Lettersmith: Scaffolding Written Professional Communication Among College Students

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ABSTRACT

Professional writing is critical for job search and performance, but many – especially those without work experience – struggle to write well. We introduce an instructional approach called 'scaffolded annotation' as a way to guide students in creating initial drafts of professional writing, like client emails and cover letters. We studied the implementation of scaffolded annotation in a digital platform called Lettersmith. First, we performed a quasi-experimental study and found that students applying scaffolded annotation in Lettersmith were more likely to include key components of professional writing. We also interviewed instructors and students who used Lettersmith and found that scaffolded annotation helped students in guiding structure, content, and tone. Instructors found the approach useful for articulating writing task expectations, pinpointing student gaps in understanding, and scaling instructional support for early-stage drafting. We provide implications for writing instruction and HCI researchers developing writing support tools.

KEYWORDS

Writing, Scaffolding, Annotation, Modeling, Reflection, Learning, Workplace Communication

1 INTRODUCTION

Communication skills are ranked at the top of the list of attributes sought by corporate recruiters [9] with employers ranking the ability to write well just as high or more highly than any technical or quantitative skills [44]. However, the landscape of communication is changing dramatically as new technologies enable communication independent of a writer's actual writing skills [1]. For instance, what if you received an impressive job application written by an AI system, how would you feel? Our position is that writing tools should be for assistance rather than the replacement of communication, especially in high-stakes contexts like job seeking and relationship development. While such automatic writing support tools may be especially useful for some situations (e.g. summarizing long discussions [103]), it may be misleading or confusing if used as a representation of human ability.

Yet, writing in general is hard to learn because it requires a range of socio-cognitive functions to effectively plan, monitor, and review one's own writing [6, 17, 47]. Employers express that professional writing skills are one of the hardest to teach, with reports stating that only 26.2% of college graduates write at a level deemed "proficient" [27]. Another report estimated that American companies spend $3.1 billion annually on up-skilling employee writing ability and re-doing work as a result of communication errors [69]. Professional writing in particular is challenging because it involves a wide range of requirements, from knowing how to structure communication to knowledge about appropriate tone [10].

Professional writing skills are expected to be taught in college-level courses in order to prepare students for the working world. Yet, prior research finds that knowledge of how to communicate in a formal context is often learned from one's family and upbringing [51]. Related research has also uncovered workplace biases that show how people in power are more likely to respond to individuals who sound like them [22], emphasizing just how serious gaps in writing proficiency may be on long-term career trajectories. Writing instruction scholars express that greater instructor transparency can reduce barriers to these "unwritten" expectations, particularly for underserved students [32, 98]. We emphasize that our goal is not to force students to lose their personal style of writing but to help them understand and adopt global standards of clear communication in the workplace, such as how to elaborate on personal experience in cover letters, construct manageable help requests in emails, and succinctly detail findings in project reports.

In order to address the challenge of preparing students for writing in the workplace, we introduce an approach to writing instruction called *scaffolded annotation* and evaluate its application through a digital platform called Lettersmith [3, 49]. Scaffolded annotation leverages learning sciences principles [13, 31] to break down expert knowledge into manageable tasks, thus helping students learn to identify and apply best practices of professional writing on their own. In this study, we address the following questions:

- **RQ1:** What is the effect of scaffolded annotation on students' professional writing task outcomes?
- **RQ2:** To what extent does scaffolded annotation influence *students'* professional writing?
- **RQ3:** To what extent does scaffolded annotation influence *instructors'* teaching of professional writing?

In order to address these questions, we build on prior work on the Lettersmith platform, which has already demonstrated its

ability to improve writer confidence and overall writing quality, even when the tool is removed [49]. In this study, we introduce 'scaffolded annotation' as an instructional approach that combines using model texts [28, 35] and annotations [53] to enhance student writing performance. Specifically, we evaluate the application of scaffolded annotation via a digital platform, Lettersmith [3], in a large midwestern university in courses teaching professional writing. First, we performed a quasi-experimental study to evaluate the differences in writing outcomes for when students did and did not use Lettersmith to draft a client-facing email. Experimental results show that students were 36.43% more likely to include key components of this type of professional writing when drafting with the Lettersmith tool (RQ1). Second, we interviewed 19 students and 11 instructors in order to understand how scaffolded annotation influenced their writing and teaching practices respectively. The interview results revealed that scaffolded annotation helped students with writing structure, content, tone, and reflection (RQ2). For instructors, scaffolded annotation helped them clarify writing task expectations, pinpoint where students had gaps in understanding, and scale instructional support for early-stage drafting (RQ3).

2 RELATED WORK

2.1 Expectations of Professional Writing

We define professional writing as any written communication performed in a workplace context or in the pursuit of work. Professional writing often serves as a bridge into careers, especially given that job applications, networking, and day-to-day work are increasingly being conducted online. Yet, professional writing follows practices unique to workplaces that are not always found in other forms of writing. Unlike other contexts, like narrative and academic writing, professional communication often involves hierarchy, in that communication is often between superiors and subordinates, employees and clients, and/or peers [10, 45]. It is typically strategic and requires careful control of a 'professional' tone, which is often both loosely defined yet also follows a broadly–but not universally– shared set of beliefs within a specific field or organization about what and how to communicate [10]. Finally, it is often expected to be concise and efficient, which requires balancing between including necessary information without being too wordy. While other forms of writing and communication might share similar attributes, employers repeatedly express that the writing taught in an academic setting does not meet the standards of workplace writing [27], and that significant improvements are needed in higher education writing instruction.

Accessible and structured approaches to writing instruction are necessary for the task of teaching professional writing. However, there are limited platforms that support professional writing at the moment, and they are largely focused on recommending connections [48, 67], organizing team discussions [103], or facilitating social networking (e.g., LinkedIn [4]). While these platforms provide places for professional writing to happen, they do little to facilitate the process of writing, such as guiding content and structure. Those that do, focus on word and sentence level guidance, like pointing out grammar mistakes or edits to make a sentence for succinct (e.g., Grammarly [2]). We address this gap in the need for professional writing support tools by building on learning sciences

constructs of writing guidance and applying it to the context of professional communication.

2.2 Writing Support Tools

The majority of existing writing support tools focus on maximizing the quality and efficiency of the written output, but do little to guide the cognitive processes of learning how to write. In an evaluation of 44 writing support tools, Strobl et al. found that the majority of writing tools primarily support writing at the microlevel like spelling and grammar mistakes [85]. HCI researchers have also developed platforms to coordinate writing, like managing and engaging crowds [14, 70] in writing of stories [58], news articles [7], and Wikipedia articles [55]. Others have developed tools for machine-in-the loop collaborative writing, such as machinegenerated sentence and phrasing suggestions [12, 29, 30, 42] and text evaluation [59, 102].

Tools that focus on supporting the cognitive process of writing have often focused on providing feedback. Peer feedback systems [63, 64, 80] have been shown to guide peers through providing feedback comparable to the instructor. Automated Writing Evaluation (AWE) systems provide students with automatic feedback [97] so that they can make changes in the moment. However, reviews of automatic feedback systems have not been shown to be particularly effective—outside of being able to provide feedback more quickly than a live instructor [82]. While feedback is useful for improving writing through iterations, it only occurs after learners create their initial draft. We see an opportunity to support the cognitive processes of writing in learners' initial process of drafting when they may have trouble planning and getting started.

