2023

AI Technology and Academic Writing: Knowing and Mastering the "Craft Skills"

Valerie A. Storey
Franklin University, valerie.storey@franklin.edu

Recommended Citation

AI Technology and Academic Writing:
Knowing and Mastering the "Craft Skills"

Valerie A. Storey, Franklin University, USA*

iD https://orcid.org/0000-0001-8868-0802

ABSTRACT

Evidence shows that artificial intelligence (AI) has become an important subject in academia, representing about 2.2% of all scientific publications. One concern for doctoral programs is the future role of AI in doctoral writing due to the increase in AI-generated content, such as text and images. Apprehensions have been expressed that the use of AI may have a negative impact on a doctoral student's ability to think critically and creatively. In contrast, others argue that using AI tools can provide various benefits resulting in rigorous research. This conceptual article first discusses the developing relationship between AI and dissertation writing skills. Second, the article explores the origins of the traditional dissertation and outlines 21st-century dissertation options which reflect contextual needs and utilization of AI. Third, identified writing challenges are highlighted before turning to an in-depth examination of AI-generated tools and writing craft skills required to complete the five chapters of a traditional dissertation.

KEYWORDS

Academic Writing, Artificial Intelligence (AI), Content Generation, Craft Skills, Dissertation, Doctoral Students, Higher Education, Integrity, Reflection

INTRODUCTION

Irrespective of the doctoral degree, completing a dissertation or thesis[1] requires intellectual and social skills, critical personality attributes such as maintaining and sustaining focus, resilience, research knowledge, and skills (Willis et al., 2010). However, the key to a successful dissertation is academic writing, which encompasses the ability to "write at a doctoral level." According to Rugg and Petre (2004, pp.129-130), writing is not a single activity. Instead, it is many activities: comprehending, analyzing, elaborating, synthesizing, mind mapping, ordering, articulating, clarifying, editing, criticizing, structuring, and sense-making. It is complex, daunting, and challenging.

Writing craft skills have been learned, refined, and practiced during a doctoral program for centuries. However, only some doctoral programs take time to ensure the doctoral student has inherent language skills grounded on precise grammar, punctuation, spelling, and extensive vocabulary, which can be a dissertation completion barrier for many doctoral candidates. The recent increase of AI-generated content such as ChatGPT (Generative, Pre-trained, Transformer) and varying types

*Corresponding Author

of generative AI tools specifically developed to generate text, code, and images (e.g., Bing Chat, Google Bard, Alpha Code, MidJourney and Stable Diffusion) has changed the dissertation writing landscape and present dissertation committees with the challenge of how to distinguish between content generated by the doctoral candidate and content generated by AI (Uzun, 2023). Compounding the challenge is that AI content can be intentionally designed to mimic human/academic writing style and that detecting tools may be unable to detect content generated by new AI tools (Uzun, 2023).

Currently, there are several effective tools for detecting AI-generated content, such as GPT-2-detector, Originally AI, GPTZero, Turnitin, Copyleaks, ZeroGPT, Winston AI, GPT Radar, and Sapling (Uzun, 2023). While human judgment is still critical, it is likely that as AI technology continues to evolve, so will the effectiveness of detection tools.

Writing craft skills are very much traditional of the era prior to AI but are currently necessary for a successful career in academia. In the postmodern era of AI, a likely future transition in dissertation writing will be to employ AI to objectively present the summary of findings or related research in the literature review chapter as long as the methodology, results, and discussion chapters are original, valid and reliable (Urun, 2023). Currently, doctoral programs highlight the need for doctoral writing to show evidence of analysis and synthesis, the application of a critical lens, and citation mastery whether the American Psychological Association (APA), Modern Language Association (MLA), Institute of Electrical and Electronics Engineers (IEEE) is the required reference style. While concerns arise over using AI in dissertation writing, Diggs (2023) argues that AI can streamline the research and writing process, enhance accuracy and reliability, and promote creativity and innovation (p.6).

ARTICLE RATIONALE

Phillips and Pugh (2010) assert that writing a dissertation is far more than merely reporting the outcome of several years of research. The quality of a dissertation is assessed through writing skills, and this skill demands attention beyond a general understanding of doctoral students' writing challenges. Interestingly two recent studies, Ciampa and Wolfe (2019) and Rafi and Moghees (2023), highlight the crucial role of academic writing in completing a dissertation and, ultimately, doctoral student retention yet make no mention of the potential role of AI-generated tools in the process. Ciampa and Wolfe (2019) focused on US doctoral students' perceptions of and satisfaction with preparation for dissertation writing. A total of 115 doctoral students currently enrolled or graduated from a university's Doctor of Education programs completed a survey. In their findings, Ciampa and Wolfe (2019) discussed students' wide range of academic writing experiences throughout their doctoral program. Furthermore, they highlight the need for a consistent, explicit approach toward supporting students in developing their academic writing skills throughout the doctoral experience. In conclusion, Ciampa and Wolfe (2019) suggest systematic and intentional conversations among faculty to develop an integrated plan that supports students in completing the dissertation process (p.102).

