Academic writing challenges faced by chemistry doctoral students: A self-study informed by three writing theories

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ABSTRACT

This research investigated the challenges faced by chemistry Ph.D. candidates writing in English as a second language. Drawing from Second Language Writing, Genre Theory, and Academic Writing Instruction and Support, we investigated the linguistic, cultural, and disciplinary factors that might affect these students' writing development. Nineteen doctoral students participated in the study, which relied on a self-study methodology. Attitudes towards writing, idea generation, revision, criticism, cooperation, and writing process awareness were only some topics covered in a seven-part online survey on academic writing. Language, method, outcomes, style, and substance were found to be the most salient aspects of academic writing as seen by graduate students. There were five major classes of issues with academic writing, including text, errors, competence, support, and dissemination medium. By drawing on the fields of Second Language Writing, Genre Theory, and Academic Writing Instruction and Support, we propose strategies for enhancing students' abilities in academic writing. These strategies range from providing more detailed instructions on the writing process to emphasizing the importance of close communication between faculty advisors and their students. The ramifications of these results for graduate education programs that want to help their students with their academic writing are substantial.

1. Introduction

Complex and multifaceted, academic writing calls for a specific set of skills and knowledge. Second Language Writing [1]; Genre Theory [2]; and Academic Writing Instruction and Support [3] are only a few of the theoretical approaches that have been taken to the study of academic writing. Particularly relevant to persons who have acquired English as a second language, second-language writing highlights the role of language and culture in the evolution of the written word [4]–[6]. Genre theory examines how disciplinary communities shape the conventions and characteristics of various forms of writing, with a particular emphasis on academic writing. "Academic Writing Instruction and Support" describes courses and resources to help students improve their academic writing skills [7]. Chemistry Ph.D. students, especially those whose first language is not English, might use these three theories as a starting point for discussing their struggles with academic writing. Zaid argues that students can benefit from a reflective approach to learning how to write to overcome the unique obstacles they experience [8]. Using these three ideas, we can pinpoint the linguistic, cultural, and disciplinary influences on writing growth and propose ways to improve students' writing skills in the classroom. Taking a self-study approach inspired by Second Language Writing, Genre Theory, and Academic Writing Instruction and Support, this study examines the difficulties Ph.D. chemistry students at Cairo University's Faculty of Science face when writing academically.

Planning, brainstorming, drafting, drafting into text, revising, and editing are all steps in the writing process that Hayes and Flower categorized [9]. Critical thinking, analysis, synthesis, and assessment are all crucial components of the academic writing process [10]. Writing styles, discourse features, and genre conventions are only a few of the many aspects of academic writing that have been the topic of study [11], [12]. Understanding the discourse community and its conventions is crucial for academic writing, as stressed by Swales and Feak [13]. The literature is full of warnings about the difficulties of academic writing, especially for beginners [14]. These obstacles were examined by Swales and Feak [13], who pointed out the importance of learning academic discourse, fostering critical thinking, and mastering writing conventions and style. The function of engaged writers in evolving fields of study has also been investigated in studies of academic writing [15], [16]. The cognitive process theory of writing, proposed by Flower and Hayes in 1981, focuses on the writers' thoughts as they put pen to paper [17]. In conclusion, academic writing is a complicated process requiring specialized expertise. Genre conventions, discourse elements, writing strategies, and academic writing difficulties are discussed in the literature on academic writing. Academic writing instruction in higher education benefits greatly from this area's research.

2. Method

This research uses a qualitative research design and a self-study approach [18]–[20]; the project will assess the academic writing challenges of chemistry Ph.D. applicants, focusing on those who speak English as a second language. Examining individuals' unique perceptions and experiences with academic writing is best done through self-study. The study will involve 19 Ph.D. students currently enrolled in chemistry doctoral programs. Participants will be selected purposively to ensure diversity in gender, academic background, and academic writing proficiency. Fig 1 shows Ph.D. student demographics. An online survey was administered to collect data on various aspects of academic writing, including attitudes toward writing, generating ideas, revising, receiving feedback, collaboration, and awareness of the writing process. The survey questions will be developed based on the three theoretical frameworks of Second Language Writing, Genre Theory, and Academic Writing Instruction and Support. The survey will be pilot-tested with a small group of participants to ensure its validity and reliability. The survey responses were analyzed using thematic analysis to identify the academic writing challenges experienced by the participants. The analysis will be guided by the three theoretical frameworks used in the study and will focus on identifying the linguistic, cultural, and disciplinary factors that may affect writing development.

