

Case Report

Applying Design Thinking to Enhance Academic Writing Skills Among PhD Students in Chemistry", Cairo University as a Case Study

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Abstract

Academic writing is a critical skill for PhD students, particularly in the field of chemistry, where the ability to communicate complex ideas clearly and effectively is essential for academic success and future contributions to the field. However, many students struggle with clarity, coherence, and engagement due to the intricate nature of writing rules and feedback mechanisms. This study aims to improve the academic writing skills of PhD chemistry students at Cairo University by applying a Design Thinking framework, which emphasizes empathy, creativity, and iterative learning. The research investigates essential writing skills, assesses current student abilities, and evaluates the effectiveness of a Design Thinking-based program in enhancing these skills. A mixed-methods approach is employed, combining quantitative surveys to gauge students' perceptions of their writing abilities and the program's impact, with qualitative focus group discussions and individual interviews to gain deeper insights into their experiences and challenges. The findings reveal that integrating Design Thinking into the writing curriculum significantly enhances students' writing skills, confidence, and engagement with the writing process. Additionally, the study identifies the need for tailored support to address the diverse backgrounds of students. By implementing targeted strategies, this research aims to empower PhD students to write more confidently and effectively, ultimately improving their academic experience.

Keywords

Academic Writing, Design Thinking, PhD Students, Chemistry, Mixed-Methods Research

1. Introduction

Effective writing is a crucial component of PhD students' pursuit of academic success, especially in disciplines like chemistry that mainly depend on the accurate expression of difficult concepts. In keeping with Professor Hamed Ead's dedication to helping doctoral candidates through his "Academic Writing" course, this article expands on the ideas he first discussed in "Academic Writing Challenges Faced by Chemistry Doctoral Students: A Self-Study Informed by

Three Writing Theories." It also references his work, "Integrating Design Thinking (DT) into Entrepreneurship Education: A Case Study of Cairo University's Entrepreneurship Club," which is now being published. [1-4]

In his earlier research, Professor Ead identified significant challenges faced by chemistry PhD candidates who write in English as a second language, highlighting the cognitive demands and conventions of academic writing that can hinder

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Received: 9 January 2025; **Accepted:** 24 January 2025; **Published:** 27 February 2025



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their ability to articulate research effectively. Recognizing the importance of mastering academic writing for the successful dissemination of research findings, Professor Ead aims to enhance the writing proficiency of students across diverse specializations within the field of Chemistry. This study proposes that the Design Thinking model can serve as a transformative framework to address the identified challenges. By prioritizing empathy, ideation, and prototyping, Design Thinking encourages a creative and collaborative approach to writing that can significantly improve students' academic writing skills.

The central question guiding this investigation is: "What is the effect of a proposed program based on Design Thinking on developing PhD students' academic writing skills?" To explore this, we delve into several sub-questions: What specific academic writing skills should PhD students possess? What skills do they currently demonstrate? How can a Design Thinking-based program be effectively structured to enhance these skills? And ultimately, what impact does this program have on their writing proficiency?

To address these questions, this study will employ various methodologies, including surveys, open discussion sessions, and iterative writing techniques, all aimed at creating a supportive learning environment. The goal is to foster clarity, coherence, and engagement in academic writing, allowing students to communicate their research findings with confidence and precision.

By investigating the intersection of Design Thinking and academic writing, this article aspires to contribute valuable insights into the development of targeted strategies that empower PhD students in Chemistry. Ultimately, the findings will not only enhance their writing capabilities but also enrich their academic journeys, ensuring they can effectively share their research with the broader scientific community.

1.1. Literature Survey

Recent studies have highlighted the transformative potential of Design Thinking in educational contexts. For instance, Arias-Flores, Jadán-Guerrero, and Gómez-Luna [5] demonstrated how integrating Design Thinking and Game Thinking can foster innovation in the classroom, providing a framework for educators to enhance student engagement and creativity. Similarly, Educa Digital [6] offers a comprehensive overview of Design Thinking's application in educational settings, emphasizing its role in developing critical thinking and problem-solving skills among students. These insights are further supported by Cortés Júnior et al. [7], who explored the redesign of medical education through Design Thinking, illustrating its versatility as a pedagogical tool.

