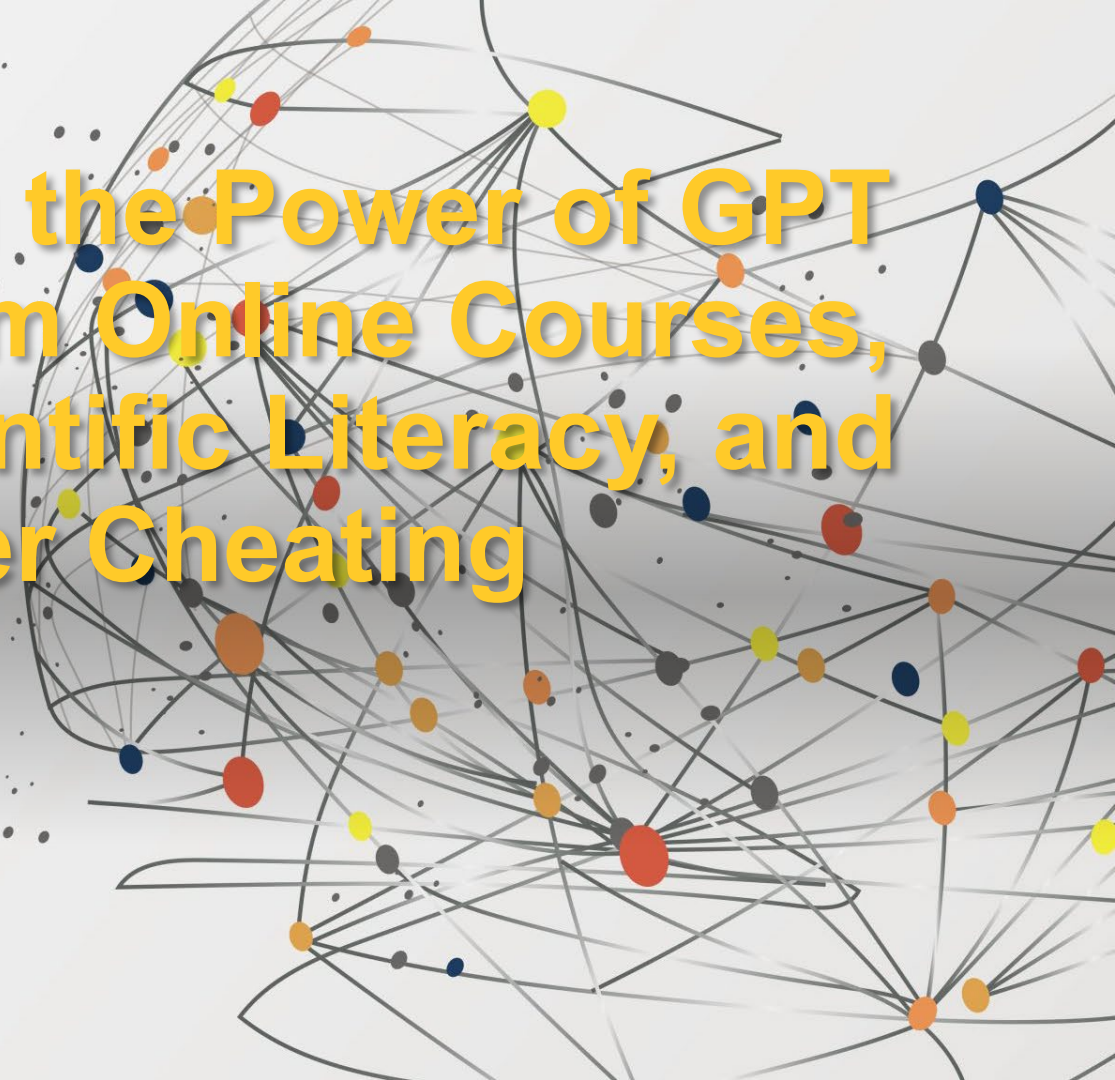




Harnessing the Power of GPT to Transform Online Courses, Foster Scientific Literacy, and Deter Cheating