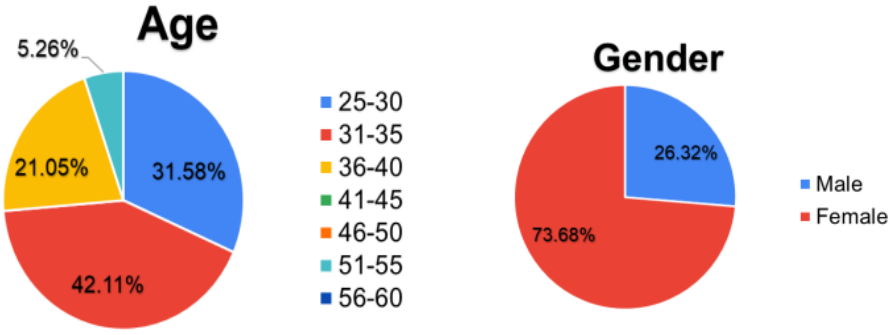

Fig. 1. Ph.D. Student Demographics

The findings will be organized into sub-themes related to graduate students' perceptions of academic writing, and specific academic writing difficulties will be categorized into sub-themes related to text, mistakes, skill, assistance, and publication venue. The study takes steps to preserve the participants' privacy and rights. Before they take the survey, participants will be informed of the study's objectives, and their consent will be requested. To safeguard the privacy of the respondents, the survey replies will be kept private and anonymous. Using a self-study methodology supported by three theoretical frameworks, this methodology aims to investigate the academic writing difficulties faced by chemistry Ph.D. candidates for whom English is a second language. The methodology strongly emphasizes the need for genuine and trustworthy data to be gathered and analyzed while upholding the participants' rights and privacy. Table 1 shows Ph.D. students' demographic characteristics.

Table 1. Ph.D. students' demographic characteristics

Pseudonym	Age	Work Background	Gender	Research Interests
Ph1	34	Bioequivalence filed (analytical chemistry)	Female	Determination and quantitation of analytes using different techniques.
Ph2	27	Teaching assistant specialized in biochemistry	Male	Biochemistry, Cancer Biology, Molecular genetics
Ph3	31	Specialist in medical laboratories. No work now	Female	Biochemistry, cancer biology, molecular biology
Ph4	27	Teaching assistant at chemistry/biochemistry department, faculty of science, Cairo University	Female	Biochemistry, mainly cancer biology.
Ph5	34	Chemist in housing and building a research center	Male	Water and wastewater treatment
Ph6	39	Organic chemistry, Assistant lecturer at Baghdad University	Female	Synthesis, Characterization, and Theoretical Study of Some Newly Synthesized Heterocyclic Compounds Containing N and/or S with Expected Biological Activity
Ph7	33	Chemist at the Ministry of Defence	Male	Synthesis, characterization, and biophysical studies of novel transition metal complexes and studies of their biological activity as antibacterial, antifungal, and antitumor.
Ph8	36	Chemist, Cairo University Nox analysis and IC analysis	Female	Water treatment and analysis
Ph9	27	Teaching assistant in Organic Chemistry	Female	Synthesis of Novel Heterocyclic Cpd
Ph10	36	Quality control lab	Female	Organic chemistry
Ph11	32	Quality Assessor at Egyptian Organization for Standardization & Quality	Female	Water treatment and waste management Analytical Chemistry
Ph12	27	Teaching assistant, organic chemistry at Cairo University	Female	Organic synthesis
Ph13	27	Teaching assistant of organic chemistry at the Faculty of Sciences Cairo University	Female	Synthesis of efficient drugs for various diseases
Ph14	27	Teaching Assistant	Male	Preparation of electrodes with good electrochemical properties
Ph15	32	Assistant researcher at the National Research Centre	Female	Synthesis of Organic Compounds
Ph16	35	Chemist in Specialized Medical Centre for military production (now no work)	Female	Analytical Chemistry Ion selective electrode
Ph17	32	Chemist at Egyptian Mineral Resources Authority Analytical Chemistry	Female	Synthesis and characterization of some transition metal complexes of Schiff bases
Ph18	36	Research assistant, Chemical Engineering Department, National Research Center	Female	synthesis and application of hydrogel, membrane science, and wastewater treatment.
Ph. 19	52	Teaching Assistant	Male	Hepatic disease