Recent advances in writing instruction tools have started to support writing structure and organization by demonstrating the use of machine learning in guiding how to write an argumentative essay [92, 94] and evaluating whether a learner has succeeded or failed at particular rhetorical moves [93, 95, 96]. While machine learning tools can help scale writing guidance, their suggestions are generated from a large library of general input and not necessarily customizable to individual instructors' preferences. Learning sciences scholars emphasize the importance of dialogue and context-specific modeling in developing student self-regulation skills of complex tasks [71, 90]. Our work may not incorporate machine learning at the moment, but we explore how a writing support tool can both scale instruction while providing agency in how instructors teach specific assignments.

2.3 Theoretically Motivated Approaches to Writing Instruction

HCI and writing education researchers argue that in order for computer-based writing tools to be effective, they must support the cognitive processes of writing [8, 45, 45, 49]. This work applies principles from social cognitive theory and cognitive apprenticeship to motivate our approach. Social cognitive theory was first introduced by Albert Bandura to express that learning occurs in a social context in which people are shaped by what they observe and experience [13]. While colleges and universities are tasked with preparing students for communicating in the working world, professional writing is challenging to teach in the classroom because so much of

	Scaffolded Annotation	Model Texts [28, 35]	Annotation [53]
Similarities	• Emphasizes learning from others • Allows for making thinking visible	• Emphasizes learning from others	• Allows for making thinking visible
Differences	• Annotated model texts that break down examples into manageable components • Shared annotations curated by instructors that outline key components of the writing task • Annotating one's own drafts using shared annotations, which can be used as examples for others	• Provides text with no overlay of explanation	• Allows for any annotation, not curated or guided by instructor • Typically has learners develop annotations

Figure 1: Table outlining the differences between scaffolded annotation and existing writing instruction approaches of model texts and annotation.

it is learned through context-specific observation and different from the type of writing students typically encounter in a college setting. Therefore, scholars have suggested using cognitive apprenticeship as a way to teach complex skills in classroom settings. Building on the principles of social cognitive theory, cognitive apprenticeship was introduced as a set of instructional approaches to make thinking visible for complex tasks [31]. Strategies of cognitive apprenticeship include modeling, coaching, feedback, and reflection, which emphasize the importance of learning by observing others and reflecting on one's own practice.

Writing researchers and practitioners have applied these learning sciences approaches to the field of writing through the pedagogical tools of *model texts* and *annotations*. Instructors use *model texts*—texts written by a specific writer in a specific situation used to exemplify a genre—to illustrate what content to include and how to organize text elements [28, 35]. Model texts, which build on the cognitive apprenticeship practice of modeling [31], provide examples that students can read and use to construct their own writing in ways that go beyond following general best practices [36]. Students may learn about form and organization from analyzing model texts in certain genres [86, 87]. For instance, students can compare multiple written examples in a given genre to uncover the "rhetorical moves" writers make in deciding what content to include [50, 86] and "how they say it" [50]. Model texts [28, 87, 88] build students' knowledge of that genre and help students transfer that knowledge to new tasks [38].

Having learners view others' *annotations* builds on the cognitive apprenticeship practice of modeling and coaching by making visible others' interpretations of text. Annotation—"a note added to text" [53, p. 12]—has been used to support expert [52] and student analysis [19, 33, 66] of model texts. Having students annotate often results in richer discussions and engagement with readings [18, 89]. Recently, advances in annotation interfaces have introduced new ways of sharing annotations. For instance, platforms that facilitate social annotation (e.g., Perusall [5]) allow students to view and respond to peer annotations, which has been shown to foster a stronger sense of community in the classroom [54]. Scholars who study annotations find that annotated material improves recall [39, 101], while reducing unnecessary summarizing and increasing critical reflection in reading responses [100, 101]. As digital technologies make it easier to share annotations, scholars suggest that making annotations visible to others can help limit the cognitive burden on novice writers [46, 56, 57]. For example, shared frameworks of annotations may help learners identify and apply rhetorical moves in model texts more quickly [61, 76, 78]. Our study focuses on the potential of using shared annotations to support student learning of professional writing.

2.3.1 Introducing 'Scaffolded Annotation'. We introduce 'scaffolded annotation' as an instructional approach that combines the benefits of *model texts* [28, 35] and *annotation* [53]. Similar to model texts, scaffolded annotation builds on principles from social cognitive theory and cognitive apprenticeship by emphasizing the importance of learning from others (Table 1). Unlike just model texts, scaffolded annotation breaks down these texts into key components and shows how they are instantiated across multiple models. Similar to prior uses of annotations, scaffolded annotation allows for making others' thinking visible by showing the annotator's reasoning behind the text. Unlike prior uses of annotation, scaffolded annotation provides a shared list of annotations curated by the instructor to help identify key takeaways and reduce cognitive load on learners. We define the features of scaffolded annotation as the following:

- *Annotated model texts* that break down examples into manageable components
- *Shared annotations* curated by instructors that outline key components of the writing task
- *Annotating one's own drafts*, which supports reflection and can be used as examples for others

Following principles of scaffolding [75], scaffolded annotation is meant to provide initial support when students are first drafting in a new genre—a stage of writing less supported among writing
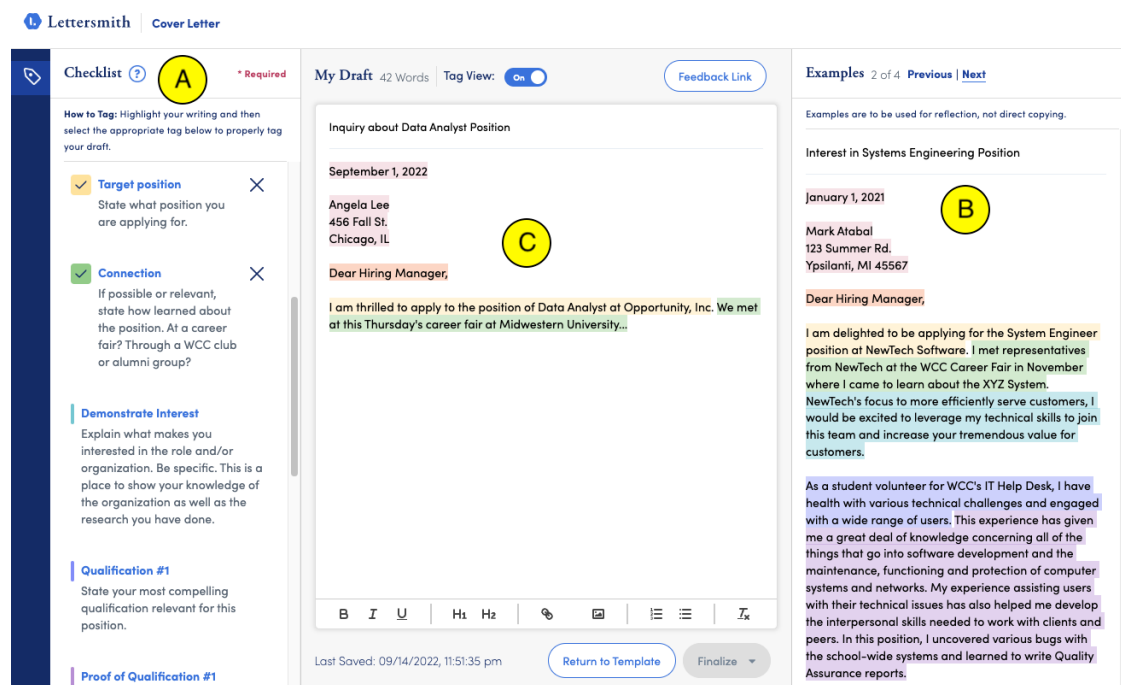
Figure 2: Screenshot of the Lettersmith interface for how to write a cover letter. Lettersmith includes shared annotations (A: 'Checklist'), annotated model texts (B: 'Examples'), and space to draft and annotate one's own writing with the checklist items (C). The Checklist and Examples change depending on the instructor and writing genre.

support tools—with the goal that students will eventually be able to write independently without the tool in place [31, 75]. We suggest that 'scaffolded annotation' is particularly useful for guiding highly structured types of writing like cover letters, reports, and certain emails given that these types of texts follow generally agreed-upon practices, depending on the field or industry. We describe the role scaffolded annotations play in influencing student professional writing in the following sections.

