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Understanding the impact of AI Hallucinations on the university community

Research – Full text

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Abstract

Since we live in the era of the information revolution, finding trusted and accurate information takestime and effort made students and researchers aim to find an easier way. Generative AI (Artificial Intelligence) tools offer an easy solution for accessing the required information easily and accessible;however, these tools rely on vast datasets to predict statistically probable outputs, not guaranteed accuracy. This can lead to misinformation, factual errors, biases, and fabricated content, which is termed "hallucinations." The research problem focuses on the challenges of detecting these AI hallucinations,the main issue for all users of AI technologies. The main objective of the study is to raise awareness about AI hallucinations and promote the ethical and effective use of AI tools among New Giza University students, faculty, and staff. This involves the approach to understanding the biases and errors associated with AI outputs. Methodologically, the study will employ a mixed-methods approach, combining quantitative analyses of AI tool accuracy with collecting qualitative data via survey of users across a range of fields

to gather insights on the impact of AI hallucinations. The expected results of this research are to reveal the pitfalls that researchers might run into when relying on AI technology for their work. Additionally, the findings will contribute significantly to information literacy programs, by advocating for the including of AI tool assessments within the broader information literacy curriculum and equipping users with the skills tocritically evaluate AI-generated content.

Keywords
Artificial Intelligence (AI), Generative AI, Natural language processing (NLP) – AI Hallucinations, Information literacy, AI literacy

1. Introduction

The integration of Artificial Intelligence (AI) into academic practices has brought both opportunities and challenges. Generative AI tools have become a common part of the research and learning process, helping students and researchers create content, solve problems, and access information more quickly and efficiently than ever before. However, these advances bring important concerns, such as the risk of plagiarism, the potential spread of misinformation, and the ethical dilemmas of depending on AI-generated content without ensuring its accuracy.

One of the key issues is "AI hallucinations" instances where AI systems produce content that is incorrect or makes no sense. This phenomenon can undermine the trustworthiness of AI-generated information, making it a significant concern for the academic community.

It's crucial to address user awareness about AI hallucinations and the ethical use of these tools. Many users might not fully understand the limitations and potential issues of AI technologies, which can lead to problems like unethical practices and reliance on unreliable information. Understanding these challenges is essential for ensuring that AI tools are used responsibly and effectively in academic environments.

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The Objectives:

The main objective of the study is to raise awareness about AI hallucinations and promote the ethical and effective use of AI tools among New Giza University's students, faculty, and staff.

Additionally, this research has many other objectives that are to educate researchers and AI users on how to use these tools ethically and effectively.

Study Significance:

The significance of this study lies in its potential to enhance the understanding and responsible use of AI technologies in academic settings. By addressing the issues of AI hallucinations and ethical usage, this research aims to contribute to the development of best practices that can be adopted by educational institutions, ensuring that the benefits of AI are maximized while minimizing potential drawbacks.

Methodology:

To achieve this, the researcher distributed a survey to the NGU (New Giza University) community, including faculty, staff, and students, and analyzed both qualitative and quantitative data to gain insights into their experiences and challenges with generative AI tools.

2. Literature Review

AI tools spread caused a huge effect on students, researchers and even citizens' attitude and interaction with information. It became a main part for all of us in our daily life. serving as a primary guide in everything from simple tasks to complex decision-making.

Artificial intelligence is one of the most important reasons for this transformative field in computer science. It produces systems that make our daily life easier as it can do human intelligence duties such as learning, reasoning, and even creativity. machine learning which made computers able to learn from various data and adapt its responses according to it (Saudi Data and Artificial Intelligence Authority, 2023).

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As AI technologies have evolved, so have tools. One of the most significant advancements has been the development of **Generative AI**, which can understand and respond to natural language inputs after they trained on large datasets and algorithms led it to generate human-like text, by natural language processing (NLP) or understanding and responding the human input (Gold, n.d.). Generative AI (GAI) uses machine learning and neural networks to automatically generate fresh and original content, such as images, text, and videos. This advancement represents a major step forward in AI capabilities. However, the term artificial intelligence (AI) encompasses a wider range of applications, with generative AI being a notable example. (AI-Khalifa, 2023).

Large Language Models (LLMs), such as GPT-3 "Generative Pre-trained Transformer 3", generate text that is both coherent and contextually appropriate. by being trained on massive datasets, allowing them to produce relevant text based on a given prompt or input even if it was simple (Najjar, 2023).

This capability in LLMs (Large Language Model) made them invaluable in various fields, from academic research to creative writing. Despite these models' abilities, they don't understand the content they produce and sometimes create confusing or unsuitable outputs. So, Human supervision is essential to guide these models and ensure their results align with the intended purpose (Najjar, 2023).
Large Language Models (LLMs) are the driving force behind generative artificial intelligence. These models consist of highly complex layers of neural networks called Transformers, which can handle various tasks in natural language processing, such as text generation, summarization, translation, answering questions, and text classification. These models learn from vast amounts of textual data and use complex algorithms to identify patterns and relationships between words and concepts.
One of the most known examples of these models is GPT-3, which is the core of the ChatGPT model developed by OpenAI. GPT-3 can generate text that resembles human writing. The term "large" refers to the huge size of the model's training data set and hyperparameters, which are sometimes measured in petabytes. Hyperparameters are the memory and knowledge that the model has learned

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during training. They determine the model's ability to solve tasks, such as predicting the next piece of text. (Al-Khalifa, 2023).