3. Results and Discussion

Based on Table 1, demographic features of Ph.D. students, the following is a possible new classification of them; (1) Field of Study; Chemistry (14 students), Biochemistry (5 students); (2) Work Background; Teaching assistant (6 students), Chemist (5 students), Specialist in medical laboratories (1 student), Quality control lab (1 student), Quality Assessor (1 student), Research Assistant (1 student), Organic chemistry lecturer (1 student), Chemist at the Ministry of Defence (1 student), Chemist in housing and building research center (1 student), No work (2 students); (3) Gender; Female (15 students), Male (4 students); (4) Age Range; students between the ages of 27 and 29 (6 students), 31 to 34 (5 students), 35 to 39 (3 students), and 52 (1 student), Age not provided (4

students); (5) Research Interests; Synthesis of organic compounds (4 students), Cancer biology (3 students), Water treatment (3 students), Analytical chemistry (3 students), Molecular biology (2 students), Preparation of electrodes (1 student), Synthesis and characterization of transition metal complexes (1 student), Hydrogel synthesis and application (1 student), Hepatic disease (1 student), No research interests provided (3 students). Table 2 shows all results of the questionnaire Ph.D. Chemistry Students in Problem Seminar Course 2022.

Table 2. All results of the questionnaire Ph.D. Chemistry Students in Problem Seminar Course 2022 Total 19 = 5 (26.32%) Male, 14 (73.68%) Female

	Statements for response	Yes	Sometimes	No
Attitudes Toward Writing	Do you like writing?	10	9	0
		52.63%	47.37%	0.00%
	Do you have confidence in generating intelligent thoughts, words, and perceptions?	15	4	0
		78.95%	21.05%	0.00%
	Do you consider yourself to be a writer?	9	9	1
		47.37%	47.37%	5.26%
Generating	Can you produce many words pretty fast and freely, without getting stuck, on a subject that interests you?	10	9	0
		52.63%	47.37%	0.00%
	Can you offer any original thoughts or insights on a subject that interests you?	11	8	0
		57.89%	42.11%	0.00%
	Can you come up with many words pretty fast and freely about a subject that doesn't particularly interest you (perhaps one that has been assigned to you) and not get stuck?	2	14	3
		10.53%	73.68%	15.79%
	Can you think of any new ideas or insights on a subject that doesn't interest you?	4	13	2
		21.05%	68.42%	10.53%
	Can you write or reason your way to an opinion on a subject where you don't initially know what you think?	11	7	1
		57.89%	36.84%	5.26%
	Can you write or think your way into truly altering your mind on a subject where you first have an opinion?	11	8	0
		57.89%	42.11%	0.00%
Revising	Can you actually change your mind about a subject you already have an opinion on through writing or thought?	12	6	1
		63.16%	31.58%	5.26%
	Can you make sense of your disjointed work and identify its major point?	8	7	4
		42.11%	36.84%	21.05%
	Can you give a piece of writing you previously organized a new shape?	16	3	0
		84.21%	15.79%	0.00%
	Can you identify and correct any flaws in your logic or reasoning?	13	5	1
		68.42%	26.32%	5.26%
	Can you clarify your sentences so that readers can understand them right away?	15	4	0
		78.95%	21.05%	0.00%
	Are your sentences vibrant enough? Can you give them a voice like a human?	14	4	1
		73.68%	21.05%	5.26%
	Can you eliminate the majority of grammar, spelling, punctuation, and other errors? Can you make your writing clear enough that most readers won't be turned off?	15	4	0
		78.95%	21.05%	0.00%
	Can you nearly eliminate all of these errors?	11	8	0
		57.89%	42.11%	0.00%
	How will most readers respond to a piece you've written?	6	7	6
		31.58%	36.84%	31.58%
	Can you adjust something you've written to fit the needs of particular readers?	15	4	0
		78.95%	21.05%	0.00%
Feedback	Can you like reading a draught of your writing aloud to friends?	15	2	2
		78.95%	10.53%	10.53%
	Could you read a rough draught of your writing out to the audience in a way that is truly clear and "given," as opposed to mumbled and "held back"?	11	8	0
		57.89%	42.11%	0.00%
	Can you honestly hear a reader's responses to your writing and attempt to understand them even if you believe they are incorrect?	14	4	1
		73.68%	21.05%	5.26%
	Can you provide constructive criticism by expressing your preferences to the author and summarising or reflecting on what you perceive the words to be saying?	11	6	2
		57.89%	31.58%	10.53%
	As a reader, can you describe in detail the "movies of your mind" that occurred while you were reading someone else's writing?	10	8	1
		52.63%	42.11%	5.26%
		11	8	0