3 DESIGN OF LETTERSMITH

While prior work outlined how each individual feature in Lettersmith was motivated by learning science principles [49], in this study we seek to articulate an explanation for why this combination of features is particularly supportive for professional writing among novices. We argue that each of the described features of Lettersmith is likely useful on its own, but together contribute a unique approach to teaching professional writing through what we call 'scaffolded annotation.' Lettersmith incorporates the practices of scaffolded annotation in the following ways (Figure 2): A) *Shared annotations* in a 'Checklist' curated by the instructor (left), B) *Annotated model texts* that serve as 'Examples' (right), and C) Open space for *annotating one's own drafts* (center). Instructors are also able to see how students annotate their drafts to inform one-on-one feedback (not shown).

In using Lettersmith, students refer to the shared annotations (A) to determine the key elements of the writing genre. Then they review how these elements are applied in annotated model texts (B).

Both the shared annotations and annotated model texts are chosen by the instructor for their specific assignments and not hard-coded by the platform. Therefore, two instructors both teaching how to write cover letters might decide to teach with different content. This ability to customize guidance addressed instructors' preference for control over how they taught writing within a genre. What one instructor considered important to include in a writing task may not match that of other instructors.

3.1 Prior Work on the Design of Lettersmith

We borrow from traditions in system design where there is a trajectory of scholarship that discusses the initial system design in one study and further evaluation in later work (e.g. [16, 20]). Lettersmith's design, presented in earlier work [49] was informed by user interviews and principles of cognitive apprenticeship [31]. To summarize, Lettersmith builds on the cognitive apprenticeship practice of *coaching* by breaking down and describing the type of content to be included in the writing task [31, 41]. Lettersmith was also motivated by the practice of *modeling*, which has been shown to increase learning of complex tasks by showing how others perform similar work [31, 37]. The opportunity to draft and annotate one's own work was informed by the practice of *reflection*, which encourages novices to reflect on their practice and supports knowledge retention [31].

Prior work on the design of Lettersmith evaluated the efficacy of the tool in supporting novice entrepreneurs in crafting introductory help requests to organizations, mentors, and users to request

conversations and access resources. In this prior study, researchers performed a within-subjects experiment and determined that Lettersmith both increased the overall quality of emails produced and the likelihood that students would send them [49]. This prior work also showed that student writing stayed at a higher quality even after the tool was removed. We add to this prior work by 1) introducing the concept of scaffolded annotation, 2) performing a quasi-experiment in a classroom setting to determine how scaffolded annotation influences writing outcomes on a more granular level, and 3) performing interviews with both instructors and students who used Lettersmith to understand how scaffolded annotation influenced their practice.

4 QUASI-EXPERIMENTAL STUDY

To answer *RQ1 (What is the effect of scaffolded annotation on students' professional writing task outcomes?)*, we followed a two-year quasi-experimental design by comparing student writing between two consecutive years of a client-based project course where one course used Lettersmith and the other did not. We describe how classes were relatively balanced based on pre-existing demographics.

4.1 Quasi-Experimental Methods

4.1.1 Participant Demographics. For the purposes of evaluating differences between the two class instances studied, we were provided aggregate demographic data pulled from the central student data warehouse, which is outlined in Figure 3. Access to this anonymized data is covered by the university IRB policy on education tools. Students in both classes were predominantly seniors in college, and primarily majoring in Information. The average ACT score reported was 30 for both classes, indicating a similar level of academic preparation. In addition, there was a similar percentage of first-gen and non first-gen students in each course. There were more females than males in both years. The student data warehouse only collects students' birth sex in a binary (either Male or Female) format and so we report using these labels but acknowledge that this does not depict students' full gender identities. Given persistent correlations between birth sex and grade outcomes in various domains, we continue to consider this variable in research projects while simultaneously advocating for improved data collection practices. Finally, both classes had a similar racial demographic makeup, with the majority of students being White, followed by Asian, and less than 10% of Black, Hispanic, and two or more race and ethnicity. Given these demographics, we believe that there were few significant demographic differences between the classes.

4.1.2 Approach. The instructor and course assignments were kept consistent between the two course years, but Lettersmith was only adopted in the second year. In the course without Lettersmith, the instructor gave a presentation on professional communication styles and preferences as guidance on how to communicate with clients. In the following year, the instructors gave this same presentation in addition to introducing Lettersmith as a supplementary tool.

Unlike a true experiment, which allows for controlling all the factors of the treatment and control group, we emphasize that a quasi-experiment does not allow for controlling all factors [23]. This comparison between non-randomized groups is common in education research (e.g., [40, 73]), given the limited ability to control

who is in each class, who teaches each class, and the amount of time instructors have for introducing an intervention. In our case, we had to compare classes across years because the participating instructor was only teaching one section each year. Therefore, we believe the most salient features, as captured in Figure 3, were sufficiently similar between consecutive years of the same course, rather than two different courses within the same year. Both courses were taught in person.

In Lettersmith, the instructor defined the following key elements of an introductory client email. This made up the shared annotations in the 'Checklist.' The instructor also provided two examples of an introductory client email with the key elements annotated in each each example. This made up the annotated model texts in the 'Examples.' The instructor then encouraged students to tag their own writing with each element of the shared annotations:

- *Greeting* - Formally, write a professional greeting and state the names of your addressees.
- *Personal and Team Introduction* - Share your name and the names of your group members.
- *Course Introduction* - Share information about the course that you are enrolled in and your school.
- *Connection to Client* - Provide a statement on why you are interested/excited about their organization and/or project.
- *Meeting Scheduling* - State your interest in meeting with your client and the timeline in which you would like to meet. Indicate times and dates that you would like to meet; additionally, state your flexibility to meet your client's schedule. Inquire about meeting mode (in-person or virtual).
- *Meeting Purpose* - State the purpose of the meeting.
- *Appreciative Closing* - State your thanks for their engagement with the school, sharing the project, and that you are looking forward to your meeting.
- *Sign-off* - Sign your message with the name of the sender and all the other team members.

Thus, we hypothesize that emails drafted with Lettersmith will be more likely to include all of the key elements:

- **H1:** Students drafting in Lettersmith are more likely to include a Greeting.
- **H2:** Students drafting in Lettersmith are more likely to include a Personal and Team Introduction.
- **H3:** Students drafting in Lettersmith are more likely to include a Course Introduction.
- **H4:** Students drafting in Lettersmith are more likely to include a Connection to the Client.
- **H5:** Students drafting in Lettersmith are more likely to include Meeting Scheduling.
- **H6:** Students drafting in Lettersmith are more likely to include a Meeting Purpose.
- **H7:** Students drafting in Lettersmith are more likely to include an Appreciative Closing.
- **H8:** Students drafting in Lettersmith are more likely to include a Sign-off.