Despite the advancements in deep learning and natural language processing (NLP) "A field of artificial intelligence and linguistics that studies the problems inherent in the processing and manipulation of natural language, with an aim to increase the ability of computers to understand human languages." (IBM Corporation.2024). A big issue with the AI-Generated output is the phenomenon of "**Hallucinations".** AI responses are still prone to hallucinate unintended, irrelevant, or incorrect text (Ji et al., 2022). Hallucinations which stand for "A response from a foundation model that includes off-topic, repetitive, incorrect, or fabricated content" (IBM Corporation.2024).

The **Causes** of these hallucinations are rooted in the way AI models are trained. When prompted to generate text, a model relies on its training data to produce a response. However, if the model does not have enough relevant information to draw from, it may resort to fabricating details, leading to outputs that are inaccurate or misleading. These hallucinations not only degrade the performance of AI systems but also undermine the trust users place in these technologies, especially in critical real-world scenarios (Ji et al., 2022).

"**Prompt Engineering"** is a field focused on developing and crafting commands directed at generative artificial intelligence. This process involves methods for effectively and systematically communicating with language models, such as ChatGPT, to achieve desired results. Designing prompts requires understanding various factors, including the language models used, the context, the purpose of the prompt, and how the AI interprets the given command.
As Saudi Data and Artificial Intelligence Authority,2023 mentioned This simple approach can help when prompting to gain the best results:

- **Clarify the Context of the Request:** Provide a clear background and purpose for the request to set the stage for what you want to achieve.
  Researcher's Comment: Providing context helps to layout the request, ensuring that the response is relevant and aligns with your goals.

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- **Define the Model's Personality:** Specify the type of persona or style you want the model to adopt in its responses. For example, should the tone be formal, informal, technical, or educational?
  Researcher's Comment: Defining the persona helps tailor the response to your needs, making it more applicable to your specific situation.

- **Use Specific Symbols:** Using symbols or markers to highlight key points in the input that need focus. These can be bullet points, numbers, or special characters.
  Researcher's Comment: Symbols help organize information clearly, making it easier to identify and address important aspects of the request.

- **Request Structured Outputs:** Asking for a structured format output such as lists, tables, or detailed reports, to ensure clarity and ease of access.
  Researcher's Comment: Structured outputs help in analyzing and interpreting the information effectively, which provides a clear and organized response.

- **Verify Input Accuracy:** Check the accuracy of the information provided as an input. Ensuring that data and details are correct helps avoid errors or misunderstandings in the response.
  Researcher's Comment: Accurate inputs are crucial for generating reliable outputs. Verification prevents potential issues and enhances the quality of the response.

- **Provide Successful Examples:** Offer clear examples of similar requests handled successfully to guide the model on how to approach the task.
  Researcher's Comment: Examples serve as practical guides, showing how to progress similar requests and setting expectations for the desired outcome.

- **Outline Required Steps:** Define steps one by one to complete the request. Provides a clear plan of action for each stage of the process.
  Researcher's Comment: A well-defined process helps push the workflow and ensures that all necessary steps are followed, leading to more effective results.

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- **Check the Outputs:** After receiving the response, make sure that it meets the requirements. Ensure that the results align with your expectations.
  Researcher's Comment: Reviewing the outputs is crucial as it ensures they are accurate and meet the required standards, confirming that the request has been properly addressed.

- **Use Specific References:** Provide specific references or sources to use for additional support or information related to the request.
  Researcher's Comment: References add credibility and provide a base for the exploration, helping to substantiate the information and findings.

- **Apply Iterative Methods:** Use iterative approaches to review and revise information. Reassess and adjust the input as necessary to improve accuracy and effectiveness.
  Researcher's Comment: Iterative methods are essential for developing the prompting technique and refine responses and enhancing accuracy.

Overall, prompt engineering is a developing skill, acts as a bridge between humans and artificial intelligence, helps presenting commands or questions in a way that ensures the AI produces the desired outcomes.

3. Research Approach and Data Analysis

Data Collection

A survey was conducted among the New Giza University community, including students, faculty, andstaff, to understand their experiences and challenges with generative AI tools. The survey captured both qualitative and quantitative data, focusing on the respondents' roles, year of study, and their experiences with AI hallucinations. Respondents were also asked about their trust in AI comparedto traditional resources and the strategies they believe could minimize the negative impacts of AI inaccuracies.

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Data Analysis

Quantitative Analysis

1. **Descriptive Statistics:**

(a) The survey was conducted at New Giza University. It was completed by a total of 261 respondents, comprising 96 males (approximately 36.8%) and 165 females (approximately 63.2% participating in the survey, as shown in Figure 1. This chart highlights the proportion of eachgender, with females comprising a larger portion of the survey participants.

