

Effective and Responsible Use of AI in Research: Guidance for Performing Graduate Research and in Writing Dissertations, Theses, and Manuscripts for Publications

The use of artificial intelligence has expanded greatly in recent years to all sectors of society. Generative AI and Large Language Models, like [ChatGPT](#)®, [Microsoft Co-Pilot](#)®, and [Google Gemini](#)® are rapidly becoming available, expanding access to this technology for use by anyone who is digitally literate.

These tools can be used effectively in conducting research, and this guidance document is developed to assist researchers, especially graduate students, in this purpose. The guidelines presented here are recommendations only, not Georgia Tech policy, and will evolve with the rapidly changing landscape of AI.¹

Some questions that guide the discussion are as follows:

- How can students use AI effectively as a tool to help generate research ideas and approaches?
- How can students use AI effectively as a writing or editing tool for publications and their thesis?
- How accurate are the results from an AI source?
- How confidential is the process? Is a student giving away valuable ideas or research results to an open platform (like ChatGPT) before the topic is peer reviewed and published? Will you lose your intellectual property rights, such as patents?
- How can students improve their skills in using AI as a tool in research?
- Are students at risk of committing research misconduct in the form of plagiarism if they use a generative AI platform to write parts of their thesis?
- How can students (and other researchers) transparently indicate within their written works the contribution of generative AI or other assistive technologies?
- What restrictions do professional societies and publishers place on the use of AI in publications and in reviewing papers or proposals?

ChatGPT® was asked similar questions, and both questions and the generated responses are given in the Appendix. Note that ChatGPT® has the following disclaimer:

“While we have safeguards in place, the system may occasionally generate incorrect or misleading information and produce offensive or biased content. It is not intended to give advice.”

Strengths of Large Language Models and Generative AI:

- It can sort through a large amount of information quickly to synthesis content from that information.
- It is good at summarizing existing information that is freely available and not behind firewalls or paywalls and is neither too old nor too recent. For example, it can summarize existing methodologies in a particular research area or positions on a topic.

¹ This content was gathered from experts at Georgia Tech in the areas of AI, in ethics, and in graduate education and edited by Bonnie Ferri. Specific groups of contributors include: Office of Graduate Education, Graduate Student Government Association, Office of Research, Responsible Conduct of Research Office, and Directors of Graduate Programs. The current version of this document is dated July 10, 2024. For suggested modifications to the content, contact bonnie.ferri@gatech.edu.

- It may help improve the communication skills of non-native speakers.

Challenges for AI:

- Current algorithms are good at summarizing but not necessarily generating accurate and dependable NEW or creative ideas.
- The quality of the output depends both on the algorithmic approach and the quality of the training data. Though the content generated may sound very plausible, it may be inaccurate such as including non-existent publications or incorrect citations of publications. There are many companies that provide generative AI platforms, and the quality is mixed.
- People are prone to biases in their work, and AI can pick up those biases from the training data and even amplify them.
- Confidentiality or security of data voluntarily input to a Large Language Model by users depends on the policies and practices of the company that owns that platform. For preciseness, these terms should be accessed outside of the AI platform, rather than prompt the AI platform for these terms. For your own security and confidentiality of your data, it is more prudent to assume that whatever is fed into a query is owned by that company.

Use of AI in Graduate Student Research:

Creating new knowledge and performing research is at the highest level of the educational experience of students. Novice researchers must learn essential critical thinking skills needed in formulating a research idea, determining appropriate methods and approaches for the research plan, collecting data, summarizing results, and drawing conclusions. AI can be a valuable tool for assistance but is not an accountable entity for the research outcomes since the ultimate responsibility of research lies with the human.

