

# **Using Generative Artificial Intelligence in your Research**

**A guide to best practice**

January 2026

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# Document Information

## Version & Updates

This document is continuously evolving to reflect developments in GenAI technology and research applications. Content is current as of **January 2026**. Please check for updates as AI capabilities and best practices continue to advance rapidly.

## Disclosure of AI Use in the Preparation of this Document:

This guidance document was developed with assistance from multiple versions of the AI models: Claude (Anthropic) and GPT (OpenAI). These models were used to:

- generate example outputs for demonstration purposes;
- create synthetic datasets for demonstration purposes;
- assist with content organization and proofreading;
- produce sample imagery

All AI-generated examples have been reviewed for accuracy and appropriateness within the academic research context.

# Introduction

The purpose of this guide is to support AUT researchers (staff and postgraduate research students) to make the most effective and responsible use of Artificial Intelligence tools (and particularly Generative Artificial Intelligence tools) in their research.

This is intended as a very practical guide: explaining AI terms and concepts, providing use cases and examples, and recommending workflows and best practices.

This guide should be used in conjunction with, and informed by, a number of other documents and procedures related to the use of AI at AUT, accessible from our AI Hubs.

## AUT AI Guidance and Documents

- **Our AI Future** - the AUT Vice-Chancellor's 'AI Taskforce' report which sets direction for the overall use of AI at AUT.
- **Guidelines for the Ethical Use of Generative Artificial Intelligence in Research** – guidance on how to ethically use GenAI in AUT research. This document *supplements* those guidelines, and must not be used in isolation from them.
- **Using Artificial Intelligence in your Research: Self-Assessments, Checklists, and Sample Text** – guiding documents to help researchers track, check, self-assess, and disclose their use of AI.
- **AI Tools Guidance** – helps you understand how to safely use a variety of AI tools in your research, drawing on trust level guidelines in the AI Tools Register.
- **AI Data Guidance** – includes examples of what types of data that might be considered sensitive or highly sensitive, and what types of AI tools are suitable for each level of data sensitivity under the AI Tools Register.

All of the above documents are available from the AI Hubs for staff and postgraduate research students at the below links:

[AI Hub for Postgraduate Research Students](#)

[AI Hub for AUT Staff](#)

## Related Procedures and Documents

All GenAI use at AUT must operate within our established ethical and regulatory framework:

- [AUT Code of Conduct for Research](#) - ensuring all research maintains the highest standards of integrity and ethics
- [AUT Research Data Management Policy](#) - protecting sensitive information and maintaining appropriate data security protocols
- [AUT Ethics Committee Guidelines and Procedures](#)

- [AUT Postgraduate Handbook](#) - for postgraduate research processes and regulations
- [Moanaroa Pacific Research Guidelines](#) – for guidance on Pacific data sovereignty and using AI in alignment with Pacific values

By operating within this framework, researchers can confidently integrate GenAI tools into their work while maintaining AUT's commitment to responsible innovation, cultural values, and research excellence.

## What is GenAI?

GenAI refers to artificial intelligence systems that can create new content - text, images, code, audio, or other media - based on patterns learned from vast datasets. Unlike traditional AI that classifies or predicts, GenAI generates original outputs in response to prompts, making it particularly valuable for creative and analytical research tasks.

## How GenAI is Transforming Research Globally

Rather than replacing researchers, GenAI is proving to be a powerful research accelerator and creativity enhancer. Here are real examples from New Zealand and Australian research communities:

- **Otago (Dentistry) used AI for better oral-cancer detection**  
Researchers developed a combined technology approach that can identify microscopic surface changes in cancer cells that traditional detection methods cannot observe (University of Otago, 2024)
- **University of Queensland used AI to assist with skin cancer diagnosis.**  
Their tests demonstrated that the AI system enhanced non-specialist healthcare providers' ability to accurately diagnose various skin conditions, improving their diagnostic precision by 16.5% (University of Queensland, 2025)

## GenAI as Research Amplifier

The most successful GenAI adoption happens when researchers view AI as a sophisticated research assistant rather than a replacement for human expertise. It excels at handling routine tasks, processing large volumes of information, and offering fresh perspectives—freeing researchers to focus on higher-level analysis, creative thinking, and meaningful interpretation.

## How Does it Work?

At its core, generative AI is built on **Large Language Models (LLMs)**—sophisticated statistical and mathematical systems that predict the most likely next word in a sequence based on patterns learned from vast amounts of text data. For example, when

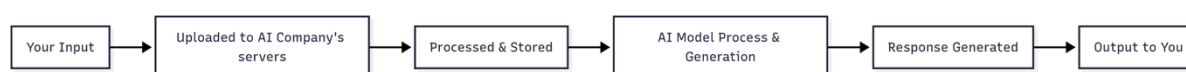
you ask ChatGPT a question, it doesn't "know" the answer like humans do, but it calculates the statistical probability of which words should follow others, building responses word by word through mathematical predictions. Think of it as incredibly advanced predictive text that has learned patterns from billions of documents across the internet.

### The GenAI Ecosystem: Different Models for Different Needs

Not all AI models are created for the same purpose—different models excel at different tasks depending on your research needs. For example, **Gemini** (by Google) offers strong integration with Google services, while **Microsoft Copilot** integrates seamlessly with Office applications. Additionally, specialized models exist for specific purposes: GitHub Copilot for coding, DALL-E for image generation, and Whisper for audio transcription.

### Data Flow & Privacy: From Your Input to AI Response

Now when you interact with GenAI tools, your data doesn't stay on your computer. Your queries and data travel through multiple systems before reaching the AI model and returning to you. Below illustrates the flow:



**Note:** Understanding this data pathway is crucial for researchers to make informed decisions about what information they share with AI tools and when additional privacy protections may be necessary.

## AI Terms and Concepts

**Hallucination:** When AI generates information that sounds plausible but is factually incorrect or fabricated.

**Prompt Engineering:** The practice of crafting effective instructions to get better outputs from AI systems. *Example:* Instead of "Write about climate change," try "Summarise the key findings from recent peer-reviewed research (2020-2024) on climate change impacts in Pacific Island nations, focusing on sea-level rise and agricultural effects."

**Large Language Model (LLM):** The underlying AI system trained on vast amounts of text data (like GPT-4, Claude, Gemini).

**Token:** The basic unit of text processing in AI systems (roughly equivalent to words or parts of words).

**Training Data:** The data that the AI model uses to learn.

**Fine-tuning:** Customising an AI model for specific tasks or domains.

**Bias:** Systematic prejudices present in AI outputs, often reflecting biases in the materials on which LLMs were trained.