	Statements for response	Yes	Sometimes	No
	Can you provide the writer with "criterion-based feedback" that details how the draught compares to the most important quality writing standards?	57.89%	42.11%	0.00%
Collaboration	Can you collaborate with a small group to complete a task, chip in, divide the work, promote teamwork, and maintain focus?	18	0	1
		94.74%	0.00%	5.26%
Awareness and Control of the Writing Process	Can you describe the events while writing, including the sensations and thoughts that crossed your mind?	9	9	1
		47.37%	47.37%	5.26%
	Do you identify issues or "stuck points" in your writing and identify their root causes?	15	3	1
		78.95%	15.79%	5.26%
	Based on what you observed, can you alter how you approach writing?	17	2	0
		89.47%	10.53%	0.00%
	Can you alter your writing process according to the circumstances, such as the subject, target audience, type of writing, etc.?	17	1	1
		89.47%	5.26%	5.26%

3.1. How did Ph.D. Chemistry Students perceive Academic Writing?

Research participants were Ph.D. chemistry students whose perceptions of academic writing were examined along five dimensions: language, process, product, form, and content. Students' attitudes towards grammar in academic writing, their familiarity with the research and preparation process, their views on various written products like the thesis or scientific article, their familiarity with the formal rules and standards of academic writing, and their appreciation of content-related factors like objectivity, evidence, and originality could all be investigated in such a study. The study has the potential to shed light on the strategies and priorities of Ph.D. chemistry students when it comes to writing for academic purposes.

1) Grammar (Readability, Academic Language, Passive voice, Formal language):

Researchers found that Ph.D. chemistry students emphasized employing correct grammar and scholarly diction in their written work. One respondent proposed a specific framework for academic writing to fulfill the needs of the academic community. Students also noted the importance of eliminating grammar and language faults, as they might diminish the value of a study. Students appear to believe academic writing should be organized and easy to read for clarity and comprehension. Unfortunately, the passage ends before any detailed feedback on the reading is offered. The study's results suggest that the Ph.D. chemistry students who took part in the study understood the importance of using proper grammar and academic language in their writing to meet the expectations of their academic community and ensure the success of their research. Some of the Ph.D. candidates suggested that the researcher academically organize his writing and evaluate the grammar thoroughly (Ph. 4). Carelessness with language or grammatical faults might have unintended consequences and lessen the impact of the study (Ph. 17). The content is simple, well-organized (Ph. 12), and easy to understand for locals and readers alike. Others claimed that they were able to succeed despite these difficulties by using search engines (Ph. 15). Finding the appropriate word to explain my reaction and using correct syntax to convey my ideas were two of the most difficult tasks (Ph. 15). My capacity to spot mistakes and adjust has increased with practice, according to a fellow student (Ph. 18). According to the vast majority, employing some web tools simplifies the process and yields academic writing with a formal tone.