Rafi and Moghees' (2023) study focused on twelve Pakistani doctoral dissertations. The findings revealed that doctoral students (especially, English-as-a-second-language (ESL) doctoral students) face challenges concerning the mechanics of writing, developing an argument in a coherent whole, and the structural organization of the dissertation. Examiners also highlighted the need for students to copyedit/proofread the dissertation to overcome mechanics of writing problems, build the argument logically, use formal language, write transition sentences to knit the texts coherently, embed citations to support the claims, and ensure the uniform structure of the dissertation.

This article is a response to the need for literature on dissertation writing (Aichison et al., 2010; Ciampa & Wolfe, 2019) and the integration of AI-generated tools in the process. Existing literature explores doctoral dissertation writing problems (Odena & Burgess, 2017), lack of writing instructions (Graham, 2018), and argumentative writing (Andrews, 2007; Wentzel, 2018) but does not discuss AI as a dissertation assistant. The literature and program handbooks cover dissertation process

information, research topic development, and committee structures, but policy guidance relating to AI-powered writing and editing tools has yet to be developed (Diggs, 2023).

This article consists of three sections. Section one discusses the origin of the dissertation and 21st-century dissertation options, which reflect contextual needs and AI. The following section examines AI-generated tools and the writing craft skills required to complete the five chapters of a traditional dissertation. Finally, identified AI and craft writing challenges are discussed before turning to an in-depth examination of the writing style and content requirements for each of the five chapters of a traditional dissertation.

SECTION ONE

The Dissertation

The traditional dissertation was imported from the Germans, who had begun transforming the entire academic enterprise to meet scientific demands (Barton, 2005). Medieval students had been expected to demonstrate their mastery of the canonical texts and age-old arguments of the Scholastics. The medieval dissertation was a combination of "opponency, disputations, and lectures," oral forms that helped students clarify their thoughts and defend them against critical attacks by the faculty (Malone, 1981). These disputations ultimately demonstrated the initiates' readiness to stand as colleagues and involved many oaths to the Church, the community, and the school (Malone, 1981). Since the ability to engage in this type of formal argument (the dialectic) was the mark of a good scholar, these disputations were not so much a "trial by fire" as a dazzling public demonstration of a new doctor's skills, a "free advertisement" that assisted the new professor in recruiting new students (Barton, 2005). Writing a dissertation and an oral defense has long been a doctoral program's capstone.

However, in the 21st Century, there is a growing consensus that the dissertation should be "reimagined." Berelson was a lone voice in 1960 when he called for a new dissertation format that was easily publishable and accessible to a broad audience. He advocated for a flexible dissertation format that better prepares doctoral students for future roles in their professional fields. Many programs now require a Dissertation in Practice (DiP) model for their capstone rather than the traditional dissertation model (Storey & Maughan, 2016). The DiP model is frequently focused on improving practice, often producing documents, processes, and products that lead to improvements in the field.

As awareness increases regarding available DiP options, the traditional five-chapter model, i.e., introduction, literature review, research methodology, results, and recommendations, is giving way to new forms coupled with new technologies (Imig, 2011; Storey, 2018). Considered dissertation options now include group rather than individual dissertations. Final products include analytical articles (usually three); case studies; client-driven consulting reports; clinical portfolios of assessment; exhibition; film and video production; portfolios; position papers (thematic/problem based); practitioner handbooks; research manuscripts for publication; practitioner handbooks; and social media tools/products (Buttram & Doolittle, 2015; Storey, 2018).

In the UK, survey findings from the Council for Graduate Education (Christianson et al., 2015), which focused on the role of dissertation publications and artifacts, found that some HEIs had already adopted flexible practices for the Doctor of Philosophy and Professional Doctorate dissertation. Institutions surveyed emphasized that a wide range of outputs are now accepted, in particular narratives that depart from the format of a research report, collections of work drawn together by an overarching explanation, portfolio, published articles, and practical outputs. The focus now is a transition from dissertation form to the role of AI in content development. Undoubtedly, the role of AI and machine learning in knowledge production and dissemination will continue to develop and influence the future development of alternative doctoral program outcomes and dissertation models.

Transformative practices such as choosing to use AI (ChatGPT, DALLE-2, CoPilot, and Google Bard) as a search tool is becoming increasingly popular amongst doctoral candidates as AI can identify

relevant sources and analyze a vast amount of data in a short time space (Diggs, 2023). Currently, however, consumers of these tools must be cognizant that AI is a product of the data it is fed, so provided information may be misleading (Urun, 2023; Diggs, 2023). Higher Education Institutions generally support using these tools as long as they are used effectively, ethically, and transparently despite concerns that reliance on AI may ultimately reduce the doctoral candidate's writing, critical thinking, and evaluation skills.