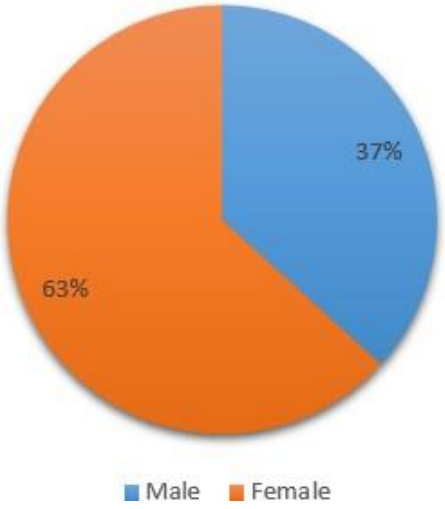

Figure 1: Gender Distribution Chart

(b) The Respondents represented various roles within the university community, including 56 faculty members, 91 staff, and 114 students. Figure 2 shows distribution, emphasizing that students made up the largest group of respondents, followed by staff and faculty. This distribution category is crucial for understanding how different segments of the university experience and interact with AI tools.

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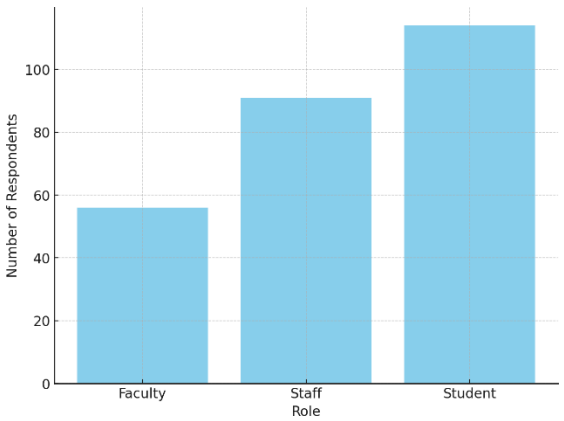

Figure 2: The Role Distribution Chart

(c) Among the student respondents, the survey captured data from all academic years. The Year of Study Distribution Chart shows that Year 1 (32 students) and Year 3 (29 students) had the highest representation, while Year 6 and graduate students were less represented. This variation across academic years provides insights into how AI tool usage and experiences might differ based on the stage of the students' academic journey.

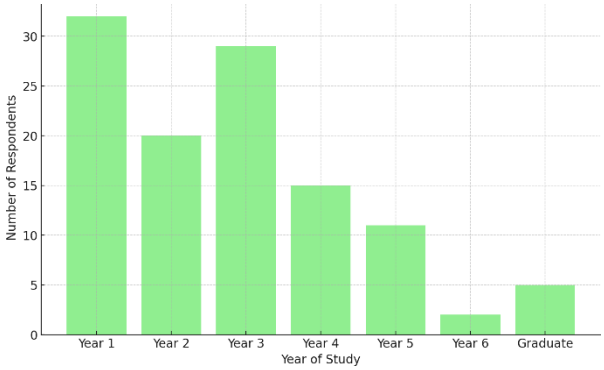

Figure 3: Year of Study Distribution Char

(d) The survey also included participants from a wide range of departments, ensuring a comprehensive understanding of AI tool usage across the university. This Representation Chart provides an overview of this diversity, with strong representation from the School of Medicine (58

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respondents), School of Dentistry (46 respondents), and the School of Engineering (43 respondents). Additionally, respondents from various administrative departments contribute to a well-rounded data set

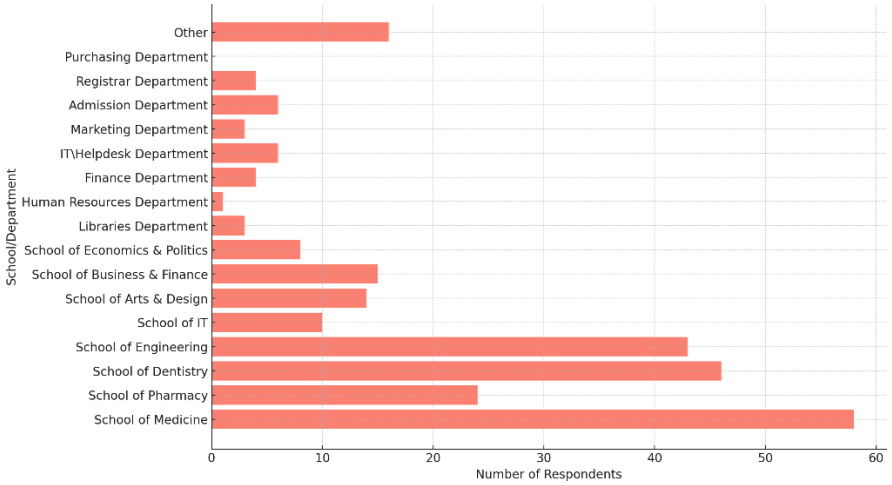

Figure 4: School/Department Representation Chart

(e) The survey also gathered data on respondents' usage trends of AI tools. The most used AI tool was Chat GPT 3.5, with 103 respondents indicating they use this tool regularly, followedby Chat GPT 4.0 with 63 users, as shown in Figure 5.