2) Process (Research, Investigation, Analysis, Synthesis, Preparation, Thinking, Planning):

Participants in the study, pursuing doctorates in chemistry, reported that the most difficult part of the academic writing process was not coming up with fresh ideas but rather putting those ideas into action. This was blamed on the difficulty and expense of doing the necessary scientific studies and developing an appropriate strategy for putting it into practice. Some of them, however, claimed that they had learned to improve their research, analysis, and planning abilities with the aid of their academic supervisor and fellow students. This indicates that students might benefit greatly from the assistance and support of seasoned mentors to get past some of the challenges they encounter during the research and writing process. The participating Ph.D. chemistry students understood the significance of the research, investigation, analysis, synthesis, preparation, thought, and planning in academic writing but also recognized the difficulty of developing and efficiently applying these

abilities. Some Ph.D. candidates have noted that the hardest part is not thinking of new ideas but rather putting them into action (Ph. 7). This is because conducting scientific research is expensive and time-consuming, and developing a thorough strategy for putting that research into practice is challenging. Another student (Ph. 10) credited my supervisor and colleagues for helping him grow as a researcher, analyst, and planner. Clarity is brought to planning "concerning different subjects" (Ph. 14). The first parts that I found difficult were the inquiry and the debate that followed the analysis (Ph. 17). One organic chemistry Ph.D. student admitted that he struggled to find the right issue to specialize in and explore for new ideas because of his passion for the field, but that he eventually did it with the help of modern search techniques (Ph. 15).

3) Product (Thesis, Article, Presentation, Scientific Writing):

Students who majored in chemistry and participated in the study emphasized the significance of scientific writing as the result that recounts the entire scientific process, from hypothesis to experiment to analysis to the conclusion. They discussed how specialized, exact, and precise writing in the scientific field might yield outstanding publishable results. One of the Ph.D. chemistry students is noted to have prior experience writing scientifically, and more precisely within the context of a thesis, in the passage. However, the reply ends before any detailed feedback on the argument itself is provided. Overall, it seems that the Ph.D. chemistry students in the study appreciated the value of academic writing in various contexts and knew that the scientific method is essential to producing high-quality work. For instance, all of the Ph.D. students I spoke with agreed that "Scientific Writing" is the end output that describes the entire scientific process, from ideation through implementation to the actual work done in the lab and the analysis done to back up the results. Following the basic steps in a specialized, precise, and accurate manner will result in a publishable masterpiece (Ph. 2). In his master's thesis, one of the students said that he had written a literature review from scratch and used the data in an ideal style that made it simple to draw connections between the different levels of analysis (Ph. 5, Ph. 7). While writing the experimental section, it was challenging to convert charts into readable data; but, with the help of more seasoned colleagues and supervisors, this process became considerably simpler over time (Ph. 16).

4) Form (Outline, Rule, Systematic, Standard):

The participating Ph.D. chemistry students all agreed that following the journal's specific criteria for format and style was essential for their academic work. They stressed the significance of learning and adhering to the specific writing guidelines required by each publication. The extract also implies that getting one's work accepted is crucial and that doing so requires, among other things, following the specific formatting guidelines of each publication. Overall, it seems that the Ph.D. chemistry students who participated in the study understood the significance of following the established norms and guidelines for academic writing, especially in terms of format and organization, to guarantee that their work would be approved by its target readers. Most doctoral candidates stressed the importance of following each journal's specific criteria regarding layout and structure. We have to write following the journal's style guide. It took a lot of time and effort to learn the correct manner of writing, according to one of them (Ph. 1, Ph. 7). It is important to gain approval (Ph. 5). One of these is conformity with the journal's preferred formatting style (Ph. 11).

5) Content (Information, Comparison, Objectivity, up-to-datedness, Evidence, criticism, Original, Consistent, statistics):

The participating Ph.D. chemistry students understood the significance of some content-related elements in scholarly writing. For content to be credible and back up the thesis, they said it needed to be objective, instructive, comparative, current, backed up by evidence, and critical. One student shared that to check the reliability of their study findings for their master's thesis, they had to familiarise themselves with fundamental scientific principles and chemical programs. This indicates that to succeed in academic writing, students may need to acquire various skills and information, such as subject-specific competence and the capacity to analyze and compare various kinds of evidence. The Ph.D. chemistry students in the study understood the significance of various content-related factors in academic writing, such as objectivity, informativeness, comparison, evidence, originality, and consistency. They recognized the difficulties associated with ensuring that content meets these requirements. To be credible and support your thesis (Ph. 1), the content of your academic paper should be objective, informative, comparative, statistical, and consistent, as indicated by the Ph.D. students. One of them (Ph. 13, Ph. Ph. 5) noted that to complete his master's thesis, he had to familiarise himself with a wide variety of fundamental scientific concepts and chemical programs to verify the accuracy and consistency of his findings about those of other scientists. Although the