Guidance on the Use of Generative AI in Generating Research Ideas or Approaches:

- Brainstorming: You can use the AI tool as a brainstorming partner, where you exchange ideas whether the AI prompts you or you prompt the AI for ideas. Brainstorming is an iterative process that can be made more effective with the way that the queries are posted. For more samples or information, post this query: “How can I use AI to help me to brainstorm an idea?”
- Surveying Existing Approaches: Large Language Models, if trained broadly in a topic, can give a good initial overview of existing approaches or existing literature on a topic. Current research sources such as library or professional society databases are more reliable in terms of accuracy of peer-reviewed content. See the [Rutgers University Library site](#) for guidance and AI platforms for searching research databases.
- Prompt engineering is important: Practice the prompts used for Generative AI. The value of the response depends on the value of the prompt. If you provide a low quality or vague prompt, you will get vague results. Critical thinking skills are enhanced by learning how to iterate on the prompts to refine results or to use the material gathered from one result to identify new avenues of inquiry to pursue. Varying skill levels among users might exacerbate existing inequalities among students. For example, students for whom English is the second language might be at a disadvantage. Examples of strategies for prompt engineering are found in the [OpenAI Guide](#) and in [Ivan Allen article on prompt engineering](#).

Advice on Usage:

- **Be very skeptical of the results.** Do not trust any outputs that you cannot evaluate yourself or trace back to original credible sources. There are many stories of generative AI giving citations of articles that do not exist (see the article in the Chronicles of Higher Education referenced below).
- **Be scientific with your prompts (or queries):** Prompting is not deterministic, so the same prompt at a different time may result in a different response. Small changes in the wording of the prompt may yield very different responses. Keep records, make small changes and see how it affects the outcome, etc.
- **Don't share any data or information that is confidential, proprietary, or have IP implications.** Your uploaded data or ideas might be incorporated into the learning model to be available for others in your research area, prior to you having a chance to publish it. If you intend to pursue commercialization or other Intellectual Property avenues for your work, putting the information into an open AI platform may be considered as disclosure.

Guidance on the Use of Generative AI in Writing Publications or Theses:

- Editorial assistance: Using an AI platform for a grammar check and for editorial improvements is similar to having a person proofread a paper or essay and generally does not require acknowledgement. An example of an AI editorial tool is Grammarly. Depending on the AI platform, keep in mind that what is intended only as a grammar check may inevitably put your ideas into a system over which you don't have control.
- Substantive Generative AI assistance:
 - Using an AI to write a portion of a dissertation or paper may constitute plagiarism. From the draft language for the Georgia Tech Scientific and Scholarly Misconduct Policy:
"Plagiarism includes deceptively representing ideas, processes, results, or words as one's own when such content was generated through the use of services, such as paper mills and ghostwriters, or technology, such as AI writers and text generators."
 - Given the mention of ideas generated by AI in the discussion of plagiarism section of the Scientific and Scholarly Misconduct Policy, is it ever ok to use an AI source in brainstorming or otherwise to help generate research ideas? How does this compare to brainstorming ideas with human collaborators? Consider, for example, brainstorming done among human colleagues that results in research that is published. The contribution of the collaborators, if substantial, may result in an acknowledgement in the manuscript or authorship. AI brainstorming can be treated similarly, to an extent. An AI session that resulted in novel ideas may be recognized in the published work, but authorship is more controversial. Sample guidelines of authorship are given in the section on Professional Societies and Publishers below. Note that all of these guidelines require that an author approve the final manuscript and be held accountable for the content. Both of these requirements would be difficult for an AI agent to fulfil in order to receive authorship recognition.

Advice on Usage:

- **Understand the AI policies for publications prior to submission:** A professional society may have specific restrictions on the use of AI in the writing of a publication to be submitted and reviewed. Make sure that you understand and abide by those restrictions before submission. For example,
 - Generally, authors are responsible for the content of their submissions, regardless of whether they used generative AI or not. So, authors would be responsible for errors in AI-generated content.
 - Some publishers require full transparency and credit for the source of AI-ideas in the manuscript.
- **Preserve confidentiality of the information:** any information that you upload into a Large Language Model may become part of that model's data and, as a result, be used to form responses to another person's inquiries on that topic. If your paper has not yet been submitted for peer review, then you may decide to seek AI editing help only on smaller sections of the paper that don't contain new research content. In some cases, you may be able to opt out of your information being included in the training data.
- **Don't short circuit the learning process:** For a PhD student, an important part of their learning processes is to gain skills on analyzing, summarizing, and discussing their research results. Inputting data into a generative AI platform and asking it to write this type of content has two disadvantages: it does not give the student the experience to gain those skills and it may produce content that sounds good but would not withstand scrutiny by experts. Putting aside the confidentiality risk mentioned above and publishers' restrictions, hypothetically, a researcher could ask the generative AI platform to outline a discussion points in order to gain ideas as a first step in doing their own analysis and write-up. The researcher should be aware of the limitations and possible consequences of that action.

