

# Generative AI in Context

An Overview

Prepared for the Faculty Meeting to Discuss ChatGPT at Mississippi State University (April 21, 2023)  
Dr. Jonathan Barlow  
Associate Director, Mississippi State University Data Science Program

barlow@datascience.msstate.edu

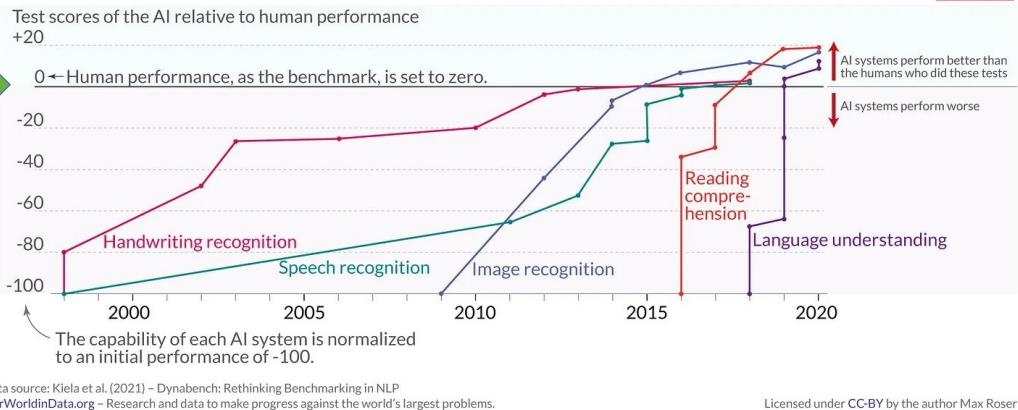
It's an honor to speak to you today about Generative AI

Presentation, Version 1.0

Mississippi State University Data Science Program  
[datascience.msstate.edu](http://datascience.msstate.edu)

## The AI Context for ChatGPT

Language and image recognition capabilities of AI systems have improved rapidly



Source: Max Roser, “The brief history of artificial intelligence: The world has changed fast – what might be next?”  
<https://ourworldindata.org/brief-history-of-ai>

Generative AI, like ChatGPT, is part of a general AI Spring in which artificially intelligent systems have reached or surpassed human levels of performance in many areas such as handwriting recognition, speech recognition, image recognition, reading comprehension, and understanding language.

The green arrow points to the baseline of average human performance on several benchmarks.

Even by 2020, before ChatGPT, when only specialists were experimenting with GPT-3 through web services, AI had surpassed some definitions of human performance in all of these areas.

Generative AI, our subject today, is a further advance from recognizing and understanding the world to contributing to it.



## Labor Market Implications

- Prior to generative AI, emphasis on potential for AI and robotics to displace low- and middle-skill human workers (e.g., drivers, carpentry)
- Goldman Sachs (2023): “we estimate that one-fourth of current work tasks could be automated by AI in the US ... with particularly high exposures in administrative (46%) and legal (44%) professions and low exposures in physically-intensive professions such as construction (6%) and maintenance (4%).
- Two-thirds of current occupations have aspects that can be automated.

Prior to generative AI, the labor market discussion was on the potential for AI and robotics to displace low- and middle-skill human workers (e.g., drivers)

Goldman Sachs (2023): “we estimate that one-fourth of current work tasks could be automated by AI in the US ... with particularly high exposures in administrative (46%) and legal (44%) professions and low exposures in physically-intensive professions such as construction (6%) and maintenance (4%). Educational instruction and library (27%)

Goldman Sachs estimates that some percentage of about 2/3 of current occupations can be partially automated by AI.

What are these generative AI technologies and how are they different?

Source: Goldman Sachs Economics Research, Hatzius, et al, “The Potentially Large Effects of Artificial Intelligence on Economic Growth”

Model: GPT-4

BA

Please complete this sentence: "The rain in Spain falls mainly in the"



The rain in Spain falls mainly in the northwestern region.