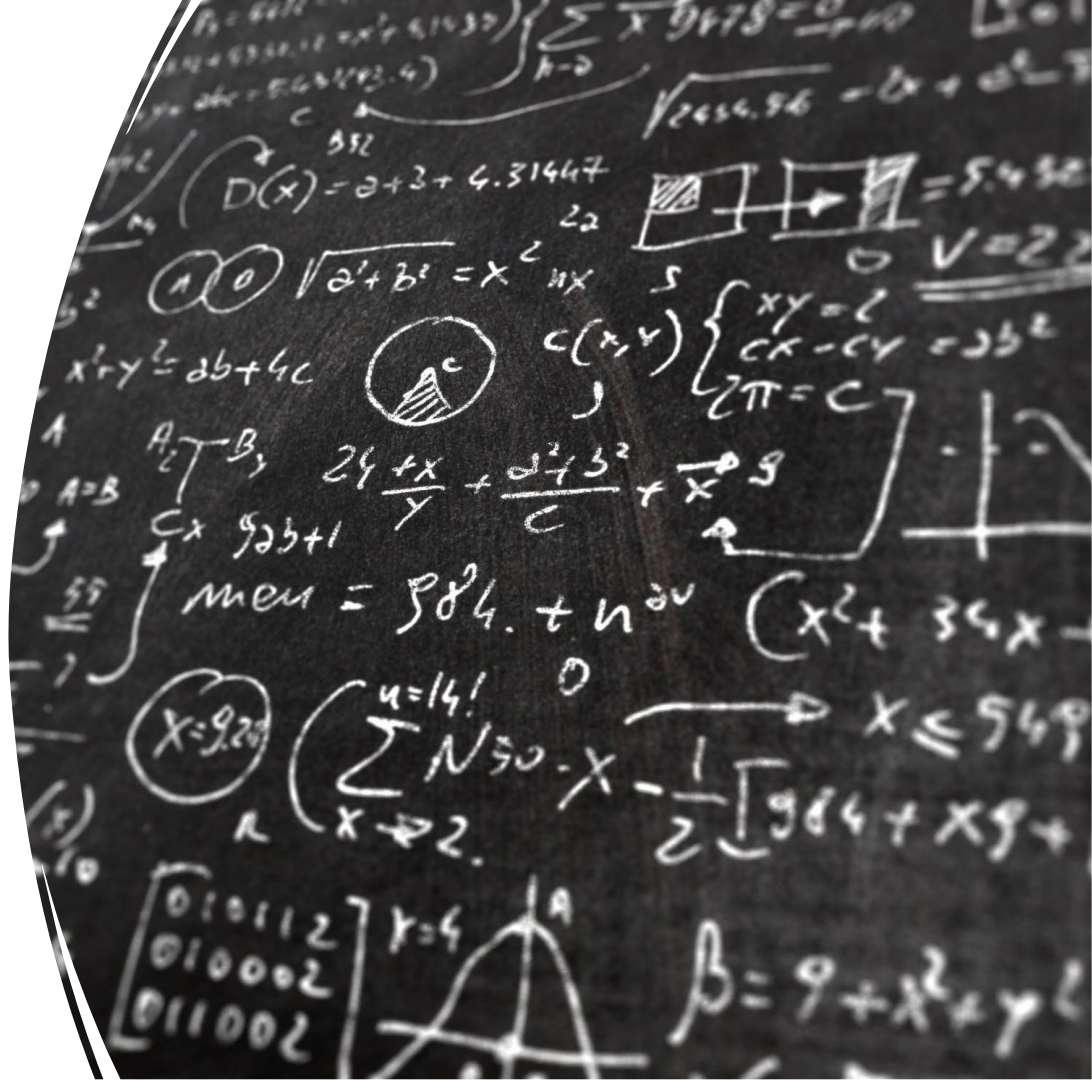


Goals for the Project

- Discourage cheating in online GEP science courses by creating unique assessments for each student using large and modifiable test banks.
- Combat mis/disinformation by harnessing the ability of GPT to mimic different personalities to teach science literacy skills.