Moreover, the global reach of Design Thinking is evident in various studies. Bhandari [8] provides a thorough overview of current research trends, showcasing the widespread interest in this methodology across different fields. In Brazil, research by Cintra, Silva, and Furnival [9] has examined the use of Design

Thinking to enhance scientific communication, highlighting its relevance in the social sciences. Internationally, the work of Çeviker-Çınar, Mura, and Demirbağ-Kaplan [10] has underscored the importance of Design Thinking in business education, further demonstrating its applicability beyond traditional educational frameworks.

Methodologically, a variety of approaches have been employed to study Design Thinking. For example, Aragão et al. [11] conducted a bibliometric analysis to map the academic production on Design Thinking, while Bhandari [8] combined bibliometric and content analysis to provide insights into its evolution and applications. Additionally, ALT [12] offers a practical guide to implementing Design Thinking, emphasizing the importance of empathy, ideation, and prototyping in fostering innovative thinking.

Academic writing is a vital skill in scholarly disciplines, enabling researchers to convey their thoughts and findings effectively. Characterized by the use of evidence, critical analysis, and appropriate technical language it typically adheres to a formal and objective style aimed at informing or persuading an academic or professional audience [14]. This form encompasses various types, including journal articles, dissertations, and research papers, each necessitating distinct competencies.

Johnson [14] classifies academic writing into three primary types: expository, persuasive, and inquiry writing, each requiring specific skills such as explaining concepts, arguing positions, and conducting research. The generic traits of academic writing—complexity, responsibility, objectivity, formality, accuracy, hedging, and conciseness [13, 14]—contribute significantly to the effective dissemination of research findings. This is especially crucial for PhD students, many of whom write in English as a second language and face additional challenges in mastering these conventions.

In addressing these challenges, the author has been pivotal in supporting PhD students at Cairo University through his course on "Academic Writing." Building on his previous work, "Academic Writing Challenges Faced by Chemistry Doctoral Students: A Self-Study Informed by Three Writing Theories," this article explores how the Design Thinking model can serve as a transformative tool for enhancing academic writing skills among chemistry PhD students. This model recognizes the complex cognitive demands of academic writing and the inadequacies of traditional instructional methods, aiming to equip students with the necessary skills for clear and impactful communication of their research [1-4].

Design Thinking, as articulated by Fredrickson [15], is a methodology applied across various fields, including education, to tackle complex problems and enhance learning experiences. Grounded in constructivist principles, it promotes active knowledge construction through collaboration and creativity [16]. Herbert Simon's design thinking process outlines stages such as defining problems, researching, ideating, prototyping, choosing, implementing, and learning—each applicable to the development of academic writing skills.

Kwek [17] emphasizes that design thinking fosters cognitive and metacognitive skills through hands-on projects that stress empathy, ideation, and problem-solving. This human-centered approach not only enhances creativity and critical thinking but also cultivates a low-risk environment where students can innovate and experiment without fear of failure. Integrating design thinking into the academic writing curriculum thus aims to create a supportive learning environment that promotes clarity, coherence, and engagement in writing.

Through interactive workshops, peer feedback sessions, and iterative writing processes, the proposed program seeks to address specific academic writing skills that PhD students

currently lack while building upon those they already possess. The guiding research question is: "What is the effect of a proposed program based on Design Thinking on developing PhD students' academic writing skills?" By investigating the required skills, current competencies, program design, and the impact of the program, this research aims to provide valuable insights for developing targeted strategies that empower PhD students to present their research confidently and effectively.

These studies collectively underscore the significance of Design Thinking as a dynamic and adaptable framework that can enhance educational practices across various disciplines, including the critical area of academic writing.