Following IRB approval, we collected and anonymized introductory emails sent by students in each course and coded whether each email included the above elements. This led to a dataset where each email was assigned a present (1) or absent (0) value for each

	No Lettersmith (2018)	Lettersmith Used (2019)
Total # of Students	140	171
Birth Sex		
Female	80 (57%)	106 (62%)
Male	60 (43%)	65 (38%)
Year in School		
Senior	139 (99%)	167 (98%)
Junior	1 (<1%)	4 (2%)
Race & Ethnicity		
White	84 (60%)	100 (58%)
Asian	28 (20%)	36 (21%)
Black	7 (5%)	9 (5%)
Hispanic	6 (4%)	12 (7%)
Not Indicated	10 (7%)	7 (4%)
2 or More	5 (4%)	7 (4%)
Standardized Test Scores		
ACT (mean)	30 (113 students reported)	30 (130 students reported)
Major		
Information	130 (93%)	165 (96%)
Business	6 (4%)	2 (1%)
Literature Sciences & Arts	1 (<1%)	2 (1%)
Art & Design	2 (1%)	2 (1%)
Music, Theater & Dance	1 (<1%)	0 (0%)
First-gen Status		
Not First-gen	125 (92%)	151 (91%)
First-gen	11 (8%)	15 (9%)

Figure 3: Student demographics in each class.

element, where the independent variable was whether Lettersmith was present and the dependent variable was whether each element of introductory client emails was present or absent in each student email. Forty students sent introductory emails in year one, while fifty students sent introductory emails in year two. Only a subset of the entire class in each year produced emails because students worked in groups where one group member drafted email communication with the clients. We analyzed the first email each student sent to their clients. We only implemented this analysis within one course given the significant labor on the instructors to compile the student emails from each year. We then performed a Pearson Chi-squared test of independence to determine whether students in the second year were more likely to include key elements of introductory client emails when drafting in Lettersmith.

4.2 Quasi-Experimental Results

Overall, 40 students produced email drafts in year 1, and 50 produced drafts in year 2. In year 2, when Lettersmith was introduced,

students on average annotated their emails with 7.74 items from the Checklist. Supporting H2-H6, students were more likely to include a Personal and Team Introduction, Course Introduction, Connection to Client, Meeting Scheduling, and Meeting Purpose when drafting in Lettersmith (Figure 4). Contrary to H1, H7, and H8, there was not a statistically significant relationship between using Lettersmith and the likelihood students would include a Greeting, Appreciative Closing, and Sign-off. This was because even without Lettersmith, the vast majority of students already knew to include a greeting, appreciative closing, and sign-off in their emails.

Figure 4 shows the contingency tables for each variable. Supporting H2, there was a statistically significant relationship between using Lettersmith and likelihood students would introduce themselves and their team, $X2(1) = 32.22$, $p<0.001$, $r=0.624$, indicating that those drafting in Lettersmith would be more likely to include a personal and team introduction. Supporting H3, there was a statistically significant relationship between using Lettersmith and the likelihood that students would introduce the course, $X2(1) =$

	Greeting present	Greeting missing	Personal and Team Introduction present*	Personal and Team Introduction missing	Total Emails
No Lettersmith	40 (100%)	0 (0%)	17 (42.5%)	23 (57.5%)	40
Lettersmith	50 (100%)	0 (0%)	49 (98%)	1 (2%)	50
Total	90	0	87	3	90

	Course Introduction present*	Course Introduction missing	Connection present*	Connection missing	Total Emails
No Lettersmith	12 (30%)	28 (70%)	4 (10%)	36 (90%)	40
Lettersmith	49 (98%)	1 (2%)	46 (92%)	4 (8%)	50
Total	90	0	87	3	90

	Meeting Scheduling present*	Meeting Scheduling missing	Meeting Purpose present*	Meeting Purpose missing	Total Emails
No Lettersmith	14 (35%)	26 (65%)	28 (70%)	12 (30%)	40
Lettersmith	45 (90%)	5 (10%)	49 (98%)	1 (2%)	50
Total	90	0	87	3	90

	Appreciative Closing present	Appreciative Closing missing	Sign-off present	Sign-off missing	Total Emails
No Lettersmith	38 (95%)	2 (5%)	40 (100%)	0 (0%)	40
Lettersmith	49 (98%)	1 (2%)	50 (100%)	0 (0%)	50
Total	90	0	87	3	90

Figure 4: Relationships between use of Lettersmith and presence of each element of an introductory client email. Elements marked with an asterisk* were found to have a statistically significant relationship.

43.99, p<0.001, r=0.723, indicating that students using Lettersmith were more likely to include a course introduction. Supporting H4, there was a statistically significant relationship between using Lettersmith and the likelihood students would include a connection to the client, $X2(1) = 57.24$, p<0.001, r=0.820, demonstrating that Lettersmith use increased the likelihood students would include a connection to the client in their email. Supporting H5, there was a statistically significant relationship between using Lettersmith and likelihood students would include meeting scheduling details, $X2(1) = 27.38$, p<0.001, r=0.575, such that those drafting in Lettersmith were more likely to include a plan for meeting scheduling. Supporting H6, there was a statistically significant relationship between using Lettersmith and the likelihood students would include a meeting purpose, $X2(1) = 11.92$, p<0.001, r=0.266 with students drafting in Lettersmith being more likely to include a meeting purpose. Students were significantly more likely to include these key elements of an introductory client email when drafting in Lettersmith compared to students not drafting in Lettersmith. No other results were significant, indicating that those drafting in Lettersmith were no more likely to include greetings, appreciative closings, or sign-offs than those not drafting in Lettersmith.

Figure 5 shows a comparison of an example introductory client email written without using Lettersmith (top) and an example written with Lettersmith (bottom). Emails written without Lettersmith were on average 129 words long, while emails written with Lettersmith were on average 230 words long. This additional length comes as the result of the emails written using Lettersmith being more likely to include key elements of a Personal and Team Introduction, Course Introduction, Connection to Client, Meeting Scheduling, and Meeting Purpose. While shorter emails are generally preferred, this is only the case if they included the necessary information needed for the receiver to respond. In this context, clients receiving student emails sometimes had little to no background information about the project. Sometimes the client had forgotten that they signed up to be a client for a class project, and sometimes the person in charge of engaging with the students has not been briefed about the university engagement at all. Therefore, while the email using Lettersmith is longer, it includes all the relevant information to establish a knowledgeable connection, highlighting how context is critical to the way professional writing is taught.

In summary, we found that students who were exposed to the practices of scaffolded annotation via Lettersmith were more likely

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Without Lettersmith

Hello Ms. [Name],

As part of our final Capstone project, we would like to request an initial meeting with you to discuss the upcoming project with [organization]. If possible, can you please let us know your availability from October 8th to October 10th? We look forward to meeting you and working with [organization] throughout this year.

Regards,
[Name]

With Lettersmith

Dear Mr. [Name],

I hope this message finds you well. My name is [Name] and I am joined by my team [Name], [Name], and [Name]. We are all students in the User Experience Design Capstone Project course at [School].