DISSERTATION WRITING

Doctoral writing is a required skill regardless of the dissertation of choice (traditional dissertation or DiP) and the AI search tool utilized. However, according to Cotterall (2011), most doctoral candidates require assistance to become competent and confident scholarly writers. While AI tools such as Grammarly can provide feedback on grammar, style, and structure (Diggs, 2023) and identify writing weaknesses, they can only improve the submitted content.

Voice

Scholarly writers are expected to develop their own 'voice' and infuse their writing with a sense of personal identity. According to Rugg and Petre (2004), getting the form and voice of the dissertation right is just as crucial as getting the content right (Rugg & Petre, 2004, p.119). When writing a dissertation, an authoritative stance must be taken, which can be difficult for doctoral students who still perceive themselves as novices rather than experts. Evolving AI-generated tools are able to mimic voice and style in writing leading to a need for doctoral student full transparency with their dissertation committee.

The 5Cs, clarity, coherence, competence, comprehensive, and critique, are positive voice attributes (see Table 1). Clarity indicates to a reader writing mastery and ensures the manuscript is accessible. Clarity should not be confused with simplicity. Writing must be competent and show domain mastery. For example, it is not uncommon for a direct quote to be used when a doctoral student knows the content is essential but cannot communicate it to the reader with understanding and certainty. Such a quote is a red flag to any dissertation committee and must be avoided.

Technical and academic terms should be used when appropriate to aid clarification, although generally, simple language is preferred. This means that convoluted sentences with multiple clauses should be avoided as it makes it harder to follow the argument. Short sentences are more effective at holding the reader's attention.

Drafting

Even when AI-generated tools are used such as Grammarly, ProWriting Aid, and GPT-4, a dissertation manuscript will go through several iterations, as writing is a process of drafting and redrafting. This tends to surprise many doctoral students, but an unwritten rule is that any first or, indeed, fifth

Table 1. The 5Cs: Clarity, coherence, competence, comprehensive, and critique

	Clarity	Coherence	Competent	Comprehensive	Critique
Argument	*	*	*	*	*
Findings	*	*	*	*	
Language	*	*	*		
Literature	*	*	*	*	*
Research	*	*	*	*	*
Voice	*	*	*	*	

submission can always be better. Active response to any feedback or critique is essential. Feedback can be hard to take, but it is important to be cognizant of the rationale behind the committee's feedback which is to improve the quality of the manuscript. A committee's feedback should not be regarded as a personal affront; instead, the comments should be accepted for what they are—a sincere and thoughtful way to help with the writing and manuscript content.

Response to feedback follows a specific process for the best outcome (see Figure 1 for the Feedback Response Cycle): read, reflect, read, critique, analyze and question the likely rationale behind the comments, reflect, make the necessary edits, ensure that all aspects of the narrative remain aligned after edits, and submit for feedback. Manuscript improvement will be immediately evident.

Chapter writing and drafting are grounded on the desired dissertation structure, research, and literature. Irrespective of the draft number, there should always be a clear chapter structure. In most dissertation chapters, there is the need to reinforce the purpose/argument three times: (1) introduce the ideas, (2) explain the ideas, and (3) give a summary. This applies to the whole dissertation with introductory and closing sections of the chapter. However, each time of writing should be different as the three text variants serve different purposes, do not simply copy a paragraph.

Structure, order, and writing issues should be addressed in the first draft so that the chapter draft is a model of excellent practice, and this is reinforced each time the doctoral students redraft their work. Leaving editing issues to nearing manuscript completion is not a recommended course of action as this means that poor writing skills are being reinforced.

Tables, Graphs, Figures, Charts, and Visuals

Essentially, tables, graphs, figures, charts, and visuals are tools the doctoral student utilizes to clarify complex material discussed in the narrative. They should not be inserted in the manuscript as a text replacement, and they should not be presented in the manuscript in isolation from the