information itself may be straightforward, the presentation may require some variation (Ph. 8). The content should be clear and concise (Ph. 12). It is impossible to overemphasize the significance of study when introducing a new idea (Ph. 15). Work on a project and finish all of its parts to share your expertise with others and develop your profession effectively (Ph. 16).

3.2. What are the problems faced by Ph.D. Chemistry Students in Academic writing?

Based on the information provided in the study, Ph.D. chemistry students face various challenges and problems when it comes to academic writing. Here are how the mentioned factors correspond to some of these challenges:

- Text (organization, Objectivity, fluency, coherence, Academic Language, Limitation): Ph.D. chemistry students may struggle with organizing their writing clearly and coherently, using proper academic language, and achieving objectivity in their work. They may also face limitations, such as word counts or page limits, making it difficult to develop their ideas fully.
- Mistakes (technique, Data Analysis, Preparation, Citation): Students are susceptible to making errors in various academic writing areas, including the research technique, data analysis, and citation, which can affect the validity and credibility of their work.
- Competence (Lack of information, Academic language, Motivation, Foreign Language, Interpretation): Lack of competence in various areas, such as subject-specific knowledge, academic language, foreign language proficiency, and interpretation of data, can hinder students' ability to produce high-quality academic writing. Lack of Motivation can also be a major issue.
- Support (Advisor, Lesson, Information, Experience): Access to adequate support, such as guidance from advisors, lessons on academic writing, and information on the requirements of different publishing venues, can be critical for students to succeed in academic writing.
- Place of publication (Access, Template, Fee): The choice of publishing venue can be challenging for Ph.D. chemistry students, as some journals or conferences may have difficult access, complex formatting requirements, or high publication fees.

Ph.D. chemistry students face complex obstacles in academic writing that necessitate cultivating a wide range of abilities and the availability of sufficient resources.

1) Text (organization, Objectivity, fluency, coherence, Academic Language, Limitation):

To accomplish their research goals, Ph.D. students must utilize precise language and organize their thoughts logically. The text should be well-organized and consistent, serving the study's central thesis or notion. While there are many benefits to writing in an academic style, there are also limitations due to the need for elegant, clear, and systematic language. Ph.D. chemistry students who want to be published authors should develop their writing skills by reading various scholarly articles. This takes time, but it's important if you want to be able to write well for school. Proper formatting, citation, and reference is essential to a well-organized research paper. In addition to ensuring that the article represents a critical review of existing literature and the student's original contributions to the area, it is also crucial that the student adhere to the standards specified by the target journal or conference. Although this may be difficult at first, given time and effort, students can learn the abilities necessary to write well academically. To gain the necessary experience and publish high-quality articles, most Ph.D. students advise reading widely in the field. Keep in mind the importance of well-written, well-organized thoughts in achieving your research goal (Ph. 3). Academic rigor requires that the text be structured in such a way that the ideas continue to flow smoothly from beginning to end (Ph. 4). Elegant, unambiguous, and systematically organized language is what academics strive for (Ph.13). To improve our writing and to learn from the work of others, we must read extensively (Ph.14). A lot of careful thought is required when planning the structure of a research paper to ensure that the thesis remains coherent throughout. The thesis should make sense and use concise, straightforward language (Ph. 15).