We are very excited to be working with your organization, [Name]! We are especially interested in this project because of your dedication to the community as a non-profit to inspire and educate others about organic gardening! We would like to schedule an initial meeting with you sometime this week to further discuss what we can do for you. We are available to meet Tuesday 2:30pm - 4pm, Thursday 7pm - 8:30pm, and all day Friday. However, if those times do not work for you, please share your availability and we will meet at your convenience. If an in-person meeting doesn't work with your schedule we can use Skype or Google Hangouts for this meeting as well.

Thank you for sharing your project with [School]. We are very much looking forward to working with you for the next eight months.

Sincerely,
[Name]
[Name], [Name], [Name]

Figure 5: Comparing an example client email written without Lettersmith (Top) to an example client email written with Lettersmith (Bottom).

to include key components of professional writing. In the case of professional client emails, students were already skilled at including common parts of general emails, like a greeting and appreciative closing, but were more likely to miss content specific to client communication, like introducing oneself and the purpose for requesting a meeting. This suggests that scaffolded annotation was particularly useful for guiding what content to include for types of professional writing that are somewhat novel to students.

5 INTERVIEWS

To answer *RQ2 (How does scaffolded annotation influence students' professional writing?)* and *RQ3 (How does scaffolded annotation influence instructors' teaching of professional writing?)*, we performed interviews with instructors and students to better understand their experiences with using the tool and subsequently how the features of scaffolded annotation supported their respective practices.

5.1 Interview Methods

5.1.1 Recruitment. We introduced Lettersmith [3], a publicly available free platform, in seven courses between 2018-2022. We recruited instructors to adopt Lettersmith if their course included

assignments with professional writing. Courses that adopted Lettersmith included a client-based project course, a career preparation course, an entrepreneurship course, an introduction to writing course, and two technical communications courses. Class sizes ranged from 28 to 368 students, with a mean size of 160 students. Prior to using Lettersmith, instructors shared rubrics and/or presentations with general writing expectations of structure and content, while some also shared model texts (e.g. example cover letters). However, prior to using Lettersmith, no instructors had implemented strategies of 'scaffolded annotation' by explicitly connecting how the model texts implemented each specific rubric item at the sentence level. Students had minimal experience communicating with clients and employers as these courses were meant to be taken as an introduction to professional engagement. In this study, instructor quotes are designated with a "T" and student quotes are designated with an "S."

5.1.2 Participant Demographics and Data Collection. We interviewed 11 instructors (8 female, 3 male) and 19 students (13 female, 5 male, 1 non-binary) from seven different courses (Figure 6). Some courses were taught by more than one instructor. Two instructors (T8, T9) were in the process of adopting, but had not deployed the

tool in their classes at the time of the interview. Instructors were recruited to be interviewed via direct email, while students were recruited via the class-wide email lists and were compensated $20 for a 30 min interview. Instructor interviews lasted 30 min to 1 hour, in which we asked about their experience using Lettersmith, student challenges with professional written communication, and how Lettersmith impacted student writing. For student interviews, we asked questions about how they used Lettersmith for the writing assignment and whether or not they found the platform useful.

5.1.3 Analysis. Through our interviews, we aimed to further understand why we see an improvement in student professional writing through the use of Lettersmith as observed in the quasi-experiment. Our final two research questions outline how enacting scaffolded annotation in Lettersmith impacted student performance (RQ2) and instructor practice (RQ3). To answer each research question, we followed a grounded theory approach [43, 83, 84] in which both authors reviewed the transcripts together and collaboratively performed open coding to categorize the data into discrete parts. Open coding to address RQ2 (How does scaffolded annotation influence students' professional writing?), involved analyzing student and instructor interview data by identifying all instances where student writing performance was mentioned. This included data around students' writing strengths and struggles before and after using Lettersmith, students' impressions of Lettersmith, and how they used the platform. While student interview data was useful for understanding how they evaluate their own skills, we also included instructor data in this analysis because it provided another perspective on student writing ability. Following this initial round of open coding, we then performed axial coding to identify higher-level patterns of how scaffolded annotation played a role in student writing ability. This involved reviewing student and instructor data to identify places where *annotated model texts*, *shared annotations*, and *annotating one's own draft* were mentioned and triangulating where these practices may have had an influence on student performance. Final themes that emerged from axial coding included descriptions of how Lettersmith supported students' writing structure and content, identifying appropriate tone, and reflection in the writing process.

To answer RQ3 (How does scaffolded annotation influence instructors' teaching of professional writing?), we also followed grounded theory analysis by having both authors work together to open code instances where instructor practice was discussed. While students sometimes described how instructors used Lettersmith, the majority of student interview data focused on their own writing experiences and less on evaluating instructor practice. Therefore, we focused our analysis of RQ3 mainly on instructor interview data. This round of open coding identified instances where instructors discussed experiences teaching professional writing, changes to their teaching practice as a result of Lettersmith, and impressions of Lettersmith. We then performed axial coding to identify how scaffolded annotation played a role in their teaching practice. Axial coding led to higher level themes of how scaffolded annotation helped them demonstrate writing expectations, pinpoint gaps in student knowledge, and guide students' writing of first drafts. Findings are structured according to each research question (RQ2 - section 5.2.1; RQ3 - section 5.2.2).

5.2 Interview Findings

Our semi-structured interviews uncovered ways scaffolded annotation in Lettersmith supported students' professional writing. Students found scaffolded annotation useful for learning structure and content in a new genre, identifying language to express appropriate professional tone, and reflecting on their own writing. Instructors found that using Lettersmith helped them articulate writing task expectations, pinpoint where students had gaps in their understanding, and scale instructional support for early-stage drafting. We describe how the features of scaffolded annotation—the use of *annotated model texts*, *shared annotations*, and *annoting one's own drafts*—facilitated these outcomes for instructors and students.

5.2.1 Scaffolded Annotation to Aid Student Performance. Students found that *shared annotations* were useful for identifying what content to include, while the *annotated model texts* were useful for determining the structure of this content and how to convey an appropriate professional tone. Furthermore, being asked to *annotate one's own draft* with shared annotations helped students reflect on their writing. This combination of guidance was found to be particularly useful for supporting early stage drafting in a new genre.

Supporting Structure and Content: By viewing *annotated model texts*, students were able to see examples of how to structure their drafts, like how to word a professional connection or a meeting schedule. For instance, S5 explained that when drafting an email to a client, using Lettersmith prompted her to include a more detailed agenda and search for resources online in preparation for the meeting.

> If we didn't have Lettersmith and had these examples, we probably wouldn't have wrote an email similar to this, we probably would have just said, 'Hi, we'd love to meet' and not really like have the full agenda...It kind of made us like have to become more prepared for the meeting as well. For one of the examples [on Lettersmith], it caused us to kind of look at different websites where we could find resources to analyze customer data. So, it definitely made us more prepared. -S5

Furthermore, students found that viewing the *shared annotations* helped illustrate what the instructor believed to be the most important components to include in their draft. Students expressed that prior to using Lettersmith, getting started was the most difficult part.

> When you have a blank canvas, I think students don't know like where to start...If you can kind of see how someone like worded something, like how did someone ask for a meeting and how did they introduce a time. If you can read how they worded that, it's much more helpful. -S14

Students liked that Lettersmith broke down examples into understandable components that they could use as inspiration in their own work. Confirming students' concerns, instructors described students having trouble determining what to include. For instance, students sometimes provided too much or not enough detail. In a technical communication course, the instructor described how

Course Type	# of Students in the Course	Professional Writing Artifacts
Client-based project course (T1, T5, T6)	171	• Introductory client email • Meeting agenda email • Meeting follow up email
Technical communications course (T7)	369	• Cover letters
Technical communications course (T11)	77	• Cover letters • Technical memos • Technical reports
Consulting course (T2)	245	• Introductory client email
Entrepreneurship course (T3, T4)	30	• Introductory client email • Meeting agenda email • Meeting follow up email
Career Development course	200	• Cover letters • Employer inquiry emails
Intro to Writing course (T10)	28	• Blogs

Figure 6: Classes that used Lettersmith from which interview participants were recruited.

students would start their reports far too broadly and be unclear about their specific contribution.

