipline for their graduate studies. Many graduate students in engineering education are new to the field and learn to adapt their writing practices based on their perceptions of scholarly writing in their field. These expectations may be explicitly or implicitly communicated to students and likely influence their writing practice. It is important to understand how graduate students learn academic writing because the ability to write well can connote expertise, affect the development of one's academic and disciplinary identity, and influence post-graduation career trajectories [1].

In this paper, I argue that learning academic writing involves learning the disciplinary conventions of writing in one's field and learning how to negotiate these expectations in one's own writing. Students' writing practices are shaped by their epistemological beliefs about research and what counts as legitimate contributions to knowledge within their field. The findings from this study illuminate some of the disciplinary expectations that graduate students

in engineering education experience around academic writing and how they have negotiated these expectations within their own writing practices.

Implications

The findings from this study can inform ways to support graduate students' development as writers and scholars in engineering education. Since many graduate students in engineering education are new to the field, teaching academic writing is about teaching them to write as members of their new discipline. This involves being explicit about disciplinary conventions and beliefs about what constitutes knowledge in the field and how knowledge is constructed and critiqued. It is important to recognize that many students come with research experience from engineering disciplines that may espouse different beliefs about knowledge and prioritize different research traditions. In these cases, it may be helpful to explicate the epistemological differences between engineering education research and other engineering disciplines to help students understand how and why they can adapt their writing to the conventions of their new discipline [15]. Beyond explaining disciplinary expectations in academic writing, we can also support students as they negotiate these expectations in their own writing. We can recognize how these expectations influence students' writing practices and which types of writing they pursue, and we can help students negotiate these expectations when they conflict with what students value. By implementing these recommendations, we can better prepare students to be effective writers and researchers in their chosen field.

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References

- [1] C. G. P. Berdanier, "Genre maps as a method to visualize engineering writing and argumentation patterns," *J Eng Educ*, vol. 108, no. 3, pp. 377–393, Jul. 2019, doi: 10.1002/jee.20281.
- [2] M. Borrego, "Conceptual difficulties experienced by trained engineers learning educational research methods," *Journal of Engineering Education*, vol. 96, no. 2, pp. 91–102, Apr. 2007, doi: 10.1002/j.2168-9830.2007.tb00920.x.
- [3] S. Dart, S. Trad, and K. Blackmore, "Navigating the path from technical engineering to engineering education research: A conceptual model of the transition process," *European*

Journal of Engineering Education, vol. 46, no. 6, pp. 1076–1091, Nov. 2021, doi: 10.1080/03043797.2021.1992609.

- [4] A. Gardner and K. Willey, “Academic identity reconstruction: The transition of engineering academics to engineering education researchers,” *Studies in Higher Education*, vol. 43, no. 2, pp. 234–250, Feb. 2018, doi: 10.1080/03075079.2016.1162779.
- [5] K. Moore, C. E. Wright, E. M. Stone, and A. Pawley, “Visualizing arguments to scaffold graduate writing in engineering education,” in *2021 ASEE Annual Conference & Exposition Proceedings*, Virtual, 2021, p. 21.
- [6] M. R. Lea and B. V. Street, “The ‘academic literacies’ model: Theory and applications,” *Theory Into Practice*, vol. 45, no. 4, pp. 368–377, Nov. 2006, doi: 10.1207/s15430421tip4504_11.
- [7] T. Lillis and M. Scott, “Defining academic literacies research: Issues of epistemology, ideology and strategy,” *JAPL*, vol. 4, no. 1, pp. 5–32, Aug. 2015, doi: 10.1558/japl.v4i1.5.
- [8] A. Gregg, C. G. P. Berdanier, and K. A. Thole, “Theoretical and applied perspectives on online graduate engineering education: Learning-centered vision, administration, and course design,” Virtual, 2021, p. 14.
- [9] M. R. Lea, “Academic literacies in theory and practice,” in *Literacies and Language Education*, B. V. Street and S. May, Eds. Cham: Springer International Publishing, 2017, pp. 147–158. doi: 10.1007/978-3-319-02252-9_19.
- [10] M. R. Lea and B. V. Street, “Student writing in higher education: An academic literacies approach,” *Studies in Higher Education*, vol. 23, no. 2, pp. 157–172, Jan. 1998, doi: 10.1080/03075079812331380364.
- [11] C. G. P. Berdanier, “Linking current and prospective engineering graduate students’ writing attitudes with rhetorical writing patterns,” *J. Eng. Educ.*, vol. 110, no. 1, pp. 207–229, Jan. 2021, doi: 10.1002/jee.20368.
- [12] G. Terry, N. Hayfield, V. Clarke, and V. Braun, “Thematic analysis,” in *The SAGE Handbook of Qualitative Research in Psychology*, 2nd ed., C. Willig and W. Stainton-Rogers, Eds. London: Sage Publications, 2017.
- [13] C. G. P. Berdanier and E. Zerbe, “Correlations between graduate student writing concepts and processes and certainty of career trajectories,” in *2018 IEEE Frontiers in Education Conference (FIE)*, San Jose, CA, USA, Oct. 2018, pp. 1–8. doi: 10.1109/FIE.2018.8658678.
- [14] L. P. Nygaard, “Publishing and perishing: an academic literacies framework for investigating research productivity,” *Studies in Higher Education*, vol. 42, no. 3, pp. 519–532, Mar. 2017, doi: 10.1080/03075079.2015.1058351.
- [15] S. Clarence and S. McKenna, “Developing academic literacies through understanding the nature of disciplinary knowledge,” *London Review of Education*, vol. 15, no. 1, pp. 38–48, 2017, doi: <https://doi.org/10.18546/LRE.15.1.04>.