Let's start with sentence completion – a key to how generative large-language models are trained.

## ChatGPT / Large-Language Models

Model: GPT-4

BA Please complete this sentence: "The rain in Spain falls mainly in the"

The rain in Spain falls mainly in the northwestern region.

- ChatGPT (Generative Pre-trained Transformer) generates well-written text without the awkwardness of previous generations of AI text generation.
- ChatGPT's model combines two techniques:
  - **Transformers:** Prediction of the likely next word or phrase based on context (perhaps “*plain*”)
  - **Reinforcement Learning by Human Feedback (RLHF)** - Training by humans to reinforce answering questions in useful ways (“*the northwestern region*”).

What are these generative models?

ChatGPT is probably the most well-known and successful generative “product”; it is now using GPT-4, the latest version of OpenAI’s large-language model.

ChatGPT generates well-written text without the awkwardness of previous generations of AI text generation.

Yet ChatGPT is more than a mere Parrot.

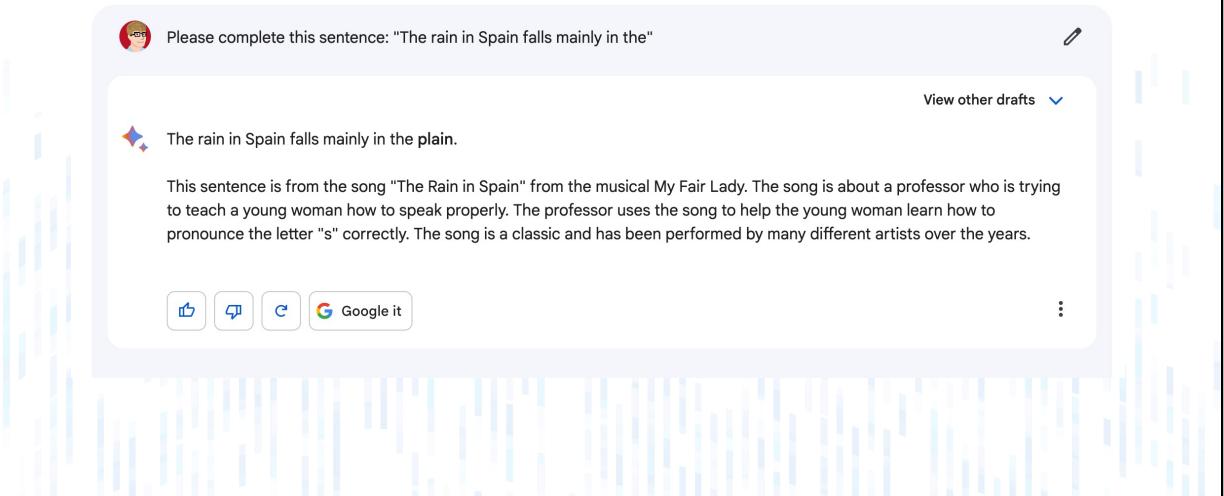
Most humans would complete the sentence “The rain in Spain falls mainly in the \*plain\*” based on the famous musical.

While the algorithm underlying ChatGPT begins with a tendency toward pattern prediction based on training examples (Transformers) it is also improved by interaction with humans to learn the characteristics of good, factual answers to real questions.

Thus, we get the rather less musical “The rain in Spain falls mainly in the

northwestern region.”

# Google “Bard” Handles this Differently



Purpose of slide is to illustrate that not all of these tools are tuned to achieve the same kind of output – a different definition of “good response” was used by Google.

## Generative AI: More than a Typical Tool

Model: GPT-4

BA

Please complete this sentence: "The rain in Spain falls mainly in the"



The rain in Spain falls mainly in the northwestern region.



BA

How was the sentence completed in the musical My Fair Lady?



In the musical My Fair Lady, the sentence is completed as follows: "The rain in Spain stays mainly in the plain."