Act ethically: The responsible conduct of research includes a number of practices that should be considered when using AI to assist in performing research:

- **Authorship:** Only include material in your writing that you or a co-author wrote or that you can cite from primary sources. Note also that there is no guarantee that an AI-generated response is not including passages verbatim from other sources, so quoting an AI-generated response may crossover to traditional plagiarism.
- **Falsification or fabrication of data:** There is no guarantee that Generative AI will produce accurate results or that it will not create new false data.
- **Responsible collection and management of data:** There are ethical standards on the treatments of research subjects and their data that must be upheld. For example, you would not upload sensitive data to an open AI platform. There's room also to reference the question of whether use of AI generated content is ever ethical by bringing up awareness of whether authors of the training data opted in, etc.
- **Awareness of the tools you're using:** make sure you're aware of its terms of service, where it obtained its data, and how it will use the information you put into it.

Sample Guidance from Professional Societies, Publishers, and Funding Agencies:

Using AI in Reviewing Proposals and Papers:

As a reviewer, you generally need to attest to confidentiality of the information that you are to review, especially not sharing the information with others. Publishers and funding agencies are starting to put restrictions on the use of AI in the review process. For example,

“NIH prohibits NIH scientific peer reviewers from using natural language processors, large language models, or other generative Artificial Intelligence (AI) technologies for analyzing and formulating peer review critiques for grant applications and R&D contract proposals.” From [NIH Notice Number NOT-OD-23-149](#)

Authorship and AI:

Below are several links to authorship guidelines from societies and publishers. The additional guidelines on authorship listed below have a common element: an author is responsible for the content of their work. So, it would not be acceptable for an author to excuse inaccuracies in their published results as “AI wrote it.”

- Association for Computing Machinery: <https://www.acm.org/publications/policies/frequently-asked-questions>;
- Discussion on Journal of American Medical Association (JAMA) rules on the use of AI: <https://jamanetwork.com/journals/jama/fullarticle/2807956>;
- *Nature*: <https://www.nature.com/articles/d41586-023-01546-4>
- Jennifer Harker, “Science journals set new authorship guidelines for AI-generated text”, Environmental Factor, National Institute of Environmental Health Sciences, March 2023, accessed October 16, 2023, <https://factor.niehs.nih.gov/2023/3/feature/2-artificial-intelligence-ethics>.
- This editorial includes the following suggestion for consideration for research publications: “Authors should specify who used the system, the time and date of the use, the prompt(s) used to generate the text, the sections(s) containing the text; and/or ideas in the paper resulting from NLP use.” From an editorial in the *Journal on Accountability in Research*.
- Guidelines on Authorship:
 - “Defining the role of authors and contributors”, International Committee of Medical Journal Editors (ICMJE) (2023) <https://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html>
 - Editorial Policies of *Nature*: <https://www.nature.com/nature-portfolio/editorial-policies/authorship#authorship> (2023). adapted from McNutt et al., Proceedings of the National Academy of Sciences, Feb 2018, 201715374; DOI: 10.1073/pnas.1715374115; licensed under CC BY 4.0);
 - Editorial Policies of *Science*: <https://www.science.org/content/page/science-journals-editorial-policies#authorship>

Cited and Additional References and Resources

“New Policies Navigate Role of AI Assistants in CS Courses”, downloaded July 9, 2024,
https://www.cc.gatech.edu/news/new-policies-navigate-role-ai-assistants-cs-courses?utm_source=newsletter&utm_medium=email&utm_content=New%20Policies%20Navigate%20AI%20in%20Computer%20Science&utm_campaign=Daily%20Digest%20-%20June%2022%2C%202023