Project Overview

- We focused on 2 online GEP science courses: Astronomy (AST 2002) and Physics (PHY 1038)
- We used GPT to assist in developing problem banks, learning modules, and new assessment problems.





Course Breakdown (PHY 1038)

- Tong Wan
- PHY1038 Physics of Energy, Climate Change, and the Environment
- Web-based
- Designation: HIP
- Technology applied in the course as part of the project: ChatGPT



Project Timeline (PHY 1038)

Accomplished:

- Created 5 problem banks for midterm exams
- Developed a learning module on logical fallacies in misinformation
- Changed 5 paper and pencil homework assignments into Canvas quiz format & added general feedback to each question

To be done by the end of Spring 2025:

- Revise logical fallacies learning module & more problem banks (and larger in size) for exams.
- Analyze student response to identify common patterns using GPT and learning analytics.



Course Breakdown (AST 2002)

- Richard Jerousek
- AST 2002 Introductory Astronomy
- Web-based
- Technology applied in the course as part of the project: ChatGPT



Project Timeline (AST 2002)

Accomplished:

- Created >650 exam questions tagged by LO in 139 question banks.
- Implemented 2 learning modules:
 1. Understanding graphs
 2. Basic Quantitative skills and Essentials of Statistics

In progress/to be done by the end of Fall 2024:

- 4 learning modules (*Each about 80% complete thanks to amazing TA Judith Lojo!*):
 1. Identifying Valid Scientific Arguments
 2. Evaluating the Validity of Sources
 3. Understanding Elements of Research Design and How They Impact Scientific Conclusions
 4. Evaluating the Use and Misuse of Scientific Information
 5. Justifying Inferences with Quantitative Data



Supporting Details

ChatGPT Prompt: I want you to pretend to be Bob. Bob is skeptical of the idea of anthropogenic climate change. Bob thinks that earth's climate has always gone through fluctuations, and that currently observed trends are just a part of that. Pretend to be Bob, and write me a paragraph stating why Bob does not believe that we should be concerned about climate change.

[...additional conversation with ChatGPT...]

Now give me an argument as though it were stated by a popular TikTok influencer in a TikTok, but arguing that humans are not the primary cause of temperature change

Output: “Hey, TikTok fam! 🌍🔥 Let's talk about global warming and greenhouse gases. So, you might've heard that we humans are the main villains in this climate change story, right? But hold on a sec! Did you know that greenhouse gases aren't entirely our fault?

Volcanic eruptions and natural processes release tons of these gases into the atmosphere. And trust me, they've been doing it long before we hopped on the industrialization train!

I'm not saying we should ignore our impact; we gotta be responsible Earth citizens! But let's not make ourselves the main scapegoats.

We need to find that balance, fam! Responsible choices, cleaner tech, and sustainable practices, without crushing our industries. It's a whole package deal!

So, stay informed, keep the dialogue going, and let's work together to make a real change. 🌱💡 #ClimateReality #GreenhouseGasesTruth”



Supporting Details

Car Salesman

Imagine you're visiting a car dealership, and a salesperson approaches you with an exciting offer for the latest model of the Speedster X1. The salesperson begins:

"Welcome! I see you've taken an interest in our Speedster X1. Let me tell you why this is the perfect car for you. When you compare it to similar models in its class, like the Compact Y2 and the Hatchback Z3, the X1 stands out for its incredible acceleration, going from 0 to 60 mph in just 5 seconds. Unlike the Y2 and Z3, the X1 offers unmatched performance and style.

Now, some folks are concerned about fuel efficiency. But let me direct your attention to this car's exclusive road trip feature. Imagine cruising through the most scenic routes the country has to offer, guided by the best navigation system on the market. Plus, it's hard to overlook the fact that the X1 has won several design awards. Isn't it great to drive a car that's both a powerhouse and a beauty?"