## Use Cases & Examples

This section provides practical examples, prompt guides, and risk assessments for specific use cases in academic research.

### Searching

GenAI can be a powerful tool for initial broad searching and identifying key themes, but researchers must understand its risks when it comes to academic rigor and source verification.

### Example Analysis

In the example below, a researcher uses ChatGPT4o to generate an overview of themes in housing affordability research in New Zealand.

What are the main themes in research about housing affordability in New Zealand?

Here's an overview of the **main themes** emerging from research on **housing affordability in New Zealand**:

---

- 1. Supply Constraints & Urban Planning**
  - Many studies emphasize that limited housing—and especially land—supply is a principal driver of rising prices and poor affordability. Fragmented urban planning and infrastructure gaps exacerbate this issue Home | Te Waihangā +15.
  - Reforms such as the “**Medium-Density Residential Standard**” and the **2021 Resource Management Amendment Act** seek to counter this by enabling up to three homes per site and reducing the need for costly resource consents Brookings +2.
- 2. Demand Pressures: Migration, Investment, and Credit**
  - Demand-side pressures include:
    - **High immigration**, alongside investor demand and low interest rates, all boosted housing demand without corresponding supply growth DLA Piper +15.
    - Policies allowing **KiwiSaver withdrawals** for home purchases have intensified buyer competition, raised prices, and failed to improve homeownership rates News.com.au.
- 3. Structural Shifts: The Property Bubble & Homeownership**
  - The long-standing **property bubble**—with house prices rising more rapidly than incomes—has led to dramatic affordability deterioration. For example, the price-to-income ratio in Auckland soared to nearly 10:1 around 2017 Wikipedia.
  - As a result, **homeownership has declined**, especially among younger groups, and homelessness and public housing waiting lists have increased Brookings.
- 4. Policy Interventions & Their Effectiveness**
  - The government has trialed several initiatives:
    - **KiwiBuild**, aiming to deliver homes to first-time buyers, but targets were scaled back due to limited impact Wikipedia +3.
    - **Special Housing Areas** introduced affordable housing requirements—yet evidence shows limited

Fig 1. Using GPT4o for New Zealand housing affordability literature search

## Strengths:

- Provides a clear, logical structure with main themes
- Covers multiple dimensions of a complex issue (supply, demand, policy)
- Uses current New Zealand-specific examples
- Gives concrete data points (Auckland price-to-income ratio of 10:1)

## Critical Problems with Sources:

- **Non-Academic Sources:** Notice the mix of source types including Wikipedia (appears multiple times) and News.com.au - neither acceptable for academic literature reviews
- **Missing Academic Rigour:** No specific author names or publication dates for most claims; references like "Wikipedia +3" suggest aggregated multiple Wikipedia sources
- **Lacks Theoretical Frameworks:** Missing housing economics theory, urban planning models expected in academic literature

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Fabricated or inaccurate citations</li> <li>• Outdated information due to training data cut offs</li> <li>• Biased coverage of non-Western scholarship</li> </ul>	<ul style="list-style-type: none"> <li>• Cross-check citations in databases</li> <li>• Run independent searches in verified databases</li> <li>• Do not completely rely on AI search results</li> </ul>
<p><b>What not to do:</b> “Give me a list of recent papers on climate change.”</p> <p><b>Better Approach:</b> “I am researching X using Y methodology. What adjacent fields or interdisciplinary perspectives might offer relevant insights?”</p>	

**What This Means for Your Research:** Use GenAI output as a starting framework only. The themes identified can guide your actual literature search, but you must follow up with proper academic databases and verified sources. Researchers should approach AI writing assistance as they would a human editorial assistant: helpful for improving expression, but everything it produces needs review.

## Recommended Workflow for Literature Searching

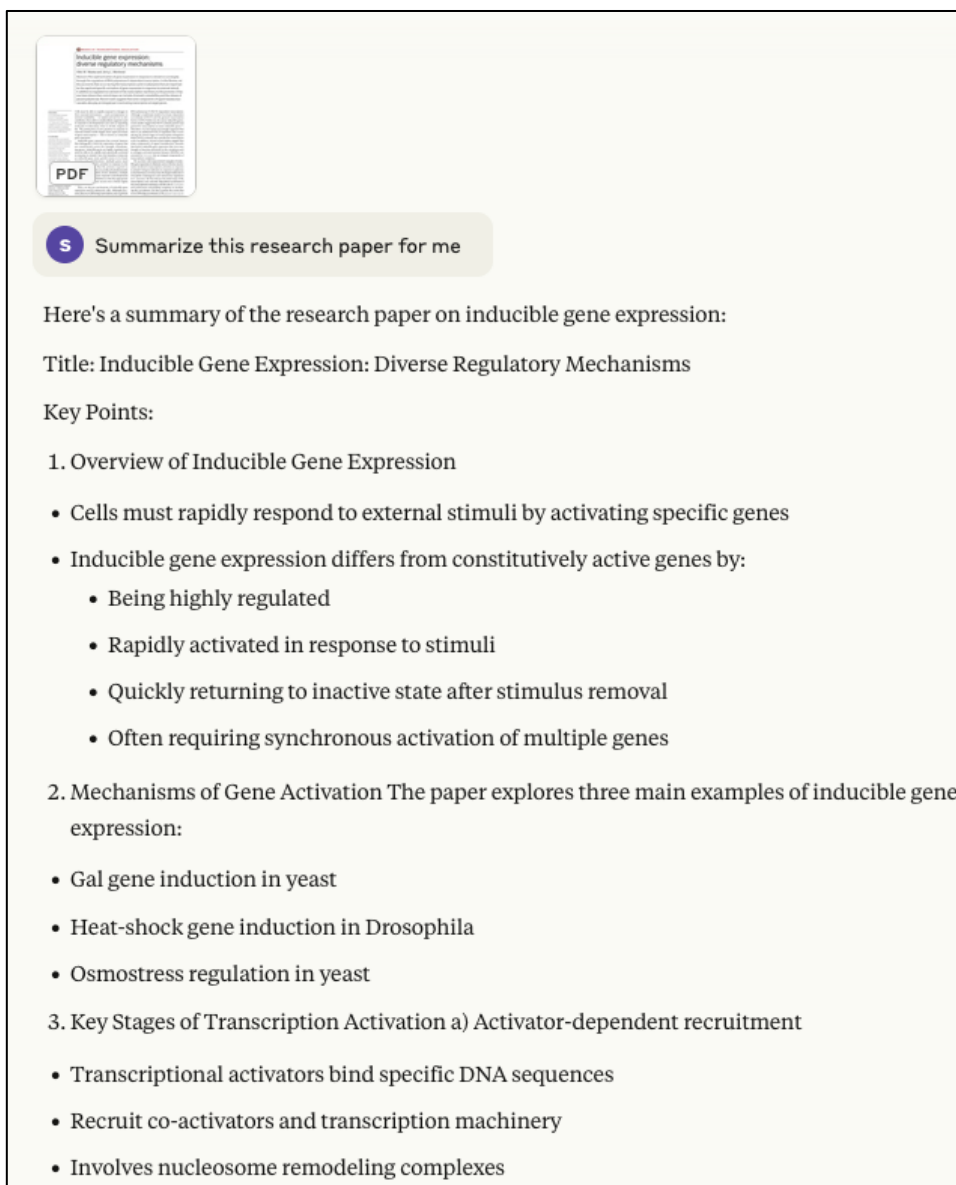
1. **Initial Theme Exploration:** Use GenAI to identify broad themes and potential research directions
2. **Framework Development:** Extract conceptual frameworks and key terminology from AI output
3. **Academic Database Search:** Use identified themes to search ProQuest, JSTOR, and other peer-reviewed databases
4. **Source Verification:** Cross-check all AI-suggested claims with verified academic sources