> They tend to start their essays with 'Since the dawn of time, blah blah blah, in society today, etc., etc." Technical writing and memos are supposed to be extremely to the point. You are supposed to open with an organizational problem. So, they need some help sorting out the layers between the big issue of climate change and the actual tiny quarter of climate change they're intervening in. -T9

Others instructors shared similar sentiments. T8, a technical communication instructor, expressed that students felt the need to include detail on every single task they performed in a project, which made the reports too lengthy and lacking a cohesive narrative. One student expressed that by viewing the *shared annotations* in Lettersmith, they were guided through the process of including only the key parts of their draft, items they otherwise might have forgotten to include if they were just provided with a single example. Another student expressed that being asked to *annotate their own writing* helped them both identify all the necessary parts and check that they had it covered in their own work.

> Since we kind of had a baseline to start with, it made me feel like oh, most of the things are already included in here...So that was kind of nice because then we're not sitting there like wondering like am I missing anything? And at the point where you can like click-check to make sure you have every part of the email that they wanted us to have was helpful because it's kind of like a double check before we sent it. -S11

By "click-check" S11 was referring to using *shared annotations* in their draft where they completed the items on the Checklist. This step-by-step process helped guide students in managing level of detail and structure, two core challenges mentioned by instructors. As on instructor expressed, "if you can't come up with a reason that this is here—if there's no tag that you can give it—then maybe it doesn't belong." Asking students to primarily include these key elements while showing examples of each could help them include the most important information in an appropriate number of words. The ability to be concise is also critical for developing a cohesive and engaging narrative.

Identifying Appropriate Tone: Both students and instructors agreed that capturing the right tone was one of the most challenging aspects of professional writing. Instructors of project-based courses, where students had to interact with clients, were particularly concerned about tone because the way students presented themselves influenced the clients' relationship with the instructor and university more broadly. Students were particularly concerned about making a positive impression on potential employers. We found that Lettersmith helped guide tone by suggesting example ways of wording introductions and requests via the *annotated model texts*.

> I just like frantically message all my friends, like can you read this?...Is the tone weird? Like, I'm always afraid that I'm coming off as too demanding or too cold. I'm very exclamation point heavy, saying like, hey nice to meet you! I'm so excited do this! And then like you sound like a two-year-old. -S4

Other students expressed similar concerns. For instance, some students noted that their instructors asked them to be polite, but they were unsure what polite looked like, whether that meant being extra formal or somewhat casual. Students understood that employers were looking for candidates that "fit the culture" but were not always sure what that looked like in written communication, thus creating the fear that the language they used might not be appropriate. T1 shared that prior to introducing Lettersmith, students would adopt a very informal tone when contacting clients for the first time.

> [Lettersmith] helps them establish that the first meeting wasn't 'Hey client, it's me, bro.' You know, it sets them up for success. It's fine if that evolves into different types of communication, but just having the first email go out from a student, not from us, and have it be something that's appropriate, even if it's an easygoing client, I think [the students] feel more like they're professionals and the client feels more confident. I think that's making a difference in that relationship. -T1

For instance, a "polite ask" or an "appreciative closing" were two common tone-based Checklist items with corresponding examples that instructors used. T6 shared that "in the end, they will forge their own relationship and develop their own tone," but a formal tone would start off a professional relationship on the right foot. Other instructors commented that providing guidance through *annotated model texts*, while ultimately letting students create their own draft, helped provide enough structure while allowing students to keep their personal writing style. While some students complained about the formal language that instructors required, instructors felt that it was most appropriate to start out the communication formally and have the client or employer dictate whether to transition to informal language.

Encouraging Reflection: Our findings also illustrated how *shared annotations* and having students *annotate their own drafts* helped students reflect on their own writing in order to meet the expectations of the writing task. These practices was particularly helpful for students who did not approach professional writing in a particularly strategic way.

> I'm not very super organized, like I like do things as they come... I'm like, oh, this should be in here and I'll like put it in there. And I'll be like, wait, this should be in here too, I'll put it in there.-S4

S4 describes adding content depending on what seems to be missing at the moment, rather than strategically choosing what information to include and in what order beforehand. Yet, in following this haphazard approach to writing, students are more likely to forget key elements. After using Lettersmith, some students described being motivated to review their own work and iterate after seeing the models of others' writing. For instance, T11 noted that asking her students to annotate their draft helped them assess whether they had at least attempted each key element of that writing genre.

> With the [Lettersmith shared annotation] function, they can see clearly, 'wow [I] didn't include a topic with a summary of [my] skill.' So that's going to help them to see the structure of their paragraph more

> explicitly... [It helps them] segment their paragraph writing into smaller, smaller, smaller ideas, and then they can see how they do with each idea. -T11

With 'segment their paragraph writing into smaller, smaller, smaller ideas,' T11 is referring to how Lettermith helps students break down a larger piece of writing into more manageable tasks at the sentence level. Similarly, T7 expressed the same belief, stating that Lettersmith could help students "de-familiarize their own documents" to "help them turn a critical eye to their own writing." By this, T7 meant that the shared annotations would help students take a step back and review whether their work included the key components. Overall, scaffolded annotations helped students identify key components and provided different examples of how to accomplish them in their own writing—a combination of supports that students found particularly useful for getting started.

5.2.2 Scaffolded Annotation in Informing Instructor Practice. We found that implementing scaffolded annotation in Lettermsith helped instructors clarify their teaching material, identify where students had misunderstandings, and reduce teaching load during early-stage writing instruction.

Demonstrating Writing Expectations: Instructors expressed that the process of creating their *shared annotations* and applying them to *model texts* helped them outline and demonstrate expectations of the writing task more clearly. Their prior instructional material typically consisted of a rubric and sometimes an example, which combined was not enough for students to perform at the desired level. For instance, as demonstrated in the quasi-experimental study, without Lettersmith, students were significantly more likely to not include key components of an introductory client email, like a personal introduction and way of connection. Instructors found that enacting scaffolded annotation helped them reflect on their own expectations and more clearly articulate them to students.

Prior to using Lettersmith, T7's cover letter guidance was a relatively short instruction list asking students to include "relevant content," a "block-style paragraph structure," and "professional and friendly language in a business letter format." T7 explains how setting up the Lettersmith environment for teaching cover letters made her expectations more clear for herself—and for her students.

> I think using Lettersmith has definitely improved my approach to teaching cover letters, because it has forced me to really think about all of these different components and defining them in really clear terms. Normally I think I would obviously say you know, this is a cover letter format, these are essentially the pieces of information that you need to have included, but I had never actually asked students to go through and identify those pieces [in] examples and then present their [drafts] having identified how they've connected those pieces in the example. I think that explicit connection and having them go through the action of identifying those things, that's going to result in a much better understanding of how the cover letter works as a genre. -T7

We found that having the instructor provide *annotated model texts* helped demonstrate to students how they could make sense of

their own writing. Another instructor expressed that Lettersmith pushed them to perform "modeling that I hadn't done in other classes" (T1). While a 'good' model text or annotation is subjective to the instructor, instructors expressed the desire to maintain control over these items in order to teach students what they felt were appropriate communication practices for their particular field (e.g. engineering, UX design).