Figure 1. Feedback response cycle
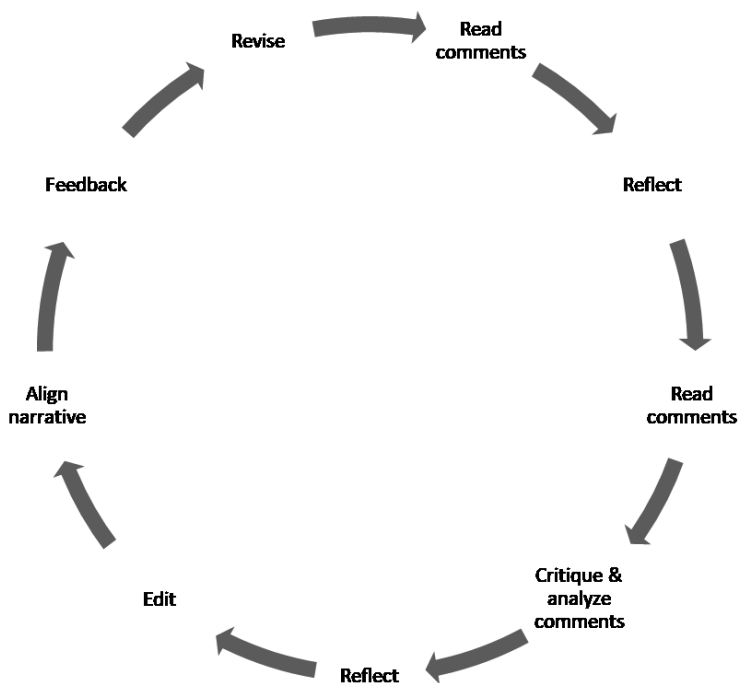
narrative. All visuals (tables, graphs, figures, and charts) should first be introduced in the text. The narrative, for example, should lead the reader through the significance of the table and its role in the argument being made. Tables can be used to summarize the literature, results, and statistical analysis and to provide context. Visuals are used to illustrate text descriptions. Presenting the text as a visual is an additional and alternative presentation of a complex process that needs to be communicated to the reader.

Plagiarism

On the one hand, plagiarism is easy to avoid if an authentic voice is used, never copying from a publication (either your work or someone else), and when paraphrasing, always cite the original author and publication date (Ober et al., 2013). The rules are unambiguous. Compliance requires that doctoral students have self-confidence and the belief that they can express themselves as well as the literature they are reading. However, as the impact of AI grows (AI-text analysis, AI-source analysis, AI-citation analysis, and AI-paraphrase detection), educators need more awareness of what is acceptable concerning the ownership of writing content. Higher Education Institutions are busy working on their policy relating to this issue.

Peer Review

Caffarella and Barnett (2000) found that critiquing their peers' writing and receiving feedback from professors and peers on successive drafts helped doctoral students understand the process and produce better texts. Based on their research, Ciampa and Wolfe (2020) recommend group review (as opposed to individual) to enhance the dissertation writing process as it can lead to constructive dialogue and individual reflection. AI–powered tools can facilitate a collaborative and supportive learning environment by providing opportunities for doctoral students and their committee to share and comment on dissertation drafts.

SECTION TWO

This section explains the specific structure of each chapter, the required writing skills, and the potential role of AI-generative tools. Typically, the traditional empirically-based dissertation structure consists of five chapters: introduction; literature review; methodology/research approach; presentation of empirical findings; discussion, and recommendations. Writing the five chapters is not necessarily linear, and chapter length can vary. Depending on the committee's recommendation, Chapter Two, focused on the literature review, may be written first, as this chapter will validate and frame the proposed research. Alternatively, Chapter Three may be written first to ensure appropriate methodology and research design. Starting at Chapter One will ensure that the study has been well thought out.

Table 2. Avoiding plagiarism

Unacceptable	Acceptable
Copying	Use authentic voice
Avoid paraphrasing	Short quotes appropriately cited
Direct quote citation with no page number	Quote with the author, year, page number
Replication of table, image, etc	Table, image, etc., cite the source. Attribute ownership
.	State whether adapted from the source
	Copyright permission is given to use a published visual
	Disclosure of the relevance of research results
	Know, practice, and master academic writing conventions

ACADEMIC WRITING PEDAGOGY

Doctoral students primarily face challenges concerning writing mechanics and the presentation of their argument in a coherent whole. Dissertation structure, writing habits, tips, and motivational suggestions are covered by doctoral program faculty and student organizations, unlike writing skills which are rarely discussed positively. While AI writing tools such as Grammarly, ProWriting Aid, and GPT-4 can enhance the quality of writing by identifying writing errors and suggesting improvements, a doctoral student must have the writing craft knowledge to know what is required in a doctoral dissertation (Lunenburg & Irby, 2008). However, today, AI tools can analyze writing styles and provide personalized feedback to improve writing quality. Currently, there is an absence of research on how AI tools will impact writing craft skills mastery or whether this is a necessary skill to develop.

A traditional approach for honing writing craft skills is to engage in collaborative research with a faculty member, ultimately co-authoring a paper or chapter. Writing strategies can then be modeled as a paper is prepared for publication. Conference presentations also enhance technical and academic vocabulary and help to develop a doctoral student's confidence and authority (Cotterall, 2011). In the postmodern AI era, Chatbots and Natural Language Processing (NLP) may take over this role by providing feedback on writing style, suggesting further research sources, and even providing emotional support during the process (Diggs, 2023).

CHAPTER 1: INTRODUCTION

Structure

- Introduction
- Background of the Problem
- Statement of the Problem
- Purpose of the Study
- Research Questions
- Significance of the Study
- Definition of Terms
- Assumptions, Limitations, and Delimitations
- Conclusion

Writing Craft Skills

It is important to remember that Chapter 1 is the engine that drives the rest of the dissertation. Once a word or phrase is established in this chapter, the same word or phrase is used throughout the dissertation to ensure chapter alignment. Effective use of transitional words and sentences from one subheading to another ensures that the reader understands the empirical argument.