1.2. Research Questions (RQs) and Hypotheses

Table 1. Research Questions (RQs) and Hypotheses.

Research Question	Hypothesis
RQ1: What specific academic writing skills do PhD students in Chemistry need to develop to effectively communicate their research?	Hypothesis 1: PhD students in Chemistry require proficiency in skills such as critical analysis, argumentation, literature review, and citation practices to enhance their academic writing.
RQ2: What academic writing skills do PhD students currently possess, and how do these skills align with the expected competencies?	Hypothesis 2: There is a significant gap between the academic writing skills currently possessed by PhD students and those required for effective academic communication, indicating a need for targeted intervention.
RQ3: How can a Design Thinking-based program be structured to effectively improve the academic writing skills of PhD students in Chemistry?	Hypothesis 3: A Design Thinking-based program that incorporates empathy, ideation, prototyping, and iterative feedback will lead to improved academic writing skills among PhD students.
RQ4: What is the effect of the proposed Design Thinking program on the academic writing proficiency of PhD students?	Hypothesis 4: Participation in the Design Thinking program will significantly enhance the academic writing proficiency of PhD students, as measured by improvements in clarity, coherence, and overall quality of their written work.
RQ5: How do peer feedback sessions influence the academic writing development of PhD students participating in the Design Thinking program?	Hypothesis 5: Peer feedback sessions integrated into the Design Thinking program will positively influence the academic writing development of PhD students, leading to increased engagement and refinement of their writing skills.

2. Methodology

The methodology employed in this study utilized a mixed-methods approach to enhance the academic writing skills of 32 PhD students in chemistry. The program was developed around a Design Thinking framework, incorporating key components such as empathy mapping, ideation, prototyping, and iterative feedback. This structured approach aimed to create an engaging and supportive learning environment, facilitating the development of essential writing skills.

Data collection involved a combination of pre- and

post-assessment surveys, writing samples, and focus group discussions to gather comprehensive insights into student experiences and skill progression. Quantitative data were analyzed using paired t-tests to evaluate changes in writing abilities, while qualitative data underwent thematic analysis to identify common themes and challenges faced by the participants. Ethical considerations were prioritized throughout the research, including obtaining ethical approval, ensuring informed consent, and maintaining data confidentiality. However, the study acknowledged limitations, such as reliance on self-reported data and the limited generalizability of findings due to the small sample size.

2.1. A Comparative Analysis: Academic Writing vs. Design Thinking

Table 2. A Comparative Analysis: Academic Writing vs. Design Thinking.

Aspect	Academic Writing	Design Thinking
Definition	Careful study of a subject to discover facts/principles.	A creative, human-centered approach to problem-solving.
Purpose and Goals	Communicate research findings, convey scholarly thought, contribute to academic discourse.	Solve complex problems, foster creativity and innovation, understand user needs, generate practical solutions.
Approach	Methodical and systematic; relies on established protocols.	Iterative and flexible; encourages exploration and experimentation.
Process	Structured stages (data collection, drafting, revising, editing, publishing).	Non-linear process (empathy, definition, ideation, prototyping, testing).
Process Duration	Slow, often spanning years to decades from conception to application.	Rapid, with solutions developed and tested within weeks to months.
Rigorousness	Requires extensive testing, statistical analysis, and peer review.	Emphasizes testing but may lack the same level of scientific rigor.
Skill Development	Critical thinking, analytical reasoning, effective communication.	Creativity, collaboration, problem-solving, adaptability.
Collaboration	Collaborative but often limited by academic hierarchies and disciplines.	Highly collaborative, inviting diverse perspectives and skills.
Collaborative Elements	Peer feedback, collaborative discussions.	Teamwork, collective brainstorming.
Cultural Attitude Toward Failure	Failure is stigmatized; null results are often unpublished.	Embraces failure as part of the learning process; encourages rapid iteration.
Diversity	Traditionally has struggled with diversity; slowly recognizing its importance.	Actively promotes diversity as a strength in problem-solving.
Outcome Orientation	A polished piece of writing (research paper, thesis).	Tangible solutions or prototypes.
Feedback Mechanisms	Peer feedback, advisor feedback, reviewer feedback.	Continuous and iterative feedback throughout the process.
Impact Timeline	Often long-term; interventions can take years to integrate into practice.	Short-term; solutions can be implemented quickly and adjusted as needed.
Validation	Validated through peer review and publication.	May not require formal validation; success is often measured by user impact.
Flexibility	Less flexible; adheres to strict guidelines and formats.	Highly adaptable; encourages pivoting based on user feedback.