This distribution highlights the preference for specific AI tools within the university community as most of the users prefer free tools.

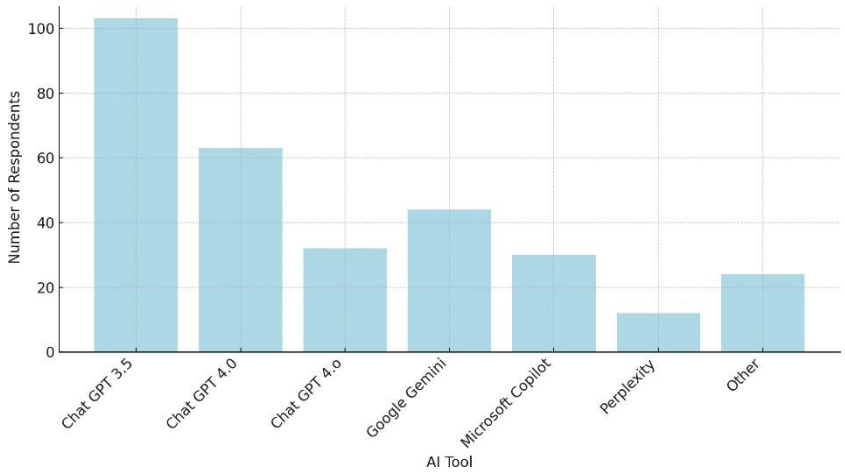

Figure 5: AI Tool Usage Chart

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(f) The survey also explored the various purposes for AI tools usage. Most respondents indicated that they use AI for research assistance (122 respondents) and assignments (74 respondents), with other common uses including content creation, creative writing, and technical assistance. Figure 6 provides a visual breakdown of these applications, emphasizing the widespread use of AI tools for academic tasks.

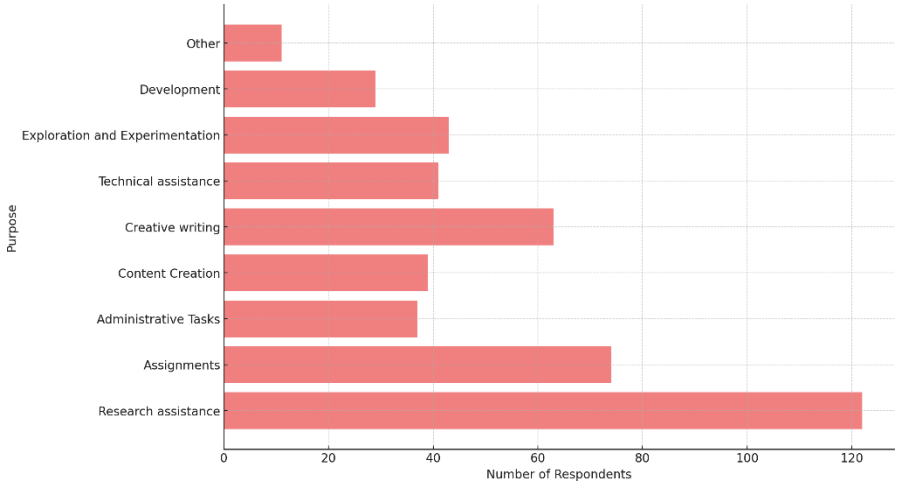

Figure 6: Purpose of AI Usage Chart

(g) Regarding the frequency of AI tool usage, the survey revealed that most respondents use AI tools weekly (58 respondents), with a notable portion using them daily (44 respondents). Figure 7 shows the regularity with which AI tools are integrated into the daily routinesof some users, while others engage with these tools less frequently.

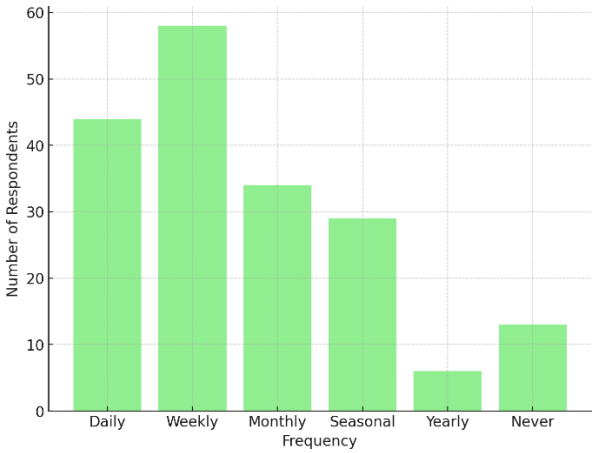

Figure 7: Frequency of AI Usage Chart

(h) As one of the research goals, it was important to add a Measure question about respondents' awareness of AI "hallucinations"before

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taking the survey. A majority (103 respondents) were not aware of the concept, asshown in Figure 8. This finding underscores the need for greater education and awareness around the limitations and potential pitfalls of AI-generated content, especially in academic areas.