“Prompt Engineering,” OpenAI Platform, accessed July 9, 2024,
<https://platform.openai.com/docs/guides/prompt-engineering/six-strategies-for-getting-better-results>

Rutgers University Libraries, “Artificial Intelligence (AI) An introduction to generative AI and its use in teaching, research, and publishing” <https://libguides.rutgers.edu/artificial-intelligence/ai-in-research>

Mohammad Hosseini, Lisa M. Rasmussen & David B. Resnik (2023) “Using AI to write scholarly publications”, *Accountability in Research*, DOI: [10.1080/08989621.2023.2168535](https://doi.org/10.1080/08989621.2023.2168535)

“How to use Chat GPT: Opportunities and Risks for Researchers,”
<https://www.animateyour.science/post/how-to-use-chat-gpt-opportunities-and-risks-for-researchers>

Mohamed Yusuf, “How to Use Chat GPT for Scientific Research Paper writing?”, accessed July 12, 2023,
<https://ai.plainenglish.io/how-to-use-chatgpt-for-scientific-research-paper-writing-a84c514494b6>

Maggie Hicks, “No ChatGPT can’t be your new research assistant.” *The Chronicle of Higher Education*, August 23, 2023. Accessed October 16, 2023. https://www.chronicle.com/article/no-chatgpt-cant-be-your-new-research-assistant?sra=true&cid=gen_sign_in

“Artificial Intelligence and the Future of Teaching and Learning, Insights and Recommendations”, Department of Education, May 2023, <https://www2.ed.gov/documents/ai-report/ai-report.pdf>

Sample policies and guidance at other universities:

- Boston University - <https://www.bu.edu/cds-faculty/culture-community/conduct/gaia-policy>;
- Stanford - [Generative AI Policy Guidance | Office of Community Standards \(stanford.edu\)](https://oos.stanford.edu/generative-ai-policy-guidance);
- UCLA - [Guidance for the Use of Generative AI – UCLA Center for the Advancement of Teaching](https://teaching.ucla.edu/guidance-for-the-use-of-generative-ai);
- USC - [CIS-Generative-AI-Guidelines-20230214.pdf \(usc.edu\)](https://www.usc.edu/cis/generative-ai-guidelines-20230214.pdf)

Appendix: Questions input to ChatGPT and the corresponding ChatGPT generated answers.

1. "How should I use ChatGPT in doing research (dated July 12, 2023)"

"When using ChatGPT for research, here are some general guidelines to keep in mind:

1. Clearly define your research question: Clearly articulate the specific topic or problem you are investigating. This will help you communicate your needs more effectively to ChatGPT and get relevant responses.
2. Break down complex questions: If you have a complex research question, consider breaking it down into smaller sub-questions. This can make it easier to handle and analyze the information provided by ChatGPT.
3. Provide context and background information: When asking a question, provide relevant context and any necessary background information. This will help ChatGPT better understand your query and provide more accurate responses.
4. Evaluate and validate information: Remember that ChatGPT generates responses based on patterns it has learned from training data. While it can provide useful insights, it's important to critically evaluate and validate the information it provides. Cross-reference the responses with reliable sources and use ChatGPT as a tool to complement your research, rather than relying solely on it.
5. Ask for sources and citations: When requesting information from ChatGPT, explicitly ask for sources or citations whenever applicable. Although ChatGPT doesn't have direct access to external sources, it can still provide general references or suggest search terms to help you find relevant information.
6. Experiment with prompts and iterations: Experiment with different phrasings and prompts to refine your questions and get more precise responses. Iterate on your queries to narrow down the scope or explore different angles of your research topic.
7. Exercise critical thinking: While ChatGPT can provide helpful suggestions and insights, it's crucial to apply critical thinking skills to evaluate the quality and reliability of the information. Verify facts, check for bias, and consider multiple perspectives.
8. Supplement with external research tools: Utilize external research tools and resources alongside ChatGPT. Online databases, academic journals, search engines, and domain-specific resources can provide additional information and help validate the insights gained from ChatGPT.
9. Be aware of limitations: Remember that ChatGPT has limitations. It may generate plausible sounding but incorrect or misleading information. Be cautious when

dealing with sensitive or controversial topics and verify information from reliable sources.