## Reading Research

GenAI can assist in initial comprehension by providing clear structural organization of complex content, identifying key concepts and main arguments and presenting information in digestible formats that help researchers quickly grasp a paper's scope and significant. However, AI cannot replace the critical analysis skills researchers must develop.

### Example Analysis

In the example below, a researcher uses Claude 3.5 to summarise a research paper on inducible gene expression.



The screenshot shows a user interface for Claude 3.5. At the top left, there is a thumbnail of a PDF document titled "Inducible gene expression: diverse regulatory mechanisms". Below the thumbnail is a button with a purple circle containing a white 'S' and the text "Summarize this research paper for me". The main content area displays the following summary:

Here's a summary of the research paper on inducible gene expression:

Title: Inducible Gene Expression: Diverse Regulatory Mechanisms

Key Points:

1. Overview of Inducible Gene Expression
  - Cells must rapidly respond to external stimuli by activating specific genes
  - Inducible gene expression differs from constitutively active genes by:
    - Being highly regulated
    - Rapidly activated in response to stimuli
    - Quickly returning to inactive state after stimulus removal
    - Often requiring synchronous activation of multiple genes
2. Mechanisms of Gene Activation The paper explores three main examples of inducible gene expression:
  - Gal gene induction in yeast
  - Heat-shock gene induction in Drosophila
  - Osmostress regulation in yeast
3. Key Stages of Transcription Activation a) Activator-dependent recruitment
  - Transcriptional activators bind specific DNA sequences
  - Recruit co-activators and transcription machinery
  - Involves nucleosome remodeling complexes

Fig 2. Using Claude 3.5 for research paper summarisation

### Strengths:

- Clear structure organizing content into logical sections (Overview, Mechanisms, Key Steps)
- Identifies key concepts and captures main
- Bullet point format makes complex information scannable and digestible

### Critical Weaknesses:

- **Oversimplification:** Loses nuanced explanations and may miss important exceptions or conditional factors mentioned in the original
- **Missing Critical Details:** No methodology specifics, statistical significance (p-values, sample sizes), or key citations
- **Context Loss:** Missing research significance, comparative analysis with previous research, and future directions recommended by authors
- This summary gives you a quick orientation to the paper's content, but you still need to read the paper to properly understand and cite the research in your own work.

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Misinterpretation of complex statistical analyses or theoretical frameworks</li> <li>• Context loss / missing details</li> <li>• Potential bias in AI's interpretation or emphasis of key findings</li> </ul>	<ul style="list-style-type: none"> <li>• Always read original papers in full</li> <li>• Verify AI interpretations against primary source</li> <li>• Focus AI assistance on initial comprehension only, not final analysis</li> <li>• Maintain detailed personal notes from original sources.</li> </ul>

**What not to do:** “Summarize these five papers [uploads five PDF files]”

**Better Approach:** ““Here are papers I've found relevant to my research on 'climate change adaptation strategies in hospitality industry' Rank them from most to least relevant and explain why:


[abstract 1] – author(s), publication date


[abstract2] – author(s), publication date


[abstract3] – author(s), publication date


..”

The below shows the example of using a better approach to assist with reading. This approach helps organize and prioritize your research reading while maintaining critical evaluation.

 **climate\_change\_walmsley.pdf**  
PDF

 **TourismandClimateChange.pdf**  
PDF

 **WeakeWorkman\_2010\_NatureRevie...**  
PDF

 **s43615-021-00141-x.pdf**  
PDF

Here are papers I've found relevant to my research on 'climate change adaptation strategies in hospitality industry'. Rank them from most to least relevant and explain your reasoning

Here's my ranking of the four papers you uploaded, from **most relevant** to **least relevant** for your topic *"climate change adaptation strategies in the hospitality industry"*, with reasoning:

---

**1. Walmsley – Climate Change Adaptation and the Tourism/Hospitality Industry**

Relevance: ★★★★★

- This paper directly examines climate change adaptation within tourism and hospitality.
- It discusses sector-specific challenges (changing tourist flows, operational risks, customer preferences) and links them to practical adaptation strategies.
- Since your focus is explicitly the hospitality industry, this is the most relevant and provides applied insights rather than just general theory.

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**2. "Tourism and Climate Change" (Scott, Gössling, Hall)**

Relevance: ★★★★☆

- A highly cited, broad study on how tourism systems interact with climate change.
- While not exclusively hospitality-focused, it covers key adaptation domains: destination management, infrastructure resilience, and guest behavior.
- Provides a strong theoretical foundation and industry-wide context that complements Walmsley's more direct hospitality analysis.

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**3. "Climate Change and Tourism Adaptation" (Nature-based solutions, s43615-021-00141-x.pdf)**

Relevance: ★★★☆☆

- Focuses more on **tourism adaptation frameworks**, ecosystem-based adaptation, and nature-based solutions.
- Hospitality appears as part of the broader tourism system, not as the central theme.
- Useful for conceptual and methodological insights (e.g., governance, sustainability), but less tailored to your specific hospitality focus.