Pinpointing Gaps in Learner Knowledge: Providing *shared annotations* helped guide students in annotating their own work, which surfaced gaps in student understanding. After students drafted their writing in Lettersmith, they were asked to *annotate their own draft*, which helped instructors pinpoint where students failed to understand certain concepts. T10 expressed that prior to using Lettersmith, he had spent significant class time teaching concepts without seeing improvements in students' writing–"I started to be like, why are all my students writing these really mediocre paragraphs after we've had this conversation in class?" He then decided to implement Lettersmith and once students annotated their own work, T10 was able to identify what part of his instruction was confusing:

> One of the things that I found really useful was that I could look at what students were tagging and try to kind of understand how each of them was grasping those individual concepts about writing. So, for example, I had one student who was continuously tagging what was actually the main argument of their writing as context, and so we were able to have a conversation. It really helped me get into kind of the thinking on a sort of one-on-one basis with some of the students… I could look at [their writing] and say all right, there's a fundamental misconception. -T10

He then used this information to structure follow-up meetings with students, citing that "they were able to have a conversation more about using those terms and those concepts." After using Lettersmith paired with instructor follow-up, he found that "there was an immediate across-the-board improvement of student work once we implemented it." Similarly, T11 expressed that having students annotate helped her determine where students faced specific misunderstandings in the writing assignment, which in turn informed iterations in her teaching approach.

> I could see whether they understood the components that we talked about, for example, if they need to add a 'goal' for seeking this job, whether they understand what is a 'goal,' and that they [annotated] the correct content and know that they understood what we talked about in class. So, that's kind of an efficient way for me to assess students' initial performance before we can go to the higher level rhetorical strategies, like how they can make the argument more persuasive. -T11

Similarly, T7, a technical communications instructor, expressed that seeing students' annotations helped her identify that students did not understand the concept of a "Why me" statement—one of their *shared annotations*. She was able to reference that particular item as a common mistake in order to guide clarification conversations with students:

> Something that they would often misunderstand about the perspective of the reader is they would often focus on I want this job because it's really good for me. They would articulate that in different ways rather than thinking about the reader's perspective. And so it was a lot of coaching them through their 'Why me' statement being both I'm really passionate about this and also, I would bring this to this company environment, this is what I have to offer you. -T7

In this case, the instructor realized that guidance she was giving might not have been sufficiently clear and that she needed to emphasize the importance of writing for the reader. Another instructor shared a similar sentiment, describing how students would often annotate personal opinions rather than facts as descriptions of prior experience. For instance, instead of sharing concrete skills learned or tasks accomplished, students would make vague statements about how they "learned a lot." Seeing that students failed to write and annotate sufficient descriptions of prior work helped inform more targeted instruction of that particular element.

Scaling Instruction of First Drafts: Instructors also found that using Letteresmith helped save them time in the long run by scaling instruction of writing first drafts in a new genre. Instructors expressed that much of their time prior to using Lettersmith was spent repeating the same basic instructions to students, despite providing a rubric. With Lettersmith, students are required to *annotate their drafts* with the *shared annotations*, so that first drafts were less likely to make basic mistakes—an effect we observed through the quasi-experiment.

T1, who teaches a project-based course of about 180 students described that he does not have enough time to review every instance of client communication, especially in the beginning when students are first setting up the relationships all at once. He expressed that using Lettersmith allowed him to scale his writing guidance by embedding his repeated set of instructions in *annotated model texts* and having students *annotate their own work* following his guidelines.

> When a class is that size, there's just too many. And we have four different sections that all meet. So it's really hard to keep track of what's going on in the class. In this case, we don't have to do any of that. If you complete your Lettersmith assignment, you have to tag what you think a greeting is and you have to tag the connection to the project or your interest in working with the client or whatever it is. We can just define those pieces and they can move forward. And they do it on their own time. -T1

Of course, direct instruction is often most helpful for student learning. But, because T1 did not have time to provide direct instruction to all his students to begin with, he was able to supplement some of that instruction with the platform. Instructors who did have more time for direct instruction were able to use the insights garnered from Lettersmith to clarify student misunderstandings and focus on more complex rhetorical processes.

Overall, our interview findings provide reasoning for why students using Lettersmith were more likely to include key elements of professional writing, an effect we saw from the quasi-experiment.

Instructors were able to articulate expectations of professional writing more clearly, which helped students better understand how to apply the appropriate writing practices to their own work. In addition to the changes in instructional practice, drafting in Lettersmith helped students address challenges with enacting best practices of structure, content, and tone.

6 DISCUSSION

This work answers calls from within the HCI community to identify tools and approaches that better support the cognitive processes of writing [45]. First, we found through a quasi-experimental study of a client-based project course that students using Lettersmith were more likely to include key components of the writing task compared to students who did not have access to the platform. Many of the instructors were motivated to use Lettersmith because they hoped it would help them scale instruction while reducing time spent reiterating best practices. For instance, instructors teaching project-based courses expressed frustration that students would often forget to include items like a course description or a meeting agenda in emails to new clients, despite in-class reminders. While some research on education support tools express that technology can introduce a "transactional distance" between instructors and students that can ultimately impede learning [68], our interview data uncovered how scaffolded annotation helped instructors identify students' points of confusion, which informed more fruitful follow-up conversations and targeted lessons. Instructors expressed that they spent less time repeatedly pointing out the same basic mistakes and more time addresing more complex rhetorical moves.

Second, we found through interviews that the features of scaffolded annotation helped students writing task outcomes. By comparing their own writing to that of the *annotated model texts*, students could determine whether they were covering similar content and level of detail. While some skills are more easily addressed, other skills like tone and structure have long been notoriously challenging to teach [24–26]. Current solutions in HCI include using AI to suggest phrasing [12, 29, 30, 42] and perform text evaluation [59], but there is little evidence showing whether these interventions improve student understanding of the writing process or ability to write effectively outside of AI-supported contexts. Our interview data show that students using Lettersmith are more aware of these strategies and that instructors report an improvement in student writing quality. In particular, having students *annotate their own work* helped them reflect on the key components of the writing assignment.

These findings provide additional insight to prior work on Lettersmith [49] by demonstrating similar results in real-world classroom adoption where instructors led the use of the tool. Students pointed to the *annotated model texts* and *shared annotations* as the most useful features of Lettersmith given that they provided guidance around what was expected and how to enact them. This aligns with the initial motivating principles from social cognitive theory and cognitive apprenticeship, which describes how context-relevant examples can improve learning of complex tasks while decreasing cognitive load [81].

6.1 Scaffolded Annotation as an Instructional Approach for Early-Stage Writing

Scaffolded annotation applies learning sciences principles from social cognitive theory and cognitive apprenticeship to help teach the conceptually complex task of writing. Specifically, we build on writing pedagogies of using 'model texts,' which emphasize the importance of learning from others as motivated by social cognitive theory, and 'annotations,' which emphasizes the importance of making thinking visible as motivated by cognitive apprenticeship. Scaffolded annotation involves the following unique practices of 1) *Annotated model texts* that break down examples into understandable and manageable components, 2) *Shared annotations* curated by instructors that outline key components of the writing task, and 3) *Annotating one's own drafts* which encourage student reflection and can serve as models for others.