The issues in Chapter 1 tend to arise from poor citation, extended quotes, APA non-compliance, unsupported claims, unwarranted claims, sweeping statements, absence of evidence to support the argument or research rationale, incoherent structures, oversimplified structures, illogical development of the argument, dated references, and over generalization, lack of synthesis, illogical progression, vagueness, repetitions, and misstated facts.

When using AI-generated tools it is essential that the dissertation committee is aware of the tools being used and that academic integrity is maintained. The doctoral candidate must ensure that text generated by AI-generated tools is not plagiarized and that any AI generated text is appropriately cited and referenced. It is therefor critical that doctoral programs regulate and guide doctoral students in the use of AI tools.

Table 3. Chapter 1 writing issues

Issues
Poor citation.
Extended quote
APA non-compliance
Absence of evidence to support an argument or research rationale
Incoherent structures
Oversimplified structures
Dated citations and references.
Over generalizations
Lack of synthesis
Illogical progression
Assumptions
Vagueness
Repetitions
Illogical development of the argument
Factual error/Misstated facts
Lack of integration of paragraphs
Simplified summary
Lack of critical review
Spelling and grammar errors
Plagiarism

CHAPTER 2: REVIEW OF THE LITERATURE

Structure

- Introduction
- Search Description
- Conceptual or Theoretical Framework
- Review of Research (organized by variable or themes)

Writing Craft Skills

The Educational Resources Information Center (1982) defines a literature review as an "information analysis and synthesis, focusing on findings and not simply bibliographic citations, summarizing the substance of the literature and drawing conclusions from it" (p. 85). Conducting and writing a comprehensive literature review is crucial to the dissertation process. It sets the stage for the research methodology section (Chapter 3). It is generally accepted that there are five different approaches to writing a literature review: narrative overview, narrative review, systematic literature review, systematic review, and umbrella review (Cardoso et al., 2021). By using explicit and systematic procedures when reviewing the literature, bias can be minimized, thus providing reliable findings from which conclusions can be drawn and decisions made (Snyder, 2019).

Doctoral students make both writing and structural errors when writing this chapter. The most frequent error is the "regurgitation" of what has been found in previous literature rather than literature synthesis. Other errors include relying on secondary sources rather than primary sources; uncritically accepting another researcher's findings and interpretations as valid rather than examining all aspects of the research design and analysis critically; failing to describe in detail the search procedures that were used in the literature review; reporting isolated statistical results rather than synthesizing them; and finally not considering, rejecting, and failing to include contrary findings and alternative interpretations to literature already cited (see Table 4).

If the content in chapter 2 is flawed then the remainder of the dissertation may be viewed as flawed because "a researcher cannot perform significant research without first understanding the literature

Table 4. Common mistakes

Inappropriate	Appropriate
Failing to describe the search procedure	Detailed description of the systematic search process
Regurgitation of previous literature	Literature synthesis
Reliance on secondary sources	Primary sources
Uncritical acceptance of findings	Critical analysis
Failure to include contrary findings.	Present all relevant literature related to the research topic

in the field" (Boote & Beile, 2005, p. 3) and having the writing skills to present the information systematically and succinctly.

AI-powered literature review tools use natural language processing and machine learning algorithms to scan, analyze, and summarize vast amounts of academic literature. This leads to a comprehensive literature review in a shorter time than the traditional process outlined above (Diggs, 2023).

CHAPTER 3: RESEARCH METHOD (OR METHODOLOGY)

Structure-Qualitative

- Introduction
- Research Design
- Research Questions
- Setting
- Participants
- Data Collection
- Data Analysis
- Conclusion

Structure-Quantitative

- Introduction
- Research Design
- Research Questions and Hypotheses
- Population and Sample
- Instrumentation
- Data Collection
- Data Analysis
- Conclusion

Writing Craft Skills

Historically, the methods section was referred to as the "materials and methods" to emphasize the two distinct areas that must be addressed. "Materials" refers to what was examined and the various treatments and instruments used in the study. "Methods" referred to how subjects or objects were manipulated to answer the research question, how measurements were made, and how the data were analyzed" (Kallett, 2004, p.1229).

Writing this chapter requires a clear, direct, detailed description of the steps taken to address the research questions or hypothesis in Chapter One and evidence of connection and alignment between the chapter's research plan and the prior research reviewed in Chapter Two (Lunenburg & Irby, 2008).

The narrative description should be grammatically correct and include appropriate technical and academic language to ensure that a reader is fully conversant with how the study will be conducted.