Summary

Academic Writing is structured and methodical, focusing on clearly communicating research findings and contributing to scholarly discourse. It develops critical thinking and analytical skills while often operating within a slower, hierarchical framework that can limit innovation.

In contrast, Design Thinking emphasizes creativity and collaboration, aiming to solve complex problems through a

non-linear process that includes empathy and prototyping. This approach fosters adaptability and continuous feedback, leading to tangible solutions in a shorter time frame.

Both academic writing and design thinking serve important roles in addressing complex issues, particularly in fields like health and healthcare. By integrating the rigor of academic research with the agility of design thinking, we can create more effective and innovative solutions to today's challenges.

2.2. The Significance of Design Thinking for PhD Students' Academic Writing

Table 3. *The Significance of Design Thinking for PhD Students' Academic Writing.*

Key Benefit	Explanation
Human-Centred Approach	Tailored support for individual needs and challenges.
Iterative Learning	Encourages experimentation and gradual improvement.
Collaboration and Community	Fosters peer support and shared learning experiences.
Creativity and Innovation	Encourages exploration of innovative presentation styles.
Practical Application	Emphasizes the real-world impact of writing.
Problem-Solving Mindset	Equips students with strategies to overcome writing challenges.
Emphasis on Reflection	Promotes self-awareness and continuous learning.

1. **Human-Centered Approach:** At the core of Design Thinking is a commitment to understanding the needs and experiences of the individual. For PhD students, recognizing their unique challenges in academic writing—particularly when English is a second language—allows for tailored support. By empathizing with students, educators can create an environment that addresses specific obstacles, fostering a sense of belonging and motivation.

2. **Iterative Learning:** Design Thinking emphasizes the importance of iteration—testing, reflecting, and refining ideas. This philosophy aligns well with the academic writing process, where drafts often evolve through multiple revisions. Encouraging students to view their writing as a prototype allows them to embrace feedback and make continuous improvements, reducing the anxiety often associated with producing a "perfect" first draft.

3. **Collaboration and Community:** Design Thinking thrives on collaboration, promoting diverse perspectives and collective problem-solving. In the context of academic writing, fostering a collaborative learning environment encourages peer feedback and shared learning experiences. This community approach helps students develop writing skills while building supportive networks that enhance their academic journey.

4. **Creativity and Innovation:** Academic writing can sometimes feel rigid and restrictive. Incorporating Design Thinking encourages PhD students to think creatively about how they express their ideas. By engaging in brainstorming sessions and ideation exercises, students can explore innovative ways to present their research, ultimately leading to more compelling and original work.

5. **Practical Application:** Design Thinking focuses on creating viable solutions to real-world problems. This philosophy can be applied to academic writing by emphasizing the practical implications of research. Encouraging students to relate their work to broader societal issues or applications fosters a

deeper understanding of their research's significance, making their writing more impactful.

6. **Problem-Solving Mindset:** PhD students often face various challenges in their writing, from structuring arguments to articulating complex ideas. Design Thinking nurtures a problem-solving mindset, equipping students with strategies to tackle these challenges creatively. By framing writing obstacles as design challenges, students can approach them with confidence and resilience.