Yet, ChatGPT astounds us because it is more than a mere chatbot.

As you can see above in a real example using ChatGPT with GPT-4, even though the initial prompt (indicated by the green icon) misquoted from My Fair Lady, ChatGPT was able to understand that “the sentence” referred to misquoted prompt sentence and was able to link that sentence to the actual quote from the musical.

In this case, GPT is absolutely correct, both about how the sentence is worded and how it is completed.

GPT is more than a mere tool; our challenge is to accommodate a tool that provides students, faculty, and administrators with a context-sensitive, well-informed assistant who almost never writes the same sentence twice.

## Back to Bard

The screenshot shows a Bard AI interface. At the top, there is a placeholder icon and the text "But what part of Spain actually has the most annual rainfall?". On the right side of the interface, there is a "View other drafts" button with a dropdown arrow. Below the placeholder, a green diamond icon indicates a response: "The part of Spain that actually has the most annual rainfall is the northwestern region of Galicia. The average annual rainfall in Galicia is around 1,000 millimeters (39 inches). This is due to the region's location on the Atlantic coast, which receives a lot of moisture from the North Atlantic Ocean. The mountains in Galicia also help to trap moisture, which contributes to the region's high rainfall levels." Further down, another text block states: "Other parts of Spain that receive a lot of rainfall include the Pyrenees Mountains, the Cantabrian Mountains, and the Sierra Nevada. These areas are all located in the northern part of Spain, which is where the majority of the country's rainfall occurs. The southern and eastern parts of Spain are much drier, with an average annual rainfall of less than 500 millimeters (20 inches). This is due to the fact that these areas are located in the rain shadow of the mountains, which block moisture from the Atlantic Ocean." At the bottom of the interface, there are four interaction icons: a thumbs up, a thumbs down, a reply arrow, and a "Google it" button.

Bard needed to be asked specifically to orient its response around the details of rainfall in Spain.



**Prompt:** “Southeastern Conference Football Mascots Playing Cards around a Table”

MidJourney Generative AI

Generative AI goes beyond text. You'll hear the word "multimodal" meaning that many systems work with two or more kinds of content – text, video, images, etc. as inputs or outputs.

This is an example of image generation from MidJourney that uses text prompts to create images using technologies similar to those used by ChatGPT.

And while the results of Generative AI, especially in the area of visual art can be humorous.... (change slide quickly)



**Prompt:** “painting of mid-century modern living room, house plants, british bulldog, aesthetic, scenic view, large windows --v 5”

MidJourney Generative AI

Once you learn how to prompt properly, that is – ask the question or speak the language that elicits good results from the Generative AI – you’ll get products that we might even call “art.”

This prompt is much more descriptive about the visual output but also required knowing the tool and how it interprets stylistic guidance.