The chapter usually consists of the introduction, research questions (and hypotheses, research design rationale, selection of participants, instrumentation, data collection, data analysis, and summary. Once all elements of the methods section are written, subsequent drafts should focus on presenting those elements as clearly and logically as possible. Doctoral programs generally ensure that their students are familiar with the chapter structure. However, chapter writing conventions should be more frequently discussed. For example, the introduction should include several paragraphs providing the reader with the chapter's structure. Integral to the narrative is a declaration that the institutional review board (IRB) governing research on living matter has determined that the study protocol adheres to ethical principles.

The methods section is the most crucial part of a dissertation as it provides the information by which the study's validity is ultimately judged. It must be written with enough information so that: (1) others can repeat the experiment to evaluate whether the results are reproducible and (2) the audience can judge whether the results and conclusions are valid (Kellett, 2004).

AI-generated tools can help to identify the research question and the data sources relevant to the research. Once data sources have been identified AI-generated tools can be used to process the data and extract insights. This approach can identify patterns that may have been overlooked in the traditional process (Diggs, 2023).

CHAPTER 4: PRESENTATION OF RESEARCH (OR RESULTS)

Structure

- Introduction
- Findings (organized by Research Questions or Hypotheses)
- Conclusion

Writing Craft Skills

This chapter presents a clear and comprehensive presentation of the results of the data analysis; consequently, the narrative must be focused and objective (see Table 6). The chapter's introduction should contain a couple of paragraphs providing an overview of the chapter's structure. This rare occasion is when sentence repetition can aid writing clarity (Cone & Foster, 2007). For example, a particular sentence structure can present similar results as this makes the narrative more accessible to the reader when comparing research results.

As mentioned, the required style citation manual is essential when writing a dissertation. This chapter uses tables to help organize descriptive data and statistical analysis results. Tables typically contain five parts: (1) number, (2) title, (3) headings, (4) body, and (5) notes, but the format may

Table 5. Common mistakes

Inappropriate
Tables not in compliance with the required style manual
Unexplained contradictory results/narrative
Lack of detail
Lack of citational support for the research design
Lack of support for the connection between research questions and variables/constructs
Inconsistency between data collection and research design
Failure to follow the university's required chapter structure/steps
No IRB declaration

Table 6. Writing mistakes

Inappropriate
Inferences
Value judgments
Generalizations
Reference to the literature
Restatement of the theoretical/conceptual framework

vary dependent on the required style manual. Compliance with the domain's required style manual is essential to doctoral writing.

AI-powered data analysis tools automate the process and produce visualizations, making it easier for doctoral students to interpret and present their findings (Diggs, 2023). Incorporating AI into the dissertation writing process can improve the reliability and accuracy of research.

CHAPTER 5: SUMMARY, IMPLICATIONS, AND OUTCOMES (OR DISCUSSION)

Structure

- Introduction
- Summary of Findings
- Conclusions (organized by Research Questions or Hypotheses)
- Discussion
- Suggestions for Future Research
- Conclusion

Writing Craft Skills

The purpose of the final chapter is to show the reader the significance of the research and the impact the research will make to both scholarship and practice. Typical ingredients of the final chapter are (1) introduction, (2) summary of the study (findings may be compared explicitly against objectives stated in the introduction), (3) discussion, (3a) how the results generalize, (3b) discussion of limitations, (4) implications, (4a)for practice, (4b) contribution to knowledge, (5) recommendations for future research, (6) conclusion.

The doctoral candidate should be aware of thinking of this as an easy chapter to write; in fact, some researchers believe this to be the most challenging chapter to structure (Drotar, 2009; Vieira et al., 2019). Far too frequently, this chapter needs to be completed better, with superficial comments that fail to add value to the manuscript. The chapter should focus on interpreting the research results and evaluating the study results over those highlighted in Chapter 4. The writing must show how the study results expand knowledge in the field of study, incorporating the obtained results into the context of previous research studies (Shah, 2016).

Finer details of the results do not need to be addressed, but whether the research findings refute or confirm previously referred to research, does need to be addressed. Disclosing whether the results confirm/refute the previous research findings is paramount (Lamanauskas, 2021). Have the expected results been achieved? The conducted research should always be kept central to the chapter.

There should be a clear delineation between Chapter 4 (research results) and Chapter 5 (discussion) and the chapter contents align with all previous chapters. The research's contribution to the body of scholarly knowledge and practice should be clearly identified and expressed.

The conclusion section is again challenging to write, for while this section should be concise, it should also be detailed as it provides the core of the research completed, including recommendations and implications of the study. The formulation of conclusions should aim to reveal how the research

Table 7. Common mistakes

Inappropriate	Appropriate
Research results are repeated verbatim. Irrelevant statements and unsubstantiated reasoning are included. Indirect issues and/or problems are discussed. Superficial and unsubstantiated comments are made. No new results are presented.	Statements confirming/refuting the hypothesis (es). Interpretations of research results. Disclosure of the relevance of research results. Possible alternative interpretations of the results are presented. The relationship with the results of the previous research is shown. Similarities and differences are indicated. Paradoxical, unexpected, or unconvincing results are explained.