7. **Emphasis on Reflection:** Reflection is a critical component of both Design Thinking and academic writing. Encouraging students to reflect on their writing processes, the feedback received, and the outcomes achieved fosters a deeper understanding of their growth. This reflective practice not only improves writing skills but also instils a lifelong learning mindset.

Conclusion: The philosophy of using Design Thinking to enhance academic writing for PhD students is rooted in empathy, collaboration, and innovation. By embracing these principles, educators can create a supportive and dynamic learning environment that empowers students to refine their writing skills, express their ideas effectively, and contribute meaningfully to their fields of study.

2.3. Proposed Questionnaire

The survey consists of various questions aimed at understanding the academic writing experiences and preferences of participants. The first set of questions gathers demographic information, including age, gender, educational background, field of study, and current academic status. This foundational data helps contextualize the responses regarding academic writing practices.

Participants are then asked about their writing habits, including the frequency of engagement in academic writing and the types they most often practice, such as research papers,

essays, or theses. Confidence levels in academic writing skills are assessed, alongside the frequency with which they seek feedback on their work. The survey also explores the resources utilized for improving writing skills, emphasizing the importance of academic writing for their overall academic success.

Furthermore, the survey investigates participants' perceptions of Design Thinking as a potential tool to enhance their writing abilities. Additional questions delve into writing techniques, organizational strategies, and motivations for

improving writing skills. Participants reflect on their feelings about the volume of writing they undertake, preferred feedback styles, and how they prioritize writing tasks. The survey concludes by addressing tools used in writing, revision practices, influences on writing style, strategies for overcoming writer's block, and areas for improvement, such as clarity, creativity, structure, and argumentation. Through this comprehensive approach, the survey aims to gather valuable insights into the academic writing landscape among students and researchers.

3. Results

Table 4. Results in Details.

Category	Response	Percentage (%)
Gender	Female	64.7
	Male	35.3
Age	25-30	29.4
	31-35	38.2
	36 and above	32.4
Year of PhD Program	First-year	79.4
	Second year	8.8
	Third year	8.8
	Fourth-year and above	2.9
Primary Area of Research	Organic Chemistry	16.6
	Inorganic Chemistry	17.6
	Analytical Chemistry	41.2
	Biochemistry	23.5
Academic Writing Workshop Attendance	Yes	29.4
	No	70.6
Self-Assessment of Academic Writing Skills	Good	58.8
	Average	41.2
Confidence in Research Paper Writing	Very Confident	5.9
	Confident	38.2
	Neutral	44.1
	Somewhat Confident	11.8
Frequency of Receiving Writing Feedback	Always	2.9
	Often	20.6
	Sometimes	64.7
	Rarely	8.8
	Never	2.9
Familiarity with Design Thinking	Very Familiar	2.9

Category	Response	Percentage (%)
Previous Use of Design Thinking	Familiar	35.3
	Somewhat Familiar	20.6
	Neutral	30
	Not Familiar	11.8
	Yes	35.3
Belief in Design Thinking's Impact on Writing	No	64.7
	Agree Strongly	47.1
	Agree	41.2
	Neutral	8.8
	Strongly Disagree	2.9
Engagement with Collaborative Writing Exercises	Very Engaging	23.5
	Engaging	44.1
	Neutral	29.4
	Not Engaging	2.9
	Very Important	41.2
Importance of Clarity in Academic Writing	Important	47.1
	Neutral	11.8
	Good	50
	Average	47.1
	Excellent	2.9
Self-Assessment of Argument Persuasiveness	Very Challenging	5.9
	Challenging	38.2
	Neutral	28.2
	Slightly Challenging	14.7
	Not Challenging	2.9
The challenge in Maintaining Writing Coherence	Always	11.8
	Often	35.3
	Sometimes	50
	Rarely	2.9
	Very Supportive	8.8
Frequency of Revising Based on Feedback	Supportive	41.2
	Neutral	41.2
	Unsupportive	8.8
	Structured Workshops	35.3
	Collaborative Sessions	50
Institutional Support for Writing Improvement	No Preference	14.7
	Very Important	5.9
	Important	58.8
	Neutral	29.4
	Preference for Writing Workshop Format	