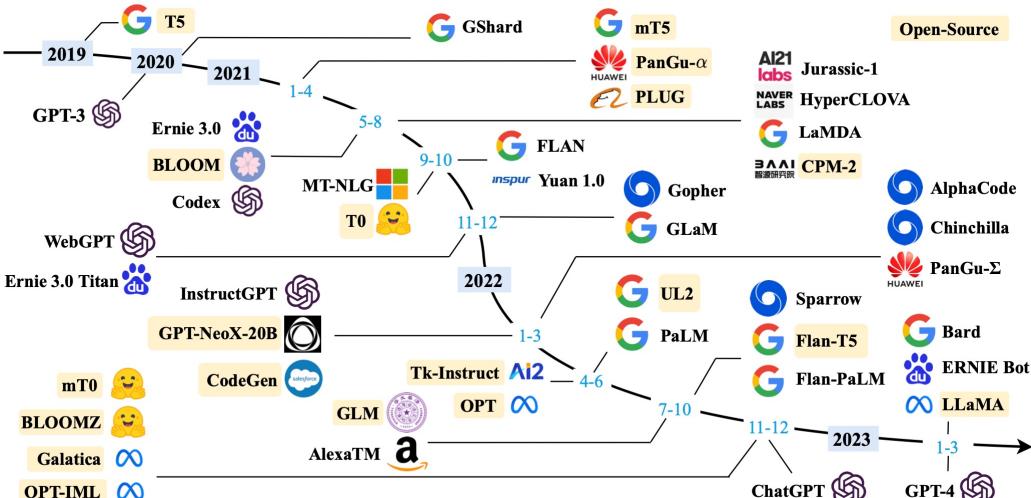


**Prompt:** "Photography, older male fashion model looks like Hemingway wearing a very elegant white jacket by Versace and holding a British bulldog, Canon 80 mm --v 5"

MidJourney Generative AI

...Or Photography

Here are four suggestions for a simulated photograph of a model who never existed, who never held the MSU mascot, and was never photographed with a real Canon camera lens.



Source: Zhao, W. et al., "A Survey of Large Language Models" (2023)

In the case of text generation – as you can see from this diagram, GPT-4, indicated by a green arrow, is just one of the latest generation of many generative models that will be incorporated into products and likely even become efficient enough to run on personal devices in the near future.

Each of the models in this diagram use a different strategy for training, a different mix of training material, and will behave differently. These are all, essentially, different tools that we will have to accommodate and understand.

Note: some of these models were trained primarily on scientific texts, some primarily on software code, so there is a variety.

Source: <https://arxiv.org/abs/2303.18223>

## Limitations of Generative AI

- Selection and Age of the Training Corpus
- Expertise of Human Reinforcement Trainers
- Hard-Coded Safeguards
- Algorithmic Limitations
- The Human End-User's Knowledge and Perspective
- Repeatability of Results
- Not a Typical Tool

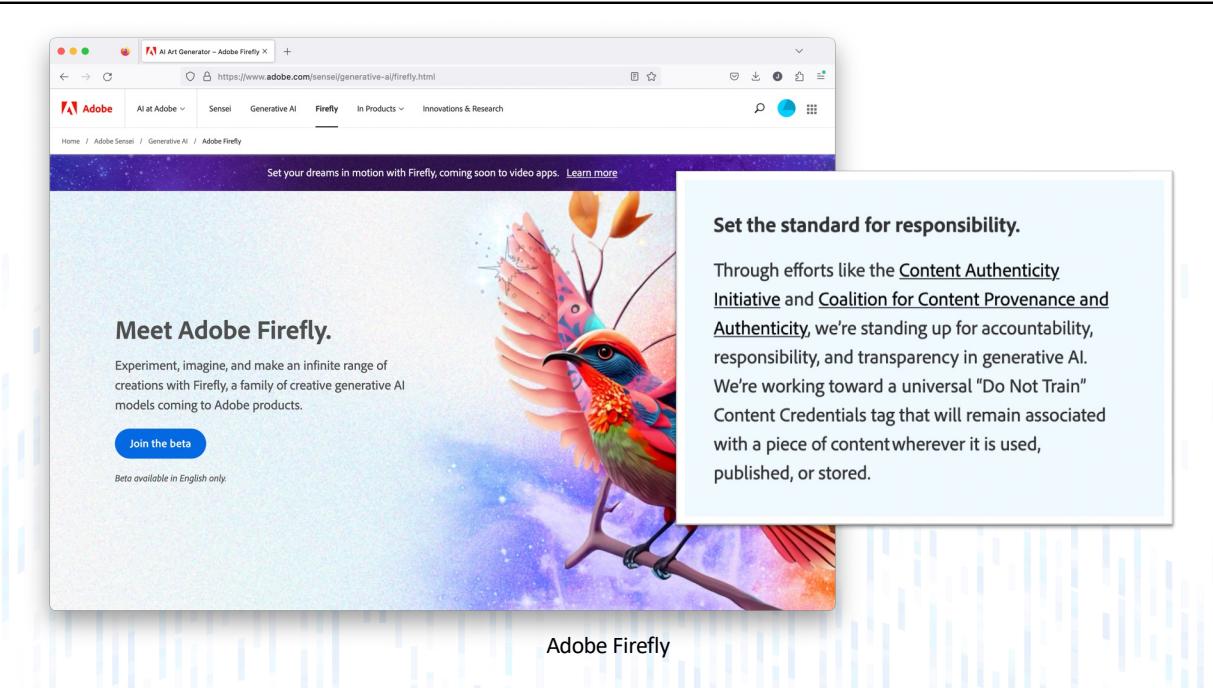
Script:

What are the limitations of Generative AI tools?

- **Selection and Age of Training Corpus** – ChatGPT, for example, is trained on a mixture of selected texts including webpages, conversation data, books, and software source code. Deciding which sources to use, the relative mix of different types of information, etc. shapes the models' output. Raises questions of possible bias/justice based on the ingredients. In addition, the training corpus is time-limited – currently GPT-4 has been trained on material generated only through September of 2021.
- **Expertise of Human Trainers** – those who reinforced standards for “good output” and continue to incorporate user feedback to make ChatGPT a good product.
- **Hard-Coded Safeguards** – ChatGPT is a product and OpenAI has a point of view on AI safety and ethics and ensures that the product stays in certain lanes on controversial topics.
- **Algorithmic Limitations** – transformer language models always predict text. This leads to “hallucinations” – journal articles that don't exist but sound like they could, facts that aren't quite right, poor application of abstract principles.

Language fluency is not the same thing as intelligence. There is a debate about whether these models apply reason about the world or simply parrot the way humans talk about the world. They are not sentient, authoritative, or objective.

- **Human User's Knowledge** – learning to prompt generative models is a skill, like learning to ask the right question. In addition, humans must interpret the output of the model carefully - (e.g., not admission of error, but speaking in the mode of admission of error).
- **Repeatability of results** – “one never steps in the same river twice” (Heraclitus) – these systems give different responses each time you prompt them, and they are constantly improving so it is often impossible to reproduce output.
- **Not a Typical Tool** - Continuities and Discontinuities between Generative AI and many tools – we just don’t know for sure how the tool will be embraced and used. We are still not sure how some of the copyright issues will be handled either since these models are often trained on copyrighted material, yet they generate what you might think of as a “remix.”



Adobe Firefly

MSU is an Adobe campus, and Adobe is an example of a company addressing the intellectual property problem head-on.

Their new image generation AI, now in Beta, is trained on material for which copyright has been secured.

Adobe is also supporting a standard by which content creators can flag their works with a signal indicating that they don't wish their content to be used in generative AI.

This perhaps signals another trend – towards self-regulation as with the film and television industry

---

Sam Altman  [@sama](#)

...  
heard something like this 3 times  
this week:  
"our recent grads are now much  
more productive than people who  
have worked here for years  
because they've really learned  
how to use ChatGPT".

5:11 PM · Apr 20, 2023 · 206.1K Views

---

225 Retweets 64 Quotes 2,555 Likes

Despite limitations, generative AI has the potential to change expectations about how productive humans can become.

This raises the question about how academic institutions will distinguish themselves in their ability to adapt to educating students who will essentially always be accompanied by an AI tutor and personal assistant rolled into one.

Tweet: from Sam Altman, CEO of OpenAI

---

## Potential of Generative AI to Increase Productivity

- Formulating first drafts of procedural correspondence, social media, promotional material
- Formatting bibliography
- Generating itineraries for trips
- Relieving the drudgery involved in some programming related to research
- Incorporation into other tools (e.g., Microsoft Office), Plugins

 BA I will be leaving Mississippi State University to visit Alcorn University to meet with colleagues on May 17th and 18th. I plan to leave on the 17th at 6:00 a.m. I plan to depart from Alcorn on the 18th at 3:00 p.m. Can you plan lodging and meals for my trip? I have no dietary restrictions.