Figure 3. Using GPT5-Fast to rank paper importance

**What this means for your research:** Use GenAI as a comprehension aid, not a replacement for thorough reading. Your final understanding, analysis and citations must come from direct engagement with the original sources. It is useful for orientation but never sufficient for academic work. The goal is to use GenAI to read more effectively, not to read less critically. In addition, there is a trade-off is between AI's efficiency in suggesting possibilities versus the risk of pursuing non-existent sources - assess what works better for your research workflow and time constraints.

### **Recommended Workflow for Research Reading Assistance**

1. **Initial Overview:** Use GenAI to create a structural summary of the paper's main sections
2. **Concept Identification:** Extract key terminology and concepts for further investigation
3. **Critical Gap Analysis:** Identify what the AI summary missed or oversimplified
4. **Manual Deep Reading:** Read the original paper focusing on methodology, limitations, and statistical details
5. **Contextual Understanding:** Research significance, comparative analysis, and future directions independently



## Writing: Research Content

GenAI can be a valuable writing companion for experienced researchers, helping to refine arguments, suggest alternative phrasings, and brainstorm ideas. It is great at restructuring complex ideas, providing additional suggestions to your content and acting as a readily available feedback tool.

However, academic writing requires specific standards for originality, citation and scholarly voice that AI cannot fully navigate, and beginners should develop core writing skills manually before incorporating AI assistance.

### Example Analysis

In the example below, a researcher uses Claude 3.7 to draft text for a literature review.

#### Conceptual Foundations

##### Privacy as a Fundamental Right

The conceptual foundations of data privacy law often begin with Warren and Brandeis's seminal 1890 article "The Right to Privacy," which first articulated privacy as "the right to be let alone" in response to emerging technologies of their era. Modern scholarship has expanded upon this foundation, with Solove (2006) developing a taxonomy of privacy that identifies sixteen distinct types of privacy problems, arguing that privacy is not a singular concept but rather a family of related concerns that require different legal and policy responses.

Nissenbaum's (2010) influential theory of "contextual integrity" provides a framework for evaluating privacy violations based on context-specific informational norms rather than abstract principles. This approach has proven particularly valuable in analyzing the privacy implications of emerging surveillance technologies.

Is it really  
"sixteen"?

wrong year

Fig 4. Using Claude 3.7 for writing a literature review

### Problems with Generic Approach:

- **Citation Issues:** Inconsistent referencing, incomplete citations, no proper bibliography
- **Vague Statements:** General statements with no specific references to support claims
- **Hallucination Risk:** AI may create fictitious citations.



### Strengths of Targeted Approach:

- Complements rather than replaces your research process
- Builds on existing verified knowledge
- Generates specific suggestions for further investigation
- Maintains researcher control over source verification
- Provides direction for expanding research scope systematically

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Hallucination of content and/or citations</li> <li>• Copyright breach if AI reproduces protected text; Plagiarism</li> <li>• Potential bias in language, loss of scholarly voice</li> <li>• Inconsistency of references</li> </ul>	<ul style="list-style-type: none"> <li>• Do not ask GenAI prompts like “Write me a literature review on...”</li> <li>• Do not ask GenAI to generate citations and references</li> <li>• Use GenAI as an editing and/or brain storming tool</li> <li>• Treat AI edits like human editorial input: verify every fact, run plagiarism/originality checks.</li> </ul>
<p><b>What not to do:</b> “Write me a literature review on data privacy and surveillance laws, include citations and sources”</p> <p><b>Better Approach:</b> “I’m writing a literature review on data privacy and surveillance law. I’ve reviewed Carpenter v. United States (2018), Schrems II (2020), GDPR provisions, and academic works by Daniel Solove and Julie Cohen. What other key cases, legislation, or legal scholars should I consider?”</p>	

The below shows the example of using a better approach to assist with a literature review. This approach helps to identify relevant additional sources to include in the discussion of the existing pre-identified sources.

**S** I'm writing a literature review on data privacy and surveillance law. I've reviewed *Carpenter v. United States* (2018), *Schrems II* (2020), GDPR provisions, and academic works by Daniel Solove and Julie Cohen. What other key cases, legislation, or legal scholars should I consider?

Your foundation is excellent - those are cornerstone cases and scholars in the field. Here are key additions to consider:

**Pivotal Cases:** *Riley v. California* (2014) established digital privacy protections for cell phone searches, predating and informing *Carpenter*. *Kyllo v. United States* (2001) addressed thermal imaging and the reasonable expectation of privacy in emerging technologies. For international perspective, *Schrems I* (2015) provides crucial context for your *Schrems II* analysis. *United States v. Jones* (2012) on GPS tracking was foundational to the *Carpenter* decision.

**Recent Developments:** The California Consumer Privacy Act (CCPA) and its amendment, the California Privacy Rights Act (CPRA), represent significant US legislative developments. The EU's Digital Services Act and Digital Markets Act extend beyond GDPR into content moderation and platform regulation. Several states have enacted comprehensive privacy laws following California's lead.

**Essential Legal Scholars:** Helen Nissenbaum's work on contextual integrity theory is fundamental to modern privacy scholarship. Ryan Calo's writing on privacy harm and robotics law offers important perspectives. Shoshana Zuboff's "surveillance capitalism" framework, while more sociological, significantly influences legal discourse. Paul Ohm's work on differential privacy and the failure of anonymization is crucial for data protection law. Danielle Citron's scholarship on privacy's role in civil rights provides important intersectional analysis.

**International Perspectives:** Consider Canada's Personal Information Protection and Electronic Documents Act (PIPEDA), Brazil's Lei Geral de Proteção de Dados (LGPD), and emerging frameworks in Asia-Pacific regions for comparative analysis.

Fig 5. Using Claude Sonnet 4 for assisting in literature review (better approach)

**What this means for your research:** Use GenAI to enhance your writing process, not replace it. AI can help you articulate complex ideas more clearly and suggest organizational improvements. However, all content, analysis and citations must originate from your research and understanding. Think of AI as a sophisticated editing tool that can help polish your ideas but cannot substitute for genuine scholarly ideas and original thought.

### Recommended Workflow for Research Writing Assistance

1. **Research Foundation:** Complete thorough literature review using verified academic sources
2. **Outline Development:** Create detailed structure with your own analysis and arguments
3. **Targeted AI Assistance:** Use specific prompts for suggestions rather than complete writing
4. **Source Integration:** Manually integrate and cite all sources according to academic standards
5. **Critical Review:** Verify all AI suggestions against your source materials
6. **Academic Standards Check:** Ensure proper citation format, bibliography, and theoretical frameworks

## Writing: Grammar & proofreading

GenAI can assist with grammar and proofreading tasks. It is especially useful for catching errors that you may not have picked up on. However, AI modifications can inadvertently alter meaning, change your academic voice or impose unwanted stylistic preferences that may not align with your intended message or regional conventions.