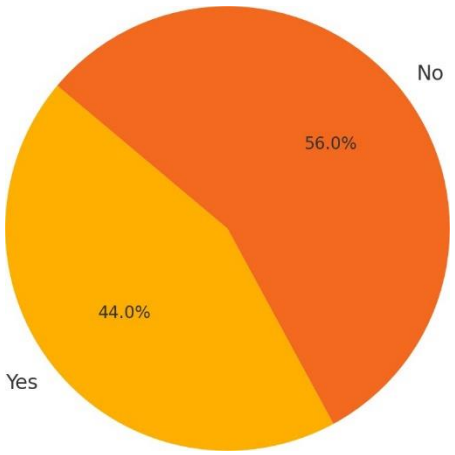

Figure 8: Awareness of AI Hallucinations Chart

Summary: These statistics and visuals provide a clear overview of the survey's respondent demographics, setting the stage for analyzing their experiences with generative AI tools. The diverse sample ensures that the findings are relevant across various roles and academic disciplines within the university.

2. **Comparative Statistics:**

(a) **Role vs. AI Tool Usage (Tasks):**

In the participant Role vs. AI Tool Usage analysis, several insights appeared from the open-endedresponses. one of the most notable is the task-specific preference for AI tools among differentroles.

Students primarily use AI tools for assignments, while faculty are more inclined to utilize these tools for research purposes. Staff members, however, use AI tools to streamline administrative tasks, such as scheduling or managing data.

For instance, onestudent noted: "I use Chat GPT to help me draft essays and complete assignments quickly".

Reflecting the utility of AI in academic tasks. A faculty member commented: "AI tools like GPT-4 assist in literature reviews and

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summarizing research papers"

Highlighting their role in research. Staff members also find AI valuable, with one respondent stating: "We use AI tools to automate routine tasks, saving time and improving accuracy".

This chart shows how students, faculty, and staff differ in their use of AI tools for tasks such as assignments, research, and development.

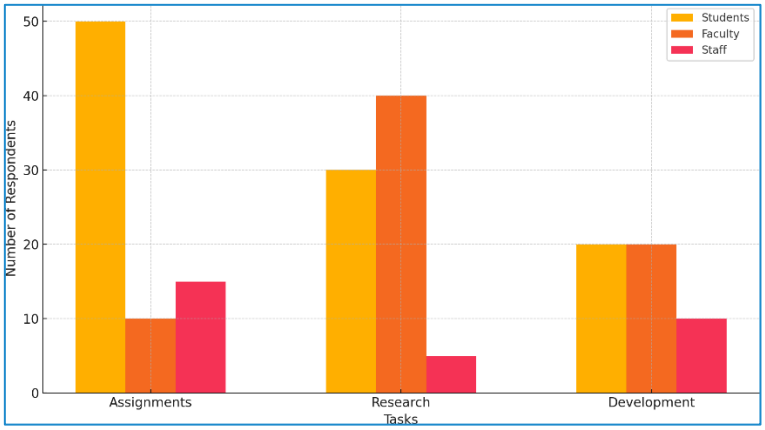

Figure 9: Role vs. AI Tool Usage (Tasks) Chart

The analysis of responses reveals that Students generally appreciate AI for its convenience in completing assignments and are comfortable relying on it. However, they need more awareness about its limitations. Faculty members see the value of AI for research but are concerned about its accuracy. This suggests that we should encourage students to use AI for deeper research and critical thinking, improve AI tools for advanced research, and provide staff with training on using AI for administrative tasks.

(b) Year of Study vs. AI Tool Usage:

First-year students generally see AI tools like ChatGPT 3.5, 4.0, and Gemini positively for simple tasks, while third- and fourth-year students appreciate them more for their advanced work. This suggests that AI literacy should start early in students' studies, and AI tools should be developed to better support complex tasks. Targeted AI workshops could help upper-year students use these tools more effectively in their advanced research.

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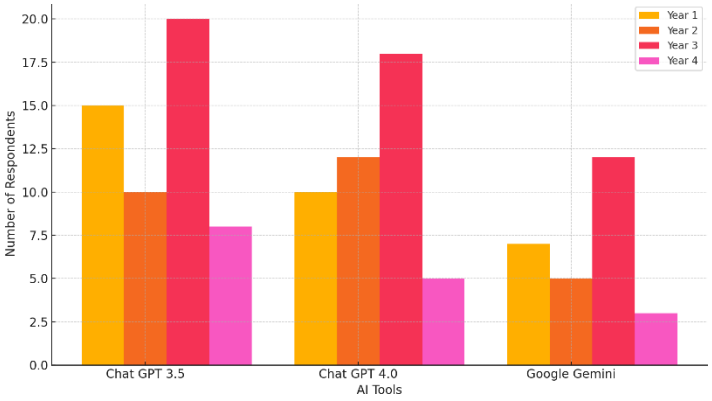

Figure 10: Year of Study vs. AI Tool Usage Chart

(c) Gender vs. Awareness of AI Hallucinations:

There is a noticeable disparity in awareness between male and female respondents. Male respondents generally show higher awareness of AI hallucinations, which could be linked to interest in AI technologies. One faculty male respondent shared, "I always double-check AI outputs because I know they can be false," indicating a cautious approach based on awareness. In contrast the female responses. This chart explores the difference in awareness between male and female respondents. male respondents are generally cautious and aware, witha balanced view of AI's capabilities, while female respondents, being less aware, may potentially over-rely on AI outputs without recognizing the risks.