Question 4

10 pts

Where did the salesperson use the "red-herring" fallacy in their statement? Choose more than one answer if applicable.

- Mentioning the car's several design awards.
- Highlighting the navigation system's road trip feature in response to concerns about fuel efficiency.
- Praising the X1 for its unmatched performance and style.
- Comparing the X1's acceleration to the Compact Y2 and Hatchback Z3.



Supporting Details

The following is a quote from a hypothetical podcaster on the topic of climate change.

"Hey everyone, welcome back to EcoSkepticViews! Today, let's dive into the myths surrounding the so-called 'climate crisis.' First off, have you ever stopped to consider the nature of CO₂? This gas, which climate alarmists claim is baking our planet, is completely invisible. Yes, you heard right—CO₂, the main villain in the global warming narrative, cannot be seen with the naked eye. How can something invisible have such a massive, visible impact on our planet's climate?"

Now, remember that really cold winter we had last year, or that surprisingly chilly summer day? These aren't just random occurrences. They're clear indicators that the planet isn't just on a one-way trip to overheating. And let's not forget about those brief periods in human history where temperatures were much warmer than today, and yet, civilization thrived. These snippets of warmer times and colder seasons present a much-needed perspective on the natural fluctuations of our planet's climate.

But here we are, focusing on CO₂—a gas you can't even see! Instead of getting wrapped up in baseless fears about invisible gases, we should turn our attention to pressing environmental issues that we can see and directly impact, like reducing waste or conserving water. Let's concentrate on real, actionable environmental goals and not get sidetracked by the climate change narrative that's based more on fear than on facts. Stay rational, stay inquisitive."

Write a comment or a counterargument in response to this quote.



You

imagine a mysterious rock is found off the shore of a beach. scientists (credible ones) are studying the sample of rock. the general public thinks it might be a meteorite but the scientists have proven it is not an asteroid, but a regular old rock. so, the general public has been mistaken.

please write a 5 sentence paragraph from the perspective of a news reporter who is delivering news to the public about the rock. please include that while people think its from space, it's actually a type of rock that is commonly mistaken for a meteorite



ChatGPT

In a captivating turn of events, the mysterious rock discovered off the beach shore, initially thought to be a celestial visitor from space, has been debunked by rigorous scientific analysis. Despite widespread excitement among the public about the possibility of an extraterrestrial origin, credible scientists have concluded that the rock is, in fact, an entirely terrestrial entity. This revelation challenges the prevailing belief that the enigmatic find was a meteorite, unraveling a narrative fueled by speculation. The experts have meticulously studied the sample, revealing its true identity as a conventional rock often mistaken for meteorites due to shared characteristics. This scientific clarification underscores the importance of thorough investigation and highlights the prevalence of misconceptions in the public's perception of celestial phenomena.

Supporting Details

You

A student was given this question on a test:

"Suppose an article in the local newspaper says an unidentified comet has been sighted heading towards Earth. The article says that if the comet is large enough, it could wipe out all of humanity. There are little mentions of credible sources in the article. How would you apply critical thinking skills when reading this article? (Select all that apply)."

The student responded with the following sentence:

"Compare the likelihood of asteroids and comets to hit Earth, which makes the likelihood of that comet hitting Earth to be far less likely."

Why is the student wrong? In three sentences

ChatGPT

The student is wrong because comparing the likelihood of asteroids and comets hitting Earth doesn't directly address the specific claims made about the unidentified comet. The student's response also does not evaluate the lack of credible sources in the article, which is a key aspect of critical thinking. Instead, the student should focus on assessing the quality and reliability of the information presented, and seek additional evidence from reputable sources to confirm or refute the claims.



Practice

Suppose an article in the local newspaper says an unidentified comet has been sighted heading towards Earth. The article says that if the comet is large enough, it could wipe out all of humanity. There are little mentions of credible sources in the