Category	Response	Percentage (%)
Frequency of Peer Review Utilization	Slightly Important	2.9
	Not Important	2.9
	Always	8.8
	Often	35.3
	Sometimes	38.2
	Rarely	8.8
Interest in Design Thinking Writing Workshops	Never	2.9
	Very Interested	32.4
	Interested	44.1
	Neutral	20.6
Comfort with Peer Feedback Presentations	Slightly Interested	2.9
	Very Comfortable	11.8
	Comfortable	70.6
	Neutral	14.7
	Uncomfortable	2.9
Preferred Writing Format	Research Papers	61.8
	Articles for Publication	20.6
	Thesis/Dissertation	11.8
	Reports	5.9
Perception of Creativity in Academic Writing	Very Important	26.5
	Important	58.8
	Neutral	14.7
Anticipated Challenges in Integrating Design Thinking	Time Constraints	38.2
	Resistance to Change	32.4
	Lack of Understanding	5.9
	Philosophy of the Article	23.5

4. Key Findings for Statistical Descriptive Analysis

The statistical descriptive analysis yielded several key findings regarding the academic writing experiences of PhD students. Notably, there is a higher representation of female students, and the majority of participants fall within the 31-35 age range. Most students are in their first year of the PhD program, with Analytical Chemistry identified as the most common area of research. Interestingly, many students reported not having attended academic writing workshops, despite generally rating their writing skills as good. However, some students expressed uncertainty about their abilities in

writing research papers.

Feedback mechanisms play a crucial role in students' writing processes; while feedback is commonly received, it could benefit from being more frequent and focused. Participants exhibited moderate familiarity with Design Thinking, with limited prior experience, yet there is a strong belief in its potential benefits for enhancing writing skills. Collaborative writing exercises are viewed positively, and clarity is considered essential in academic writing. However, many students reported challenges in maintaining coherence throughout their work.

Most students revise their writing based on feedback, although perceptions of institutional support for writing improvement varied. Collaborative workshop formats are preferred over traditional structured workshops, highlighting the

importance of iterative feedback in the writing process. There is significant interest in Design Thinking workshops, and the majority of students feel comfortable presenting peer feedback. Research papers emerged as the most preferred writing format, with creativity also regarded as an important aspect of academic writing. Anticipated challenges in integrating Design Thinking include time constraints and resistance to change.

These findings provide valuable insights into the academic writing landscape for PhD students, indicating areas for improvement and opportunities for enhancing writing support through workshops and feedback mechanisms.

1. Gender Distribution: Female: 64.7%, Male: 35.3% The gender distribution indicates a higher representation of female PhD students, suggesting a potential area for further exploration regarding gender dynamics in academic writing.

2. Age Distribution: 25-30 years: 29.4%, 31-35 years: 38.2%, 36 and above: 32.4% The majority of students fall within the 31-35 age range, with a balanced representation across the other age groups, indicating a diverse cohort in terms of age.

3. Year of PhD Program: First year: 79.4%, Second year: 8.8%, Third year: 8.8%, Fourth year and above: 2.9% A significant majority (79.4%) are first-year students, highlighting a need for foundational academic writing support early in their PhD journey.

4. Primary Area of Research: Analytical Chemistry: 41.2%, Biochemistry: 23.5%, Inorganic Chemistry: 17.6%, Organic Chemistry: 16.6% Analytical Chemistry is the most represented area, which may influence the specific academic writing skills needed for this group.

5. Workshop Attendance: Yes: 29.4%, No: 70.6% A large percentage of students have not attended academic writing workshops, suggesting a gap in available resources or student engagement with existing programs.

6. Self-Assessment of Academic Writing Skills: Good: 58.8%, Average: 41.2% The self-assessment shows a positive perception of writing skills, with most students rating their abilities as good.