### Example Analysis

In the example below, a researcher prompts an AI tool to check their grammar in an excerpt of text.

Input Prompt	Output
<p><i>"Check this grammar:</i></p> <p>The data suggests there might be some correlation between social media usage and academic performance among university students. However, the research methodology have some limitations that effects the reliability and generalisation of the findings."</p>	<p>"The data <b>clearly demonstrates a strong</b> correlation between social media usage and academic performance among university students. However, the research methodology <b>has</b> some limitations that <b>affect</b> the reliability and <b>generalization</b> of the findings."</p>

### Problems with Basic AI Correction:

- **Altered Meaning:** AI changed tentative language ("suggests there might be some") to definitive claims ("clearly demonstrates a strong"), completely altering the researcher's intended level of certainty
- **Regional Bias:** Changed NZ spelling "generalisation" to American spelling "generalization" without permission

Issues/Risks	Mitigations
<ul style="list-style-type: none"> <li>• Altered meaning through overly aggressive editing</li> <li>• Loss of academic voice and intended tone</li> <li>• Regional spelling bias (e.g. NZ vs US English)</li> <li>• Unwanted stylistic changes</li> </ul>	<ul style="list-style-type: none"> <li>• Use specific, controlled prompts that limit AI's scope</li> <li>• Process text in small segments</li> <li>• Maintain back-up copies of original text</li> </ul>
<p><b>What not to do:</b> “Fix the grammar and improve this paragraph [pastes entire section]”</p> <p><b>Better Approach:</b> “Only correct grammar and spelling errors using NZ English conventions. Do not change sentence structure, add content or alter meaning: [specific sentence of paragraph]”</p>	

**What this means for your research:** Use GenAI's grammar assistance as a technical proofreading tool, not a writing enhancer. Focus on correcting errors while preserving your scholarly voice and intended meaning. It should help polish your existing ideas, not reshape them.

### Recommended Workflow for Grammar Assistance

1. **Sentence-by-Sentence Review:** Process text in small segments to maintain control or;
2. **Specific Instructions:** Provide detailed prompts specifying exactly what to correct
3. **Regional Conventions:** Specify your regional spelling conventions (e.g., NZ English)
4. **Manual Verification:** Review all changes to ensure they align with your intended meaning
5. **Original Backup:** Always maintain copies of your original text

## Data Analysis

GenAI can significantly enhance data analysis workflows across both quantitative and qualitative research methodologies. However, each approach requires careful consideration of methodological rigor, accuracy verification, and ethical implications.

### Quantitative

GenAI can greatly assist in quantitative data analysis tasks by processing data, identifying patterns in data, or performing statistical analysis.

### Example Analysis

In the example below, a researcher asks GPT5-auto to identify which factors in a set of student performance data most influence academic performance.

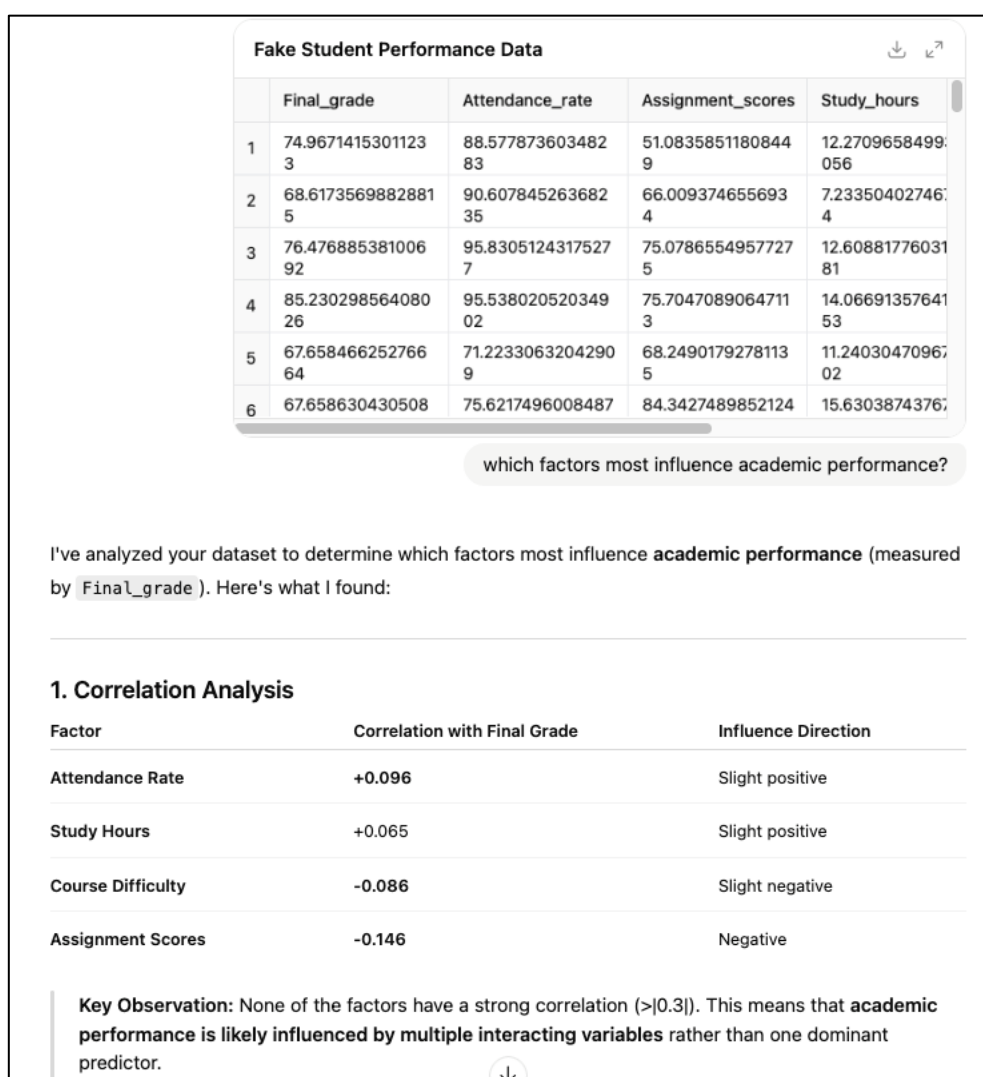


Fig 6. Using GPT5-auto for a statistical analysis

## Strengths:

- Quick generation of correlation analysis and statistical outputs
- Clear numerical results with coefficient values
- Identification of potential relationships between variables