Source: Adapted from Lamanauskas (2021)

contributes to closing a research gap in a particular field of science or addresses a specific complex problem of practice.

The final formulation of conclusions shows the achieved degree of the effectiveness of the research study (introductory part, implications, recommendations).

While AI can be used to assist with many aspects of research and writing it cannot replace the skills, knowledge, and critical thinking of the doctoral candidate (Diggs, 2023) and currently there are no AI-generated tools that can assist with the writing of this chapter. As AI-generated tools continue to evolve, algorithms will become consistently reliable and be able to not only analyze and interpret data but make projections and recommendations grounded on the analyzed data.

EDITING AND PROOFREADING

AI-generative editing and proofreading tools can provide several benefits for dissertation writer, primarily optimize an effective use of time and reduce stress levels knowing that AI tools will meet required deadlines. Using machine learning algorithms, AI can analyze the completed manuscript and suggest corrections for any errors; AI style checking tools can ensure appropriate style and consistency;

Table 8. AI dissertation assistance

Component	AI Tools and Algorithms	Benefits
Literature Review	Natural Language Processing & Machine Learning Algorithms	Automation of literature review saves time, identifies relevant studies
Data Analysis	Machine Learning Algorithms	Automation of time-consuming data analysis
Writing & Editing	Natural Language Processing & Machine Learning Algorithms	Improves grammar, sentence structure, and writing style, saves time for non-native English speakers
Future Innovations	Natural Language Processing for Automated Literature Reviews, Chatbots for Personalized feedback, Virtual Research Assistants for Data Analysis	Reduced time & effort, personalized feedback, assisting with data analysis
Ethics & Integrity	Unbiased & Representative Data	Ensures ethical use of AI, promotes academic integrity, and prevents academic misconduct

Source: Adapted from Diggs (2023)

AI plagiarism detection tools can be utilized; and AI formatting tools can ensure that the manuscript is formatted consistently and correctly according to the appropriate formatting guidelines (Diggs, 2023, p.15). However, it is vital that AI tools are appropriately cited and referenced.

CONCLUSION

As we transition into the postmodern AI era, concerns relating to distinguishing AI-generated text may subsume concerns focused on the ability of a doctoral student to write effectively in a scholarly manner. Despite the rise in AI-generative tools which some predict will change the very nature of the dissertation and doctoral program outcomes, recent research studies remain focused on the crucial development of craft writing skills. Although it can be argued that in the postmodern AI era, mastery of craft writing skills may no longer be necessary, we need to be cognizant that the full consequences of AI development cannot yet be foreseen. AI tools are already impacting the dissertation writing process but how AI will affect the format of the dissertation and the development of critical skills of the doctoral student is currently unknown.

REFERENCES

American Education Research Association. (2006). Standards for reporting on empirical social science research in AERA publications. *Educational Researcher*, *35*(6), 33–40. doi:10.3102/0013189X035006033

Andrews, R. (2007). Argumentation, critical thinking and the postgraduate dissertation. *Educational Review 59*(1), 1–18. 10.1080/00131910600796777

Barton, M. D. (2005). *Dissertations: Past, present, and future*. http://scholarcommons.usf.edu/etd/2777.

Berelson, B. (1960). *Graduate education in the United States*. McGraw-Hill.

Boote, D. N., & Beile, P. (2005). Scholars before researchers: The centrality of the dissertation literature review in research preparation. *Educational Researcher, 34*(6), 3-15.

Buttram, J. L., & Doolittle, V. (2015). Redesign of EdD and PhD educational leadership programs. *International Journal of Educational Reform*, *55*(2), 1–6. doi:10.1177/105678791502400306

Caffarella, R. S., & Barnett, B. G. (2000). Teaching doctoral students to become scholarly writers: The importance of giving and receiving critiques. *Studies in Higher Education*, *25*(1), 39–51. doi:10.1080/030750700116000

Cardoso, E., Lacerda, D., Morandi, M., & Gauss, L. (2021). *Literature reviews*. Springer International Publishing. doi:10.1007/978-3-030-75722-9

Christianson, B., Elliot, M., & Massey, B. (2015). *The role of publications and other artifacts in submissions for the UK PhD*. UK Council for Graduate Education.

Ciampa, K., & Wolfe, C. (2019). Preparing for dissertation writing: doctoral education students' perceptions. *Studies in Graduate and Postdoctoral Education, 10*(2), 86-108. 10.1108/SGPE-03-2019-0039

Cotterall, S. (2011). Doctoral students writing: Where's the pedagogy? *Teaching in Higher Education*, *16*(4), 413–425. doi:10.1080/13562517.2011.560381

Diggs, B. (2023). *The AI dissertation writing guide CHATGPT*. Amazon.