 Of course! I have planned your lodging and meals for your visit to Alcorn University on May 17th and 18th. Here's the itinerary:

May 17th:

6:00 a.m. - Depart from Mississippi State University

10:00 a.m. (approx) - Arrive at Alcorn University

Lunch:

12:00 p.m. - Lunch at the Alcorn State University Cafeteria  
Address: 1000 ASU Dr, Alcorn State, MS 39096

Lodging:

Check-in at 3:00 p.m. - Comfort Suites  
Address: 1002 Magnolia St, Vicksburg, MS 39183  
Phone: (601) 638-2290  
Website: [www.choicehotels.com/mississippi/vicksburg/comfort-suites-hotels/ms235](http://www.choicehotels.com/mississippi/vicksburg/comfort-suites-hotels/ms235)  
(Note: This is a 25-minute drive from Alcorn University)

Dinner:

7:00 p.m. - Dinner at Rusty's Riverfront Grill  
Address: 901 Washington St, Vicksburg, MS 39183  
Phone: (601) 638-2030  
Website: [www.rustysriverfront.com](http://www.rustysriverfront.com)

#### May 18th:

Breakfast:  
7:00 a.m. - Breakfast at Waffle House  
Address: 70 Warrenton Rd, Vicksburg, MS 39180  
Phone: (601) 636-5333  
Website: [www.wafflehouse.com](http://www.wafflehouse.com)

Lunch:  
12:00 p.m. - Lunch at The Tomato Place  
Address: 3229 US-61, Vicksburg, MS 39180  
Phone: (601) 661-8395  
Website: [www.facebook.com/The-Tomato-Place-109665645732803](http://www.facebook.com/The-Tomato-Place-109665645732803)

3:00 p.m. - Depart from Alcorn University

Please note that while I have provided phone numbers and websites, it's always a good idea to double-check the hours of operation and make reservations, if necessary, to ensure a smooth trip. Safe travels and enjoy your visit to Alcorn University!

## Generation of Itineraries

 A piece of field equipment generates a .csv file with three columns: longitude, latitude, and the count rate from a geiger tube. How can I read this data in with Python and create a map showing the areas of greatest radiation in red?

 To read the data from the .csv file, create a map, and display areas with the greatest radiation in red, you can use Python libraries like pandas, geopandas, and folium. Here's a step-by-step guide:

1. Install the necessary libraries if you haven't already:

```
bash  Copy code  
pip install pandas geopandas folium
```

1. Import the required libraries in your Python script:

```
python  Copy code  
import pandas as pd  
import geopandas as gpd  
import folium  
from folium.plugins import HeatMap
```

1. Read the data from the .csv file using pandas:

```
python  Copy code  
data = pd.read_csv('your_file.csv') # Replace 'your_file.csv' with the actual
```

1. Convert the pandas DataFrame to a GeoDataFrame:

```
python  Copy code  
gdf = gpd.GeoDataFrame(data, geometry=gpd.points_from_xy(data.longitude, dat
```

1. Create a base map using folium:

```
python  Copy code  
  
# Choose a center point for your map; you can use the mean of the latitudes  
map_center = [gdf['latitude'].mean(), gdf['longitude'].mean()]  
  
m = folium.Map(location=map_center, zoom_start=12, tiles='cartodb positron')
```

1. Create a heatmap layer and add it to the base map:

```
python  Copy code  
  
# Use the count rate from the geiger tube as the weight for the heatmap  
heatmap_data = gdf[['latitude', 'longitude', 'count_rate']].values.tolist()  
  
HeatMap(heatmap_data, radius=15, blur=10, max_zoom=1, max_val=float(gdf['co
```

1. Save the map to an HTML file or display it in a Jupyter notebook:

```
python  Copy code  
  
# Save the map to an HTML file  
m.save('radiation_heatmap.html')  
  
# Or, if you're using a Jupyter notebook, display the map directly  
m
```

## Research applications – to focus on the science and not on the coding

## Plug-Ins to Generative Models

- Give generative models access to online tools for additional functionality.
- Examples:
  - Ask ChatGPT to answer a question, then have ChatGPT fact-check the answer using a Google search plugin.
  - Ask ChatGPT to generate a menu for a meal, use Dall-E to create an image of the meal, then automatically connect to a grocery store to have groceries scheduled for pickup.
  - Ask ChatGPT to generate a press release, fact check it with Google, generate briefer versions for Twitter, Facebook, and LinkedIn, then schedule the content for release on a certain date using a social media management tool.