7. Confidence in Research Paper Writing: Very Confident: 5.9%, Confident: 38.2%, Neutral: 44.1%

Somewhat Confident: 11.8% A significant portion of students (44.1%) feels neutral about their confidence in writing research papers, indicating potential insecurity or lack of experience.

8. Frequency of Receiving Writing Feedback: Always: 2.9%, Often: 20.6%, Sometimes: 64.7%, Rarely: 8.8%, Never: 2.9% The data suggests that feedback is commonly received, with 64.7% of students getting feedback sometimes, but there is room for improving the frequency and quality of feedback.

9. Familiarity with Design Thinking: Very Familiar: 2.9%, Familiar: 35.3%, Somewhat Familiar: 20.6%

Neutral: 30.0%, Not Familiar: 11.8% Familiarity with Design Thinking is moderate, indicating a need for more education on this methodology among the students.

10. Previous Use of Design Thinking: Yes: 35.3%, No: 64.7% A majority of students have not previously engaged with Design Thinking, suggesting an opportunity to introduce this framework in writing workshops.

11. Belief in Design Thinking's Impact on Writing: Agree Strongly: 47.1%, Agree: 41.2%, Neutral: 8.8%, Strongly Disagree: 2.9% The strong agreement on the positive impact of Design Thinking on writing reflects an openness to employing innovative strategies in their academic writing.

12. Engagement with Collaborative Writing Exercises: Very Engaging: 23.5%, Engaging: 44.1%, Neutral: 29.4%, Not Engaging: 2.9% The majority find collaborative writing exercises engaging, which can be leveraged to enhance peer feedback mechanisms.

13. Importance of Clarity in Academic Writing: Very Important: 41.2%, Important: 47.1%, Neutral: 11.8% Clarity in academic writing is viewed as essential by most students, underscoring the need for focused writing instruction.

14. Self-Assessment of Argument Persuasiveness: Good: 50.0%, Average: 47.1%, Excellent: 2.9% While half of the students assess their argumentation skills as good, there is still a considerable portion that rates them as average.

15. Challenge in Maintaining Writing Coherence: Very Challenging: 5.9%, Challenging: 38.2%, Neutral: 28.2%, Slightly Challenging: 14.7% Not Challenging: 2.9% A significant number of students find maintaining coherence challenging, indicating an area for targeted support.

16. Frequency of Revising Based on Feedback: Always: 11.8%, Often: 35.3%, Sometimes: 50.0%

Rarely: 2.9% Most students revise their work based on feedback, which is crucial for developing writing skills.

17. Institutional Support for Writing Improvement: Very Supportive: 8.8%, Supportive: 41.2%

Neutral: 41.2%, Unsupportive: 8.8% Opinions on institutional support are mixed, suggesting that perceptions of support vary among students.

18. Preference for Writing Workshop Format: Structured Workshops: 35.3%, Collaborative Sessions: 50.0% No Preference: 14.7% A clear preference for collaborative sessions indicates that students value interactive and peer-driven learning environments.

19. Importance of Iterative Feedback in Writing: Very Important: 5.9%, Important: 58.8%, Neutral: 29.4%, Slightly Important: 2.9%, Not Important: 2.9% Most students recognize the importance of iterative feedback, aligning with best practices in academic writing.

20. Frequency of Peer Review Utilization: Always: 8.8%, Often: 35.3%, Sometimes: 38.2%, Rarely: 8.8%, Never: 2.9% Peer review is utilized by a significant portion of students, reflecting a collaborative writing culture.

21. Interest in Design Thinking Writing Workshops: Very Interested: 32.4%, Interested: 44.1%, Neutral: 20.6%, Slightly Interested: 2.9% There is considerable interest in Design Thinking workshops, indicating a readiness for innovative approaches to writing.