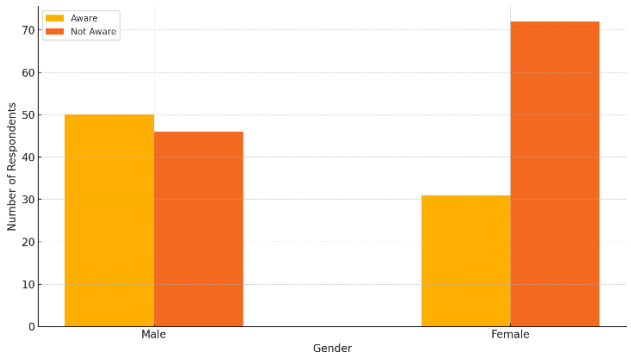

Figure 11: Gender vs. Awareness of AI Hallucinations Chart

(d) School/Department vs. Encountering AI Hallucinations:

The analysis shows that students in technical fields like Engineering encounter AI hallucinations more often, likely because their queries are more complex. For instance, a student noted, "AI tools often

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struggle with complex technical problems," highlighting AI's limitations with technical tasks. In contrast, students in Business and Arts face fewer hallucinations, probably because they rely less on AI for critical decisions. This trend suggests that AI literacy training should be incorporated into technical courses to help students better manage AI hallucinations. AI tools should also be improved to perform better in technical fields like engineering and medicine. Offering specialized training for students in these areas could help them detect and handle AI hallucinations more effectively.

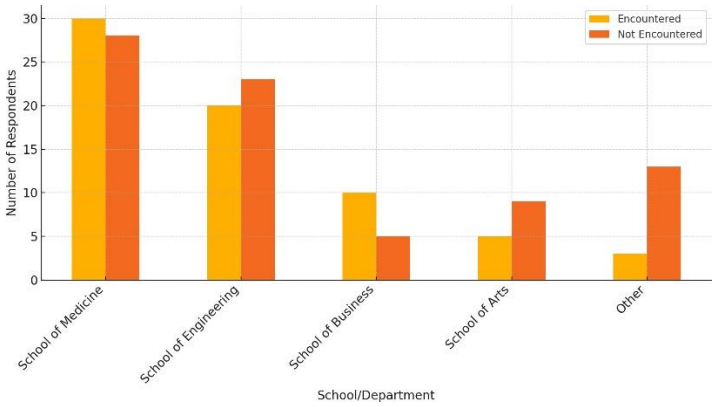

Figure 12: School/Department vs. Encountering AI Hallucinations Chart

(e) Frequency of AI Usage vs. Trust in AI:

The analysis indicates that respondents who use AI tools more frequently tend to have higher trust in AI outputs, likely due to their familiarity with the tools. Daily users trust AI because they use it regularly and understandits tricks. This shows a level of comfort with AI that comes with regular use. However, there is also a sense of cautious optimism among users, with many expressing trusts in AI's benefits while remaining aware of its limitations. For instance, an occasional user noted, "I'm still on the fence about trusting AI completely," reflecting a balanced view. Meanwhile, those who never use AI tools expressed a lack of trust, as one respondent stated, "I don't trust AI because I haven't seen enough evidence of its reliability." And "others said that they are more intelligent than AI".

The "Frequency of AI Usage vs. Trust in AI" chart shows that people who use AI tools daily or weekly are more likely to trust AI ("Yes" responses).

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However, many across all usage levels say "Maybe," indicating some caution. Notably, those who never use AI tools are more likely to say "Maybe" or "No," showing less trust in AI.

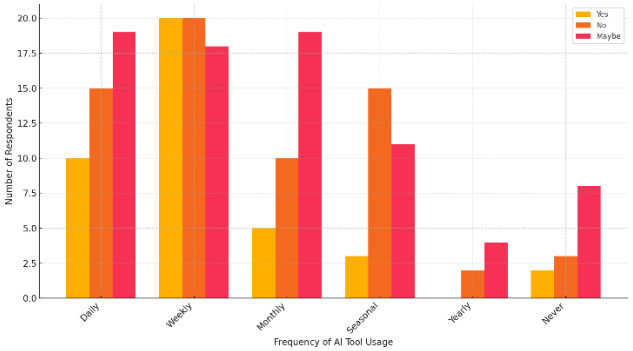

Figure 13: Frequency Of AI Usage Vs. Trust In AI

Qualitative Analysis

The survey conducted among the university community revealed significant insights into the details of AI hallucinations and their impact on users' trust and interaction with AI tools. A noteworthy finding is that over half of the respondents (57.1%) have encountered AI hallucinations, with a significant portion experiencing them at least occasionally. This high frequency of occurrence raises concerns about the reliability of AI tools, particularly in academic and professional contexts where accuracy is pivotal.