## Critical Statistical Analysis Risks:

- **Premature Analysis:** No verification of data quality or reasoning about appropriateness of chosen statistical methods
- **Oversimplified Interpretations:** Correlation coefficients presented with broad labels ("strong," "moderate") without context for specific research domain
- **Missing Methodological Rigor:** No consideration of sample size adequacy, effect sizes not contextualized within disciplinary norms, assumptions about linear relationships not tested
- **Reproducibility Issues:** If publications require showing analysis steps, inability to recreate without access to AI processing may cause problems

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Misapplied statistics</li> <li>• Non-reproducible</li> <li>• Biased models</li> <li>• Sensitive data leakage</li> <li>• Incorrect assumptions made</li> </ul>	<ul style="list-style-type: none"> <li>• Rely on established statistical software or code for actual data analysis</li> <li>• Use it to assist or explain</li> <li>• Generate scripts for use in accepted analytical tools</li> <li>• Validate GenAI-suggested analyses by reviewing proper calculations</li> </ul>
<p><b>What not to do:</b> “What factors most influence academic performance? [uploads csv data]”</p> <p><b>Better Approach:</b> "Give me some general statistics of this data [uploads csv data]”</p>	

**Better Practice - Start with Data Exploration:** Begin with descriptive statistics, data visualization, and assumption testing before proceeding to inferential statistics. Use AI insights to inform hypothesis development rather than as final analytical conclusions.



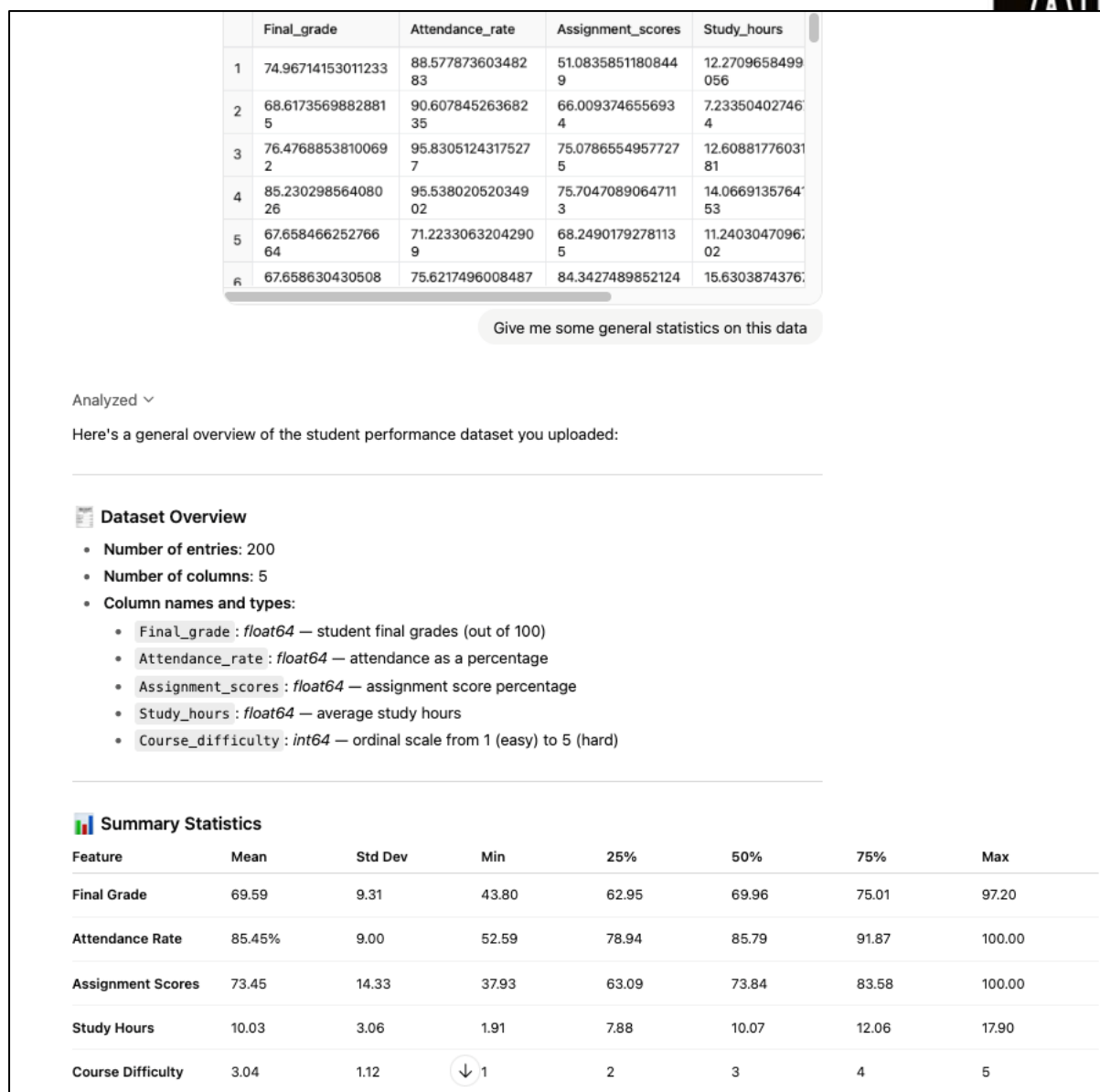


Fig 7. Example of student performance data in excel

### Strengths of Exploration-First Approach:

- **Data-Driven Hypothesis Formation:** Descriptive statistics reveal actual patterns in your data rather than assumed relationships
- **Assumption Verification:** Allows you to test statistical assumptions (normality, linearity) before selecting appropriate analytical methods
- **Informed Question Development:** Rather than asking generic questions like "which factors influence performance?", you can formulate specific, testable hypotheses based on observed distributions and relationships
- **Methodological Rigor:** Ensures statistical analysis is driven by informed research questions rather than automated AI assumptions

- **Defensible Findings:** Creates more robust and academically sound research conclusions that can withstand peer review

This methodical approach transforms exploratory insights into targeted analytical strategies, leading to more credible and meaningful research outcomes.

**What this means for your research:** Use as an analytical assistant, not an analytical decision-maker. It can help you explore data patterns and suggest methodological approaches, but your research conclusions must be based on statistical analysis using established methods and software (e.g. SPSS, R, etc). Think of it as helping you ask better questions of your data, not providing final answers.