22. *Comfort with Peer Feedback Presentations*: Very Comfortable: 11.8%, Comfortable: 70.6% Neutral: 14.7% Uncomfortable: 2.9% Most students feel comfortable with peer feedback presentations, which can facilitate collaborative learning.

23. *Preferred Writing Format*: Research Papers: 61.8%, Articles for Publication: 20.6%, Thesis/Dissertation: 11.8%, Reports: 5.9% A clear preference for research papers highlights the type of writing students are most focused on during their studies.

24. *Perception of Creativity in Academic Writing*: Very Important: 26.5%, Important: 58.8%

Neutral: 14.7% Most students believe that creativity plays an important role in academic writing, suggesting a potential area for development in writing workshops.

25. *Anticipated Challenges in Integrating Design Thinking*: Time Constraints: 38.2%, Resistance to Change: 32.4%, Lack of Understanding: 5.9%, Philosophy of the Article: 23.5% Time constraints and resistance to change are the primary challenges anticipated in implementing Design Thinking, indicating areas for attention in program design.

This statistical analysis provides a comprehensive overview of the demographics, perceptions, and preferences of PhD students regarding academic writing. The findings highlight key areas for improvement, including the need for increased engagement with writing workshops, enhanced institutional support, and the potential benefits of integrating Design Thinking into the writing process.

5. Conclusion and Recommendations

5.1. Conclusion

This study has demonstrated that integrating Design Thinking into the academic writing curriculum for PhD students can significantly enhance their writing skills, confidence, and engagement with the writing process. The findings reveal that a majority of students recognize the importance of clarity and creativity in their writing, yet many face challenges such as maintaining coherence and receiving adequate feedback. The diverse backgrounds and experiences of the participants highlight the necessity for tailored support that addresses their unique needs.

The positive reception towards collaborative writing exercises and Design Thinking workshops suggests that these approaches could foster a more effective and supportive academic writing environment. By focusing on iterative learning and peer feedback, students can develop not only their writing skills but also their overall confidence in presenting their research.

5.2. Recommendations

Implement Design Thinking Workshops: Institutions should develop and offer workshops that incorporate Design

Thinking principles, focusing on collaborative writing, iterative feedback, and creative problem-solving.

Enhance Feedback Mechanisms: Establish structured feedback systems that encourage regular, constructive peer reviews. This can help students feel more comfortable and confident in their writing.

Tailor Support Programs: Academic writing support should be customized to address the specific needs of different research areas, particularly for students in less represented fields like Organic and Inorganic Chemistry.

Increase Awareness of Design Thinking: Provide resources and training for students and faculty on the principles and applications of Design Thinking in academic writing to enhance familiarity and application.

Foster a Supportive Community: Create platforms for students to share their writing experiences, challenges, and successes, promoting a sense of community and shared learning.

Further Research: Future studies should explore the long-term impact of Design Thinking on academic writing skills and investigate additional variables, such as stress levels and time management, that may affect writing performance.

By implementing these recommendations, academic institutions can better support PhD students in developing the necessary skills to articulate their research effectively, thereby enhancing their overall academic experience and future contributions to their fields.

Abbreviations

DT Design Thinking

Acknowledgments

For taking part in this work, I would like to thank the following PhD students: Amany N. Georgy, Hatem M. Shahete, Ahmed F. Elsayed, Alaa Faik Omran, Asmaa Khamees, Asmaa M. Mahmoud, Mahmoud Gamal, Marwa A. M. Shata, Marwa M. Gado, Rasha S. Mohamed, and Rawan S. Alhamawi. Their opinions and thoughts were really helpful to our study. I want to express my gratitude to everyone who participated in this program. Their dedication and diligence over two months were inspiring. Their thoughts and recommendations have greatly benefited the Academic Writing course and will play a significant role in future developments. Their enthusiasm and enthusiastic engagement in the learning process are much appreciated. Because of their involvement, this project has been powerful and fulfilling.

Author Contributions

Hamed Abdelreheem Ead is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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