2) Mistakes (Method, Data Analysis, Preparation, Citation):

Students should pay close attention to the journal's guidelines to avoid making any citation errors. Students pursuing a doctorate in chemistry are aware that errors made at any point in the research process can significantly affect the study's validity and dependability. A sound methodological approach and thorough preparation for the activity at hand are essential for avoiding these pitfalls. Being well-prepared reduces the likelihood of making mistakes that cost time, energy, and money. To

sum up, Ph.D. chemistry students know the need to take precautions to reduce the likelihood of making errors while conducting research and writing. Using reliable citation management software, strict adherence to journal requirements, and thorough preparation are all essential. Following these guidelines will help students improve the validity of their study. All Ph.D. candidates agreed that errors are common during assay execution and must be repeated several times before they can be confident in the results. Good software can help you avoid making citation mistakes (Ph. 8, Ph. 2). To prevent squandering time, energy, and resources, you must thoroughly prepare for your work (Ph. 3). Analysis of the data yields valid associations and practical inferences. It's challenging to cite sources because resources aren't always readily available, making the process time-consuming and costly. Preparational blunders result in lost time and resources. Mendeley was a great help in reducing the time spent manually citing sources.

3) Competence (Lack of information, Academic language, Motivation, Foreign Language, Interpretation):

Academic writing is the language most commonly used in scholarly works. A language barrier can reduce the quality of research by preventing researchers from expressing their thoughts clearly and accurately. This is especially true for those who are not native English speakers and may have difficulty communicating in the language of instruction. Data interpretation is a crucial ability for chemistry Ph.D. candidates. Findings and conclusions from the study rely heavily on the researcher's data analysis and interpretation skills. Mentorship and instruction from teachers and counselors may be necessary for pupils to acquire this skill. In conclusion, chemistry Ph.D. students face a wide range of competence-related challenges, including a lack of Motivation, an information gap, a language barrier, and an interpretive challenge. Successful academic writing and research need students to develop the necessary skills, gain access to appropriate resources, and keep up their Motivation. One doctoral student commented that he didn't think a scientist without drive should bother with research (Ph.1). Motivation is the driving force behind the researcher's in-depth investigation and subsequent discovery of new information (Ph. 1). If you want to avoid a void in your research (Ph. 2), you need to do thorough preparation. The use of simple, intelligible language for both readers and arbitrators is a sign of English language proficiency (Ph. 6). One more student admits he has a lot to learn in terms of expanding his knowledge of science and developing his proficiency in academic English writing (Ph. 14). Another one mentioned that she found it difficult because she is Egyptian and speaks Arabic as her first language, but that her co-workers helped her tremendously (Ph. 15). Achieving a good step, no matter how tiny, might motivate you to take the next step towards your goal. Furthermore, without proper interpretation, academic writing fails to convey its intended meaning (Ph.19).

4) Support (Advisor, Lesson, Information, Experience):

As a result, you gain the tools you need to become an effective writer and researcher in your academic pursuits. Students pursuing a doctorate in chemistry understand the value of having an advisor or mentor they can turn to for advice and encouragement. Having someone to keep you motivated and on track while you acquire the skills and knowledge you need to succeed can be invaluable. Mentorship is essential for academic writing and research success, but students also need access to high-quality lessons, material, and experiences. Access to materials that might aid in skill development is also essential, as is keeping up with recent advancements in the subject. In conclusion, academic writing and research success need the guidance of instructors, as well as courses, resources, and experience. Ph.D. chemistry students with access to and use these tools will be better prepared to become leaders in the field and more likely to conduct research that leads to meaningful discoveries. As future scientists, the Ph.D. students emphasized the need for a guide to help us stay on track (Ph. 1, Ph. 11). To finish what we have started (Ph. 2), we need the encouragement and assistance of our advisors. To succeed, we need to know what we're doing, have some background, and have our teachers and other resources backing us up (Ph. 6). Having a skilled advisor and a strong support system behind you makes it easier to see the end goal and stay focused on the path that will lead you there (Ph. 18). Not only does it help you become an expert in your industry, but it also boosts your professional prospects. One Ph.D. candidate wrote, "The help I received from my family and my advisor got me through the tough times in my work and set me on the right path" (Ph.16).