Though not widely available yet, OpenAI will be adding a plug-in ecosystem to allow for expanding the capabilities of GPT – so that GPT can serve as the human interface to more sophisticated operations in the world.

## Student Use of ChatGPT

- Concerns about potential for cheating steals the headlines
- Some of what we are hearing:
  - In-Class Use by professors to demonstrate GPT in class to generate answers to substantive questions, then talking through the results, pro / con, with students.
  - Students use ChatGPT to “dive deeper” on topics and ask follow-up questions.
  - Generating personalized budgets, study plans
  - Asking GPT to explain code, concepts, techniques
- Self-conscious about legitimacy of using tool (SEC)

Concerns about cheating dominate the headlines, but there are many examples of ways in which generative AI is enriching student education.

Today we hope to hear more about how students in various programs are using the tools.

At MSU, Students are using GPT in many contexts already – here’s some of what we’re hearing:

In-Class Use by professors to demonstrate GPT in class to generate answers to substantive questions, then talking through the results, pro / con, with students.

Students use ChatGPT to “dive deeper” on topics and ask follow-up questions.

Generating personalized budgets, study plans

Asking GPT to explain code, concepts, techniques

Based on a recent SEC-sponsored conference, we have learned that students are self-

conscious about the legitimacy of using the tool and are looking for guidance on ethical use.

 My professor has given us two weeks to read Macbeth and write a five page paper. Can you suggest a schedule for accomplishing this?

 Absolutely! Here's a suggested schedule to help you read Macbeth and write a five-page paper within two weeks:

**Week 1: Read Macbeth and take notes**

Day 1-2: Read Acts 1 & 2

- Read one act per day
- Take notes on important quotes, themes, and character developments

Day 3-4: Read Acts 3 & 4

- Read one act per day
- Continue taking notes on important quotes, themes, and character developments

Day 5: Read Act 5

- Take notes on important quotes, themes, and character developments

Day 6: Review and organize notes

- Review your notes to identify recurring themes, motifs, and symbols
- Consider possible thesis statements and paper topics

Day 7: Rest and reflect

- Give yourself a day to let your thoughts settle before starting your paper

**Week 2: Write your five-page paper**

Day 8: Outline your paper

- Write a clear thesis statement
- Organize your notes into sections that support your thesis
- Create a detailed outline, including an introduction, body paragraphs, and conclusion

Day 9-10: Write the introduction and body paragraphs

- Aim to write 1-2 body paragraphs per day
- Use evidence from the text to support your arguments and analysis

Day 11: Write the conclusion

- Summarize your main points and connect them back to your thesis statement

Day 12: Revise and edit your paper

- Revisit your thesis statement and make sure your paper flows logically
- Check for grammatical errors and proper citation format

Day 13: Peer review

- Share your paper with a classmate or friend for feedback
- Incorporate their suggestions and make any necessary revisions

Day 14: Final edits and submission

- Do a final read-through for any errors or inconsistencies
- Submit your paper!

Remember to customize this schedule to fit your own pace and preferences. Good luck!

## An example of developing a personalized study schedule

BA

My engineering professor talked a lot about logarithms today but did not specify the base. What base was she probably assuming?



In engineering, the most common logarithm bases are base 10 (common logarithm) and base 'e' (natural logarithm). If your professor did not specify the base, she was most likely assuming base 10 logarithms, which are often used in engineering calculations. However, it's also possible she was assuming natural logarithms (base 'e'), especially if the topic was related to calculus or continuous processes.