Our findings demonstrate how the combination of these practices is particularly helpful for guiding students who were first learning to write in new types of professional genres (e.g. client emails, cover letters). Lettersmith helped translate the writing task "into smaller, smaller, smaller ideas," as one instructor described. This process of breaking complex tasks into more manageable steps is at the core of scaffolding and has been shown to increase learning and retention [75]. Furthermore, our data show how encouraging students to apply *shared annotations* to their own work enforces reflection. Reflection involves encouraging the learner to evaluate their performance by comparing their work to expert models and identifying opportunities for improvement [79]. Students expressed that seeing examples of writing helped them understand key elements and determine whether they had met genre expectations in their own work.

Approaches to writing instruction have reflected different epistemologies based on how much guidance should be given to students [34]. In this case, instructors are encouraged to provide significant modeling and guidance to learners so that they understand what exemplary writing looks like in order to apply those practices themselves. Opposing views argue that writing instruction should be hands-off, allowing students to write on their own with little intervention in order to learn through practice. While the latter allows for greater exploration and creativity, Lettersmith aligns with the former approach given the highly structured nature of professional writing [10, 25] and the importance of learning from others in workplace contexts [65]. We find that scaffolded annotation increases transparency of teacher expectations, which has been shown to improve learning outcomes [32, 99] and decrease attrition at the introductory level, particularly for underserved students [98, 99]—a population we hope to support in future work.

We also believe that the affordances of a digital tool, in this case Lettersmith, make scaffolded annotation possible. Through Lettersmith, students can browse *annotated model texts* regularly updated by the instructor, while instructors can examine how students apply *shared annotations* in real time. Our interview data show that this allows students to leverage these practices to improve their writing structure, content, and tone, while allowing instructors to pinpoint student misunderstanding and inform targeted feedback.

6.2 Design Implications for Writing Support Tools

Researchers should not only question what technology could do to advance writing production, but how such tools support writers themselves. While prior work has outlined advances in writing tools, like using AI to produce written documents, we believe research on supporting a writer's growth should be equally important given the critical role individually-produced writing plays in online professional (and personal) relationship development. *How might we create a hybrid future that leverages advances in AI technologies and writing pedagogy for writer skill development?*

6.2.1 Scaffold Rather than Perform Writing Tasks. Our focus is less on how technology can efficiently create well-written documents and more on how technology can support *writers* themselves. Prior work on writing support tools in HCI have outlined myriad new ways AI [12, 29, 30, 42, 59, 94] and crowd-based tools [7, 14, 55, 58, 70] are able to produce written products. While these innovations are novel, they do not necessarily address our particular focus of centering the *writer* and improving their performance. Supporting writers is critical considering that people build new relationships and access socio-economic opportunities based on personally-written messages online. We suggest leveraging learning and cognitive science principles to develop writing support tools that support the cognitive processes of writing. This might include designing supports for learning from others [13], reflection [31], sensemaking [21, 77], and just-in-time teaching [72] — each of which has been shown to support learner skill development of complex tasks. We introduced *scaffolded annotation* as one way to foster learning from others and reflection in the writing process. For instance, having students annotate their own work contrasts with writing instruction tools leveraging AI to automatically label student content for them. Rather than analyzing machine-generated annotations of one's own text [93–95], we encourage students to analyze instructor-annotated model texts and annotate their own work as part of the reflection process. While Lettersmith does not currently apply AI, we see opportunities for using these tools to help teach writers, rather than replacing them. For instance, AI could be used to enhance intelligent tutors for writing by providing just-in-time teaching when an instructor is not readily available.

6.2.2 Support Context Flexibility and Awareness. Professional writing is often hierarchical, highly structured, requires careful control of "professional" tone [11, 45]. The boundaries of each of these attributes are unique to the context and industry, making learning professional writing a highly dynamic process [15, 74, 91]. For instance, the language for applying to a job at a small tech startup company is likely to be significantly different from the language used to apply to a large marketing company. Such variability requires writing tools that allow for flexibility depending on context for both the student and the instructor. For students, AI tools could support writers in making sense of model texts by automatically highlighting patterns in writing styles or helping evaluate the accuracy of student self-annotations on their own writing. However, machine-generated guidance informed by outdated training data could suggest communication practices that lead to negative ramifications on students' careers. Thus, live instructor engagement

in how these tools are implemented may continue to be necessary. With enough annotated model texts, AI could learn from examples curated by expert writers (instructors) to surface annotation themes, such as categories of annotations and common tags.

6.2.3 Structure Evaluation from Peers and Experts. One of the ways technology has significantly advanced writing support is through feedback and reflection. For instance, AI platforms have been introduced to help evaluate whether a learner has succeeded or failed at particular rhetorical moves [93, 95, 96]. Similarly, other researchers have developed platforms that coordinate feedback between peers [60, 62]. We highlight the importance of advancing this work and suggest further opportunities to structure such interactions between writers and evaluators. As we have shown, Lettersmith uses *shared annotations* to help instructors to observe how students make sense of their work. Future work could implement human-in-the-loop feedback where AI tools produce initial suggestions, while instructors or peers could tag or comment on what they agree or disagree with depending on the context. This in turn would improve the algorithm for machine-generated evaluations depending on the situation. We believe humans are still a critical part of the feedback process because nuances of professional writing are highly dependent on the context.

Overall, we highlight these implications as opportunities for HCI researchers and designers to consider how to support people learning professional writing. While machine-generated content will definitely change the nature of communication in the future of work, developing the cognitive processes behind writing will continue to be a much needed skillset. Through this study, we provide one approach to enhancing writing instruction via scaffolded annotation, and hope to continue testing on this approach in other contexts.

7 LIMITATIONS

While we now have a greater understanding of how Lettersmith can support professional writing in a university setting, it is unclear whether these findings could scale to other contexts. For instance, we wonder whether such a platform could be useful in workforce development centers where job seekers seek guidance from employment counselors. We also wonder how issues of digital literacy and access might influence the efficacy of Lettersmith. In addition, given the initial quasi-experimental approach, we were unable to randomize groups. However, this is not uncommon in education research [40, 73] as setting up a true experiment is challenging in a classroom context and introduces ethical considerations when withholding a potentially positive intervention. Furthermore, because the control group did not use a digital tool, some of the effects we observed may be due to the usage of a novel tool that may not replicate after continuous usage. However, since we encourage instructors to use Lettersmith only in the early stages of learning a new genre, we believe the value of the intervention will persist. Finally, while our prior work demonstrates evidence of learning through a within-subjects experiment among novice entrepreneurs [49], we plan to perform future studies to see if we see similar learning effects long-term and in additional contexts.

8 CONCLUSION

Employers have long called for improvements to teaching professional writing in a college setting. We introduce the instructional approach of 'scaffolded annotation' and evaluate its use in the digital platform Lettersmith. Lettersmith guides students through the process of drafting professional writing via the scaffolded annotation practices of 1) Annotated model texts that break down examples into manageable components, 2) Shared annotations curated by instructors that outline key components of the writing task, and 3) Annotating one's own drafts to encourage reflection and serve as models for others. Through a quasi-experiment of 90 students in a project-based course, we found that students drafting in Lettersmith were more likely to include key elements of introductory client emails. Interviews with instructors and students who used Lettersmith described how applying scaffolded annotation helped clarify instructor expectations, guide tone, identify where students had misunderstandings, as well as encourage students to reflect on whether they met genre expectations.

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