5) Place of publication (Access, Template, Fee):

Expensive in terms of time, money, or both. Finding the appropriate journal for one's research findings can be challenging for Ph.D. chemistry students, who may have to consider issues such as accessibility, template requirements, and publication fees. Despite the difficulties, publishing can be a rewarding experience for chemistry Ph.D. candidates. Their efforts in the field are acknowledged, and the time and effort they put into their study are rewarded. To be successful in getting their work

published, students need to plan and make decisions that support their study aims. This could entail looking into several journals, examining their publication criteria, and consulting with mentors and peers. Overall, picking the right place to publish your research and writing as a Ph.D. chemistry student might be difficult, but it is essential. Students can improve their chances of publishing high-quality research findings and significantly contributing to the area by seriously considering their alternatives and making well-informed decisions. The final stage, publishing it, is the most rewarding because it acknowledges my work, pays me back for my efforts, and shows other scientists that I can assist them. Many students cited the publication process and deciding which journal to submit to as the most difficult parts of a Ph.D. program. It might be time-consuming and challenging to decide on a magazine for publishing (Ph. 12). One of them complained that the cost of publishing in an international magazine has skyrocketed since he, like me (Ph.14), pays for my publication out of pocket in addition to receiving funding from his advisors. My research institute's assistance was crucial to my success (Chapter 15 Ph. To aid and promote young scholars, journals should be open access and have lower submission fees (Ph. 8).

Chemistry Academic writing is seen by Ph.D. students as difficult but necessary for their studies and research. They recognize the difficulties in ensuring that content satisfies multiple needs, such as objectivity, informativeness, comparability, evidence, originality, and consistency. Mistakes in methodology, data analysis, preparation, and citation, constraints in text organization and academic language, lack of Motivation, language difficulties, and difficulty in interpretation are just a few of the issues students experience when writing for academic purposes. To meet these difficulties head-on, students will need a wide range of knowledge and abilities, including subject-specific expertise, research methods, and data analysis. Academic writing and research achievement necessitate instructor guidance, lessons, resources, and experience. Publication is another important step in writing and researching for an academic audience, but selecting the appropriate venue can be difficult. Students can improve their chances of publishing high-quality research findings and significantly contributing to the area by seriously considering their alternatives and making well-informed decisions. Students at the doctoral level have found that using online resources facilitates the creation of formal academic writing. Finding the right words to express a response precisely and arranging one's thoughts grammatically remain formidable obstacles. Creating a complete implementation plan in the scientific community can be time-consuming and expensive. In the eyes of a Ph.D. candidate, science writing is the culmination of a long and arduous process that begins with the generation of ideas and extends through the conduct of experiments and the analysis of data to back up conclusions. They emphasize the need for academic publications to be accurate and to back up a thesis by being objective, informative, comparative, statistical, and consistent. Research findings should be trusted, so ensuring they meet these standards is important. Doctoral candidates agree that reading widely before putting pen to paper is essential for learning new material and creating high-quality writing samples. They also understand that academic writing should be organized so that the ideas flow smoothly, and the argument is backed up. Therefore, sophisticated, precise, and well-organized academic writing guidelines are required. By doing so, they can generate academic writing appropriate for their target audience and clearly convey their study findings. One Arabic-speaking Egyptian Ph.D. student spoke about the unique difficulties she experiences in academic writing. However, the publishing process is the most rewarding because it acknowledges her efforts, advances the area, and aids other researchers. Choosing a journal and publishing your work are two of the most difficult parts of getting a Ph.D. However, they realize that these challenges may be overcome with the aid of friends.

4. Conclusion

The primary purpose of this research likely is to investigate the challenges faced by ESL chemistry Ph.D. candidates in their academic writing. Genre theory, academic writing instruction and support, and second language writing serve as theoretical touchstones for this self-study. Researchers intend to examine linguistic, cultural, and disciplinary factors that may impact these students' writing development to enhance their academic writing skills. The study's opening describes academic writing as a multifaceted process that requires a certain set of competencies. The study authors stress the significance of knowing your academic writing community and its norms. The challenges of academic writing, such as the need to understand academic discourse, develop critical thinking skills, and understand writing conventions and style, are also discussed in the introduction. The authors drew on several ideas and studies of academic writing to illuminate current practices in higher education. In conclusion, the three writing theories discussed in the study's abstract and introduction—Second

Language Writing, Genre Theory, and Academic Writing Instruction and Support—provide a useful framework for analyzing the obstacles to academic writing encountered by chemistry doctoral students, particularly those for whom English is a second language. These theories provide possible solutions to the problem of low academic writing skills and expand our knowledge of the linguistic, cultural, and disciplinary factors that may influence writing development.

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