### Recommended Workflow for Quantitative Data Analysis

1. **Data Quality Check:** Request dataset overview, missing data assessment, and basic descriptive statistics
2. **Variable Examination:** Review distributions, outliers, and appropriate measurement scales
3. **Hypothesis Formation:** Based on data exploration, formulate specific testable hypotheses
4. **Appropriate Test Selection:** Choose statistical methods matched to your data characteristics and research questions
5. **Results Verification:** Cross-check findings using traditional statistical software when possible
6. **Methodological Documentation:** Record all analysis steps, assumptions, and decision points for reproducibility and peer review.

### Data Visualisation

GenAI excels at creating quick exploratory visualizations to validate initial hypotheses and identify patterns in data. It can rapidly generate multiple chart types which allows researchers spot observations of data much quicker. However, AI-generated visualizations often lack the precision and formatting standards required for academic publication.

### Example Analysis

In the example below, a researcher asks GPT5-Fast to generate a bar graph.





Fig 8. Using GPT5-Fast to generate a bar graph

## Strengths:

- Rapid generation of exploratory visualizations
- Good for initial pattern identification and hypothesis validation
- Quick iteration capabilities for different visualization approaches
- Accessible to researchers without advanced design skills

## Problems with Basic AI Data Visualisation:

- **Inappropriate data presentation:** AI tools may make assumptions about how to present the data that are inappropriate to the dataset or the purpose of the visualisation.
- **Poor formatting & quality:** AI-generated data visualisations are unlikely to be of a standard suitable for publication

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Makes assumptions about data presentation</li> <li>• Formatting and quality risk for academic standards</li> <li>• Reproducibility challenges for peer review</li> <li>• May suggest inappropriate chart types for data characteristics</li> <li>• Limited customization for disciplinary conventions</li> </ul>	<ul style="list-style-type: none"> <li>• Be explicit in your requests – provide detailed prompts specifying exactly what you want</li> <li>• Use GenAI visualizations for exploration</li> <li>• Manually create publication-quality versions using dedicated software</li> <li>• Able to reproduce the final visualization using statistical software</li> </ul>
<p><b>What not to do:</b> “Visualize this dataset [uploads file]</p> <p><b>Better Approach:</b> "Create a horizontal bar chart comparing customer satisfaction scores (1-10 scale) across three service categories: technical support, billing, and delivery. Use distinct colours and include sample sizes for each category.”</p>	

**What this means for your research:** Great tool for data exploration, but not as final publication materials. GenAI can help you quickly test different ways of presenting your data and identify meaningful patterns, but your final visualizations should be created using established statistical software to ensure reproducibility and meet academic standards.

### Recommended Workflow for Data Visualization

1. **Purpose Definition:** Clearly specify the research question your visualization should address
2. **Explicit Prompt Design:** Provide detailed instructions about chart type, variables, and formatting requirements
3. **Exploratory Generation:** Create initial visualizations to identify patterns and validate hypotheses
4. **Quality Assessment:** Review for accuracy, appropriate scaling, and clear labelling
5. **Publication Preparation:** Recreate final versions using dedicated software with proper formatting
6. **Reproducibility Documentation:** Save data files and step-by-step instructions for journal requirements

## Qualitative

Qualitative research involves analysing non-numerical data to understand meanings, experiences, and social phenomena. GenAI can assist researchers in several key areas of qualitative analysis - from converting audio recordings to text through transcription, to identifying patterns and themes in complex datasets. However, qualitative research demands careful attention to participant voice, contextual meaning, and researcher interpretation that AI cannot fully replicate.

### *Transcription*

AI-powered transcription tools can significantly reduce time investment while maintaining reasonable accuracy for most research contexts. They're particularly effective for clear speech in standard dialects and can handle multiple speakers reasonably well. However, researchers must carefully balance efficiency gains with privacy protection, transcription quality, and the preservation of contextual elements crucial for qualitative analysis.

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Privacy &amp; confidentiality-concerns with cloud-based processing</li> <li>• Transcription inaccuracy with less common speech, technical jargon or poor audio quality</li> <li>• Loss of emotional context, tone, and non-verbal cues</li> <li>• Data security risks with sensitive participant information</li> </ul>	<ul style="list-style-type: none"> <li>• Always conduct full human review of transcription</li> <li>• Ensure participants consent to AI-assisted transcription</li> <li>• Use offline transcription tools for sensitive data</li> </ul>
<p><b>What not to do:</b> “Transcribe this interview [upload sensitive audio file]”</p> <p><b>Better Approach:</b> Use offline transcription tools such as Dragon NaturallySpeaking, NVivo’s built-in transcription features etc.</p>	

## Recommended Workflow for AI-Assisted Transcription

1. **Privacy Assessment:** Evaluate sensitivity of data and participant consent for AI processing
2. **Tool Selection:** Choose appropriate transcription service based on language, accent, and security requirements
3. **Initial Transcription:** Process audio using AI-tool
4. **Human Review Process:** Listen to audio while reading AI transcript, flagging uncertain sections
5. **Final Verification:** Complete accuracy check before proceeding to analysis phase

### *Theme extraction*

AI can assist in identifying initial patterns and themes across large qualitative datasets, helping researchers organize complex information into manageable categories. It's particularly useful for processing multiple transcripts simultaneously and spotting obvious patterns that might be missed in manual review. However, AI cannot replace the nuanced interpretation, theoretical framework application, and deep contextual understanding that characterizes rigorous qualitative analysis.

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Shallow understanding that misses nuanced meanings and context</li> <li>• Bias analysis</li> <li>• Privacy and data concern with sensitive research data</li> </ul>	<ul style="list-style-type: none"> <li>• Remove any identifiable details before processing</li> <li>• Obtain consent from participants</li> <li>• Can be used as initial coding framework or gap check</li> <li>• Do not the output as final analysis</li> </ul>
<p><b>What not to do:</b> “Analyze these interview transcripts and tell me what the main themes are [uploads raw participant data transcript]”</p> <p><b>Better Approach:</b> “I’ve anonymized these interview excerpts about workplace stress. I have identified the following categories [list of categories]. Help me identify more potential themes in addition to what I have found: [uploads processed data transcript]”</p>	

**What this means for your research:** Use AI theme identification as a starting point for your analysis, not as your final interpretation. AI can help you organize and structure your approach to coding, but the meaningful analysis - connecting themes to theory, understanding participant perspectives, and drawing research conclusions - must come from your expertise as a researcher.