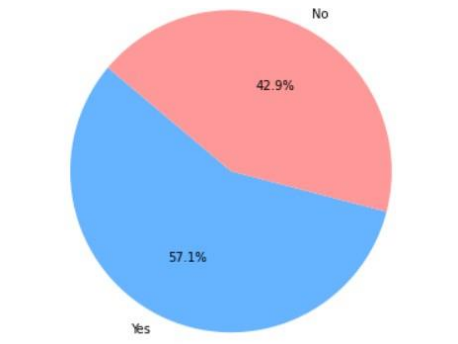

Figure 14: Encountered AI hallucinations

Misinformation emerged as the most Dominant type of hallucination, reported by 51.6% of respondents. This was followed by omissions (28.8%) and fabrication (22.3%). These findings highlight the challenges that users face when relying on AI-generated content, which can often be incomplete or misleading. One respondent shared their experience of encountering

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fabricated sources, which, upon verification, did not exist. Such incidents underscore the importance of verifying AI-generated information, particularly in academic research, where the integrity of sources is critical.

Bias and disinformation were also significant concerns, reported by 21.7% and 16.3% of respondents. The presence of bias in AI-generated content suggests that AI tools may reinforce existing prejudices or inaccuracies, potentially leading to skewed or harmful outcomes. For instance, one respondent observed that AI sometimes emphasizes certain perspectives, which can be misleading in a balanced academic discussion. This observation highlights the need for users to critically evaluate AI outputs and consider multiple sources to ensure a well-rounded understanding of the subject matter.

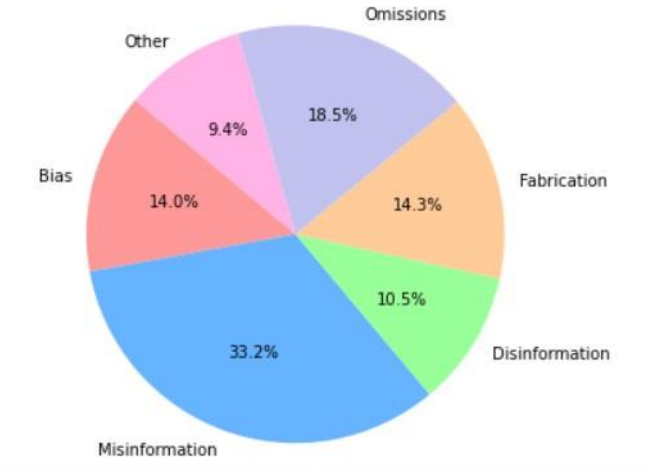

Figure 15: Types of AI Hallucinations

The frequent encounter with AI hallucinations has also had a noticeable impact on users' trust in AIsystems. Many respondents reported that their trust in AI had diminished, particularly when hallucinations occurred frequently. And others said that when they first started using AI and faced Hallucinations, they just stopped using it. This lack of trust has led users to adopt more cautious approaches, suchas double-checking AI outputs against reliable sources or relying more heavily on human verification.One respondent expressed their growing doubts, noting that they had started to rely less on AI forcritical tasks due to the frequency of errors.

Notable, those who frequently encountered hallucinations were more attuned to the different typesof inaccuracies that AI tools can produce. This heightened

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awareness suggests a relation between frequent AI use and a deeper understanding of its limitations. However, this awareness often came with frustration, as users had to invest additional time and effort to verify and correct AI-generated content.

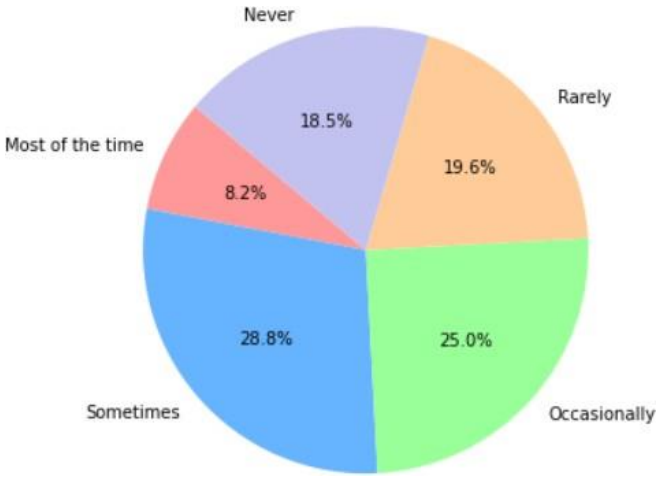

Figure 16: Frequency of AI Hallucinations

The sentiment surrounding AI hallucinations is predominantly negative, with many users expressing frustration and concern over the reliability of AI-generated content. The emotional impact of encountering misinformation or fabrications was palpable, with respondents describing the experience as frustrating and time-consuming. One user described their frustration when AI-generated content, which initially appeared credible, turned out to be false.