Drotar, D. (2009). Editorial: How to write an effective results and discussion for the Journal of Pediatric Psychology. *Journal of Pediatric Psychology*, *34*(4), 339–343. doi:10.1093/jpepsy/jsp014

Graham, S. (2018). Changing how writing is taught. *Review of Research in Education*. Advance online publication. doi:10.3102/0091732X18821125

Imig, D. (2011, Fall). Dissertations or capstones: The conundrum facing EdD programs. *University Council for Educational Administration (UCEA) Review*, 12–13.

Kallett, R. H. (2004). How to write the methods section of a research paper. *Respiratory Care*, *49*(10), 1229–1232. PMID:15447808

Lamanauskas, V. (2021). Writing a scientific article: Focused discussion and rational conclusions. *Problems of Education in the 21st Century, 79*(1), 4-12. 10.33225/pec/21.79.04

Lunenburg, F. C., & Irby, B. J. (2008). *Writing a successful thesis or dissertation*. Sage.

Malone, T. L. (1981). *A history of the Doctor of Philosophy dissertation in the United States 1861-1930.* Wayne State University. University Microfilms International.

Ober, H. M., Simon, S., & Elson, D. (2013). Five simple rules to avoid plagiarism. *Annals of Biomedical Engineering*, *41*(1), 1–2. doi:10.1007/s10439-012-0662-9 PMID:23053297

Odena, O., & Burgess, H. (2017). How doctoral students and graduates describe facilitating experiences and strategies for their thesis writing learning process: A qualitative approach. *Studies in Higher Education, 42*(3), 572-590.

Phillips, E. M., & Pugh, D. S. (2010). *How to get a Ph.D* (5th ed.). Oxford University.

Publication Manual of the American Psychological Association. (2020). 7th ed.). American Psychological Association.

Rafi, M. S., & Moghees, A. (2023). Writing challenges, causes, and strategies to facilitate the doctoral dissertation-writing process: A qualitative analysis. *International Social Science Journal, 73,* 139–156. 10.1111/issj.12367

Rugg, G., & Petre, M. (2004). *The unwritten rules of PhD research*. Open University Press.

Shah, J. (2016). How to write 'discussions, conclusions' in scientific Journal article. *Journal of Patan Academy of Health Sciences*, *3*(2), 1–2. doi:10.3126/jpahs.v3i2.20266

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333–339. doi:10.1016/j.jbusres.2019.07.039

Storey, V. A. (2018). Alternative dissertation models: The development of modern capstone design. In C. Costley & J. Fulton (Eds.), *Methodologies for practice research: Approaches for professional doctorates.* SAGE.

Storey, V. A., & Maughan, B. D. (2016). Dissertation in Practice: Reconceptualizing the nature and role of the practitioner scholar. In V. A. Storey (Ed.), *International perspectives on designing professional practice doctorates: Applying the critical friends' approach to the EdD and beyond.* Palgrave Macmillan. http://www.palgrave.com/us/book/9781137527059

Thompson, P. (2013). Thesis and dissertation writing. In B. Paltridge & S. Starfield (Eds.). *The handbook of English for specific purposes* (pp.200-283). Wiley.

Uzun, L. (2023). ChatGPT and academic integrity concerns: Detecting artificial intelligence generated content. *Language Education and Technology*, *3*(1), 45–54.

Vieira, R. F., Lima, R. C. D., & Mizubuti, E. S. G. (2019). How to write the discussion section of a scientific article. *Acta Scientiarum. Agronomy*, *41*(1), e42621. Advance online publication. doi:10.4025/actasciagron.v41i1.42621

Wentzel, A. (2018). *A guide to argumentative research writing and thinking: Overcoming challenges*. Routledge.

Willis, J., Inman, D., & Valenti, R. (2010). *Completing a professional practice dissertation*. Information Age Publishing.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(39), 1–27. doi:10.1186/s41239-019-0171-0

ENDNOTE

[1]   In North America, doctoral programs refer to the culmination of doctoral research as a dissertation; in the UK, it is referred to as a thesis (Thompson, 2013). This article follows North American conventions by describing the extended written work at the doctoral level as a dissertation (Ciampa & Wolfe, 2019).

Valerie A. Storey retired from the University of Central Florida in the School of Teaching, Learning, and Leadership /Educational Leadership Programs as Associate Professor Emerita. She is currently an adjunct professor in the Professional Practice Doctorate at Franklin University, Ohio. She earned her doctoral degree in Educational Leadership and Policy from Peabody College, Vanderbilt University, master's from Manchester University (UK) and her Bachelor's from Leeds University (UK). In the public schools she has served as an administrator at the school and district level. Dr. Storey's primary research interests include: leadership preparation, innovative andragogy, EdD program design, and dissertation models. She is Chair of the American Education Research Association (AERA), Division A: Educational Leadership Outstanding Dissertation Award, and President of the Florida Association of Professors of Educational Leadership. Dr. Storey has over 45 scholarly works in refereed and/or peer-reviewed dissemination outlets.