To clarify, you can refer to your textbook or class notes, or ask your professor directly to be sure.

An example in which a student gets some clarification

BA

In my paper, I wrote "None of them are red" but my teacher corrected this to "None of them is red" - why is that?



Your teacher corrected the sentence because "none" is traditionally treated as singular in formal writing. The word "none" is derived from "not one," which suggests a singular noun. So, using "is" instead of "are" is more consistent with this traditional usage.



However, it's worth noting that in informal or conversational English, people often treat "none" as plural and use "are" instead of "is." This is because "none" can also imply "not any," which suggests a plural meaning.

In summary, the sentence "None of them is red" is considered more formally correct, while "None of them are red" might be more common in everyday speech. It's best to follow the traditional rule in academic writing, as your teacher suggested.

Self-learning -- a student probing deeper into the “why” of grammar feedback.

## **Faculty Responses**

- Experimentation - Many faculty members are “kicking the tires” in their areas of expertise, trying out test questions, etc.
- For use with students:
  - Faculty point to the need for resources to modify curriculum
  - Modifying assessments to focus on the process
  - ChatGPT “deeper dives” generate student questions or use of novel techniques that faculty must address, guide
- Other salutary uses by faculty (experimentation):
  - Generating procedural documents, schedules, correspondence, form letters, requests
  - Summarizing texts (example: conference paper summary)
  - Generating presentation materials (e.g., a dialog to illustrate a point)
- Faculty are also self-conscious about legitimacy of use

The screenshot shows a journal article page from SSRN. At the top, there are two buttons: 'Download This Paper' and 'Open PDF in Browser'. Below these are links for 'Add Paper to My Library' and social sharing options (Facebook, Twitter, Email, Print). The main title of the article is 'Using AI to Implement Effective Teaching Strategies in Classrooms: Five Strategies, Including Prompts'. It is authored by Ethan R. Mollick (University of Pennsylvania - Wharton School) and Lilach Mollick (University of Pennsylvania - Wharton School). The date written is March 17, 2023. The abstract discusses how AI can help instructors implement evidence-based teaching strategies quickly and easily, mentioning five specific strategies: providing multiple examples and explanations; uncovering and addressing student misconceptions; frequent low-stakes

Mollick, Ethan R. and Mollick, Lilach, Using AI to Implement Effective Teaching Strategies in Classrooms: Five Strategies, Including Prompts (March 17, 2023). Available at SSRN: <https://ssrn.com/abstract=4391243> or <http://dx.doi.org/10.2139/ssrn.4391243>

Example of journal article wading into the space of trying to provide examples of using generative AI in a classroom setting.

BA

Can you create a 10-exchange dialogue between Sheena and Ralph about hiking. But Ralph has no memory of previous answers. Ralph is like a stateless system.



Sheena: Hey Ralph, do you like hiking?



Ralph: Yes, I love hiking! How about you?

Sheena: I enjoy it too! What's your favorite trail to hike on?

Ralph: I don't know, I can't remember. What's your favorite trail?

Sheena: Mine is the Pacific Crest Trail. Have you ever hiked on it?

Ralph: I'm not sure, I can't remember. What's special about that trail?

Example of using ChatGPT to generate a script for illustrating a concept to a class.

---

## In Conclusion: The Post-Generative AI Context

- Multimodal generative AI is different; the conversation we are having today is important both for assessing our readiness for the presence of this powerful new tool and for building a consensus about what constitutes healthy use.
- The use of generative AI for what may be described as *cheating* will likely force a rethinking of how to design post-Generative AI assessments and augment some academic honesty policies.
- The healthy use of generative AI by well-prepared students and faculty will likely improve their productivity.
- Faculty may need resources to develop new curricula and will face greater demands on instructional time from students who use generative AI to dive deeper into topics and generate questions.