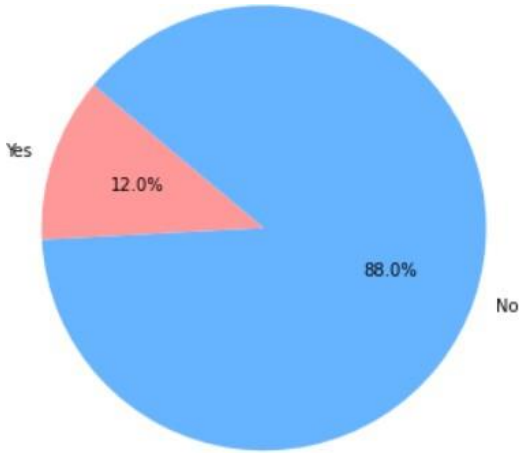

Figure 17: Negative Impact of AI Hallucinations

This erosion of trust and the emotional toll of dealing with AI hallucinations suggest that more needs to be done to improve AI tools and support users in

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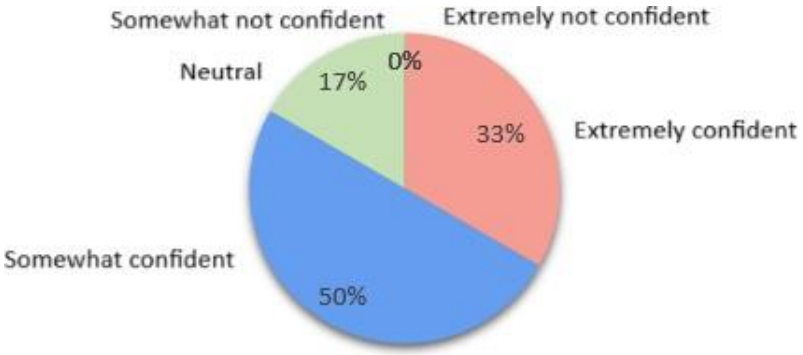
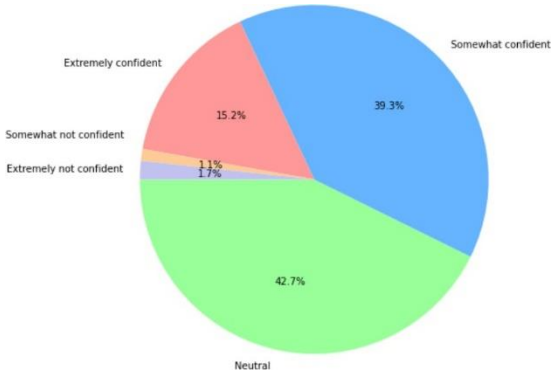
navigating their limitations. Educational practices should integrate AI literacy into the curriculum, ensuring that students, faculty, and staff are trained to recognize and verify AI-generated content. AI developers, on the other hand, should focus on improving the accuracy and reliability of their tools, particularly in sensitive areas like academic research and policymaking.



(a) Confidence Levels Among Those Aware of AI Hallucinations



(b) Confidence Levels Among Those Unaware of AI Hallucinations

Figure 18 & 19: Comparison of Confidence Levels Based on Awareness of AI Hallucinations

4. Conclusion

This study has explored the issue of AI hallucination instances where AI tools generate inaccurate or misleading content and how these inaccuracies impact the university community, specifically from the perspective of librarians. The

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results highlight a crucial need for students, faculty, and researchers to better understand the limits of AI.

User Awareness:

AI hallucinations can negatively impact the quality of academic work and affect research integrity. For librarians, they play a key role in guiding research and helping students and faculty, being aware of these limitations is vital. By educating the university community about the potential pitfalls of AI inaccuracies, librarians can encourage a more cautious and critical approach to using these technologies. This awareness will empower individuals to better assess the credibility of AI-generated information and minimize the risk of misinformation in their research.

AI Literacy Sessions:

To tackle the challenges caused by AI hallucinations, Providing AI literacy sessions into our educational programs is crucial. These sessions should not only cover how AI tools work but also teach practical skills for evaluating the accuracy of AI-generated content. These sessions are an opportunity to influence how students and faculty engage with AI tools. By providing hands-on training, librarians can equip users with the knowledge they need to effectively navigate AI technology and address potential errors.

AI Usage Policies:

Developing clear and effective AI usage policies is also essential for managing the impact of AI hallucinations. Developing guidelines on how AI tools should be used, including how to verify and report inaccuracies, will help set best practices across the university. Librarians have a key role in creating and enforcing these policies, ensuring they meet the needs of our academic community and tackle the specific challenges posed by AI.

In summary, understanding and addressing AI hallucinations is crucial for making the most of AI tools in academia. From a librarian's perspective, boosting awareness, offering AI literacy sessions, and setting up solid usage policies are all crucial steps. By focusing on these areas, librarians can help make AI a more reliable and effective part of the academic experience, ensuring it supports rather than hinders our work

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