10. Provide feedback: If you encounter errors or inaccuracies in ChatGPT's responses, provide feedback to OpenAI. This helps them improve the model and provide more reliable information in the future.

Overall, ChatGPT can be a valuable tool for research, but it's important to use it as part of a broader research process that includes critical thinking, validation, and utilization of other reliable resources.

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2. “How can I use ChatGPT in writing a dissertation?”

Using ChatGPT as a tool to assist you in writing your dissertation can be beneficial in several ways. Here are some steps you can follow to effectively incorporate ChatGPT into your dissertation writing process:

1. Familiarize yourself with the tool: Spend some time exploring and experimenting with ChatGPT to understand its capabilities, limitations, and prompts it responds well to. This will help you maximize its utility during the dissertation writing process.
2. Identify specific areas where ChatGPT can be helpful: Consider the sections or topics in your dissertation where ChatGPT can provide valuable insights, generate ideas, or help you refine your arguments. For example, you can use it to brainstorm ideas, ask for alternative perspectives, seek clarification on complex concepts, or request suggestions for references.
3. Craft clear and specific prompts: When interacting with ChatGPT, provide detailed and precise prompts to get the most relevant responses. Clearly specify the information or assistance you are seeking to ensure ChatGPT understands your requirements accurately.
4. Use ChatGPT for idea generation and expansion: If you're experiencing writer's block or need help generating ideas, ChatGPT can serve as a valuable resource. Ask it open-ended questions about your topic or specific aspects you're exploring, and let it provide insights or alternative perspectives that can stimulate your thinking.
5. Verify and fact-check responses: While ChatGPT can generate creative and thought-provoking responses, it's essential to remember that it may also produce inaccurate or unreliable information. Always verify the responses provided by ChatGPT by cross-referencing them with credible sources and academic literature.

6. Employ critical thinking and synthesis: As you receive responses from ChatGPT, critically evaluate and analyze the information. Assess the relevance, validity, and coherence of the generated content. Incorporate the insights provided by ChatGPT into your writing only after careful consideration and integration with your existing knowledge and research.
7. Maintain academic integrity: While ChatGPT can be a valuable tool, it's crucial to acknowledge its role and limitations. Clearly distinguish the content generated by ChatGPT from your original work, giving appropriate credit to the tool when necessary. Ensure that your use of ChatGPT aligns with your institution's guidelines on academic integrity and plagiarism.
8. Seek human feedback and guidance: While ChatGPT can provide assistance, it's important to remember that it's an AI language model and not a substitute for human expertise. Engage with your advisor, professors, or peers to receive feedback, guidance, and suggestions on your dissertation. They can provide valuable insights, offer constructive criticism, and help you refine your arguments.

By following these steps, you can effectively utilize ChatGPT as a supportive tool throughout your dissertation writing process. Remember to balance its assistance with your own critical thinking and scholarly efforts to produce a well-researched and original piece of academic work.

3. The best way to determine confidentiality of data or information that you voluntarily input into a platform is to examine the terms and conditions of the platform, accessed outside of the model. For curiosity, the following question was entered in ChatGPT (highlight added later for emphasis):

"If I shared data with ChatGPT during a conversation, will that data be shared with others?"

As of my knowledge cutoff in September 2021, as an AI language model, I don't have the ability to store conversations or share information with others. I can only provide responses based on the input given to me during the current session. However, please note that while I don't store the conversations, OpenAI may collect and store conversations for research and improvement purposes, but they are generally anonymized and stripped of personally identifiable information.

It's always a good practice to avoid sharing sensitive or personally identifiable information while interacting with AI systems. If you have any concerns about privacy or data security, I recommend reviewing the privacy policy or terms of service of the platform or application you are using to access ChatGPT, as they may provide more specific information on how your data is handled.