### **Recommended Workflow for GenAI-Assisted Theme Analysis**

1. **Data Preparation:** Anonymize transcripts and remove identifying information before AI processing
2. **Initial Pattern Identification:** Use AI to identify obvious patterns and potential themes
3. **Framework Development:** Apply AI output as starting structure for manual coding process
4. **Theoretical Integration:** Manually apply relevant theoretical frameworks to interpret themes
5. **Participant Voice Validation:** Ensure themes accurately represent participant perspectives without AI bias
6. **Cross-Validation:** Verify themes against original data context and research questions

## Visual Design and Imagery

GenAI-generated imagery offers researchers new capabilities for creating visual materials quickly and efficiently. From simple graphics to complex conceptual illustrations, AI can support research communication while researchers need to pay careful attention to accuracy, bias, and academic standards.

### Example Analysis

In the example below, a researcher asks GPT5-auto to generate a recruitment poster.

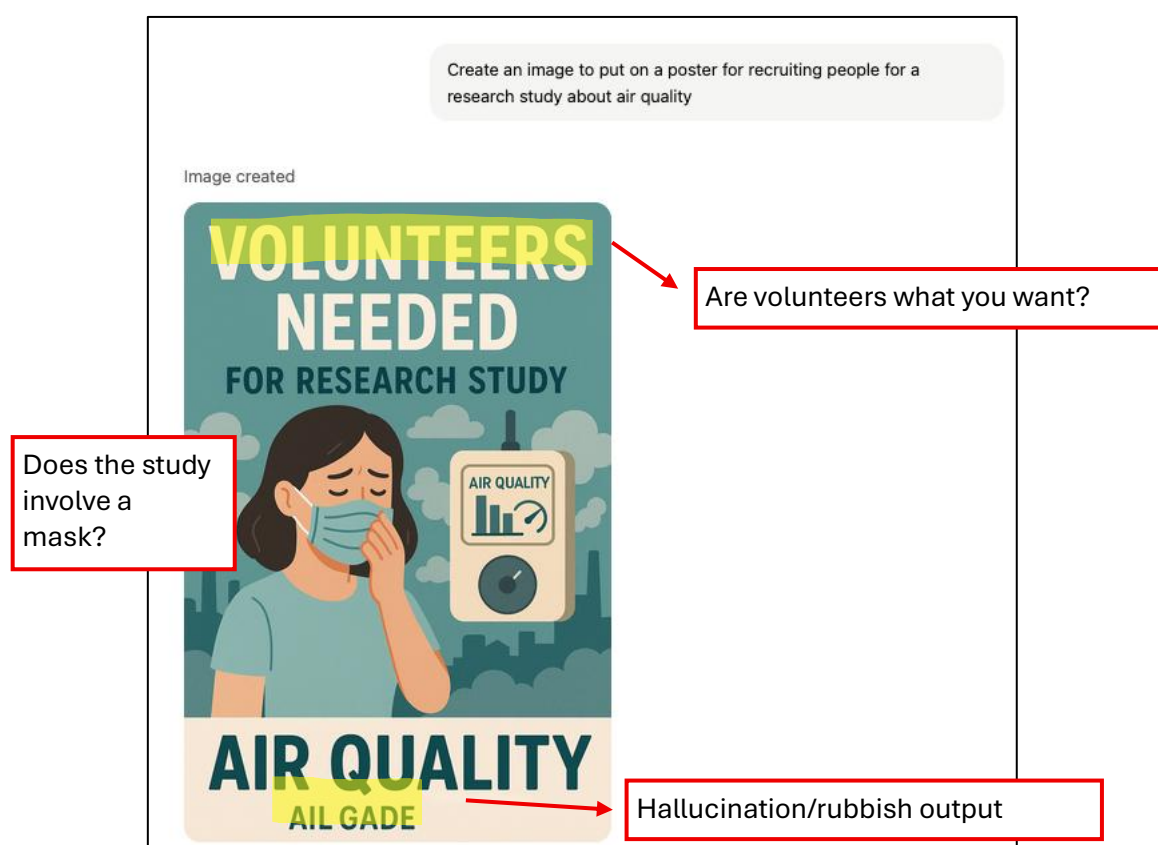


Fig 9. Using GPT5-auto to generate a research study poster

**Critical Consideration for Research Context:** In the example shown, researchers must consider the implications of visual choices: Do participants need masks? Should air quality devices be present? How might the visual representation affect participant perception of the study? Always evaluate generated imagery for research-specific accuracy and appropriateness.

Risks	Mitigations
<ul style="list-style-type: none"> <li>• Bias and stereotypical representations of people, cultures or concepts</li> <li>• Technical inaccuracy in scientific diagrams or data representations</li> <li>• Copyright and licensing ambiguity</li> <li>• Inconsistent quality that may not meet academic publication standard</li> <li>• Misrepresentation of research concept/goal</li> </ul>	<ul style="list-style-type: none"> <li>• Human review of all content to ensure fairness and accuracy</li> <li>• Prompt engineering/continuous prompt refinement</li> <li>• Review journal/institutional visual standards</li> <li>• Declare use (see templates/disclaimer section for more details)</li> </ul>
<p><b>What not to do:</b> “Make a diagram showing how supply and demand works”</p> <p><b>Better Approach:</b> “Create a professional economic diagram showing supply and demand curves intersecting at market equilibrium. Include clearly labelled axes (Price on Y-axis, Quantity on X-axis), upward-sloping supply curve, downward-sloping demand curve, and equilibrium point marked as <math>P_e</math> and <math>Q_e</math>.”</p> <p>[You may require a few more prompts for refinement / revision]</p>	

**What this means for your research:** Use AI-generated visuals as starting points for research communication, but always verify accuracy and appropriateness. AI imagery works best for conceptual illustrations and presentation graphics, but should not replace professional design for technical diagrams or participant-sensitive materials. Always document your use of AI tools and ensure compliance with your institution's guidelines. Disclose any use of AI-generated imagery in your research publications, presentations, or materials according to your institution's transparency requirements.

### Recommended Workflow for AI Visual Generation

1. **Purpose & Context Definition:** Clearly specify the visual's role in research and target audience
2. **Prompt Engineering:** Craft detailed prompts including style, composition, colour scheme, and technical requirements
3. **Iterative Refinement:** Refine prompts based on results and research needs



4. **Quality Assessment:** Evaluate accuracy, appropriateness, cultural sensitivity, and potential bias
5. **Documentation Process:** Record prompts, tools used, generation process, and modifications for reproducibility
6. **Rights & Attribution:** Verify usage rights and document AI assistance according to institutional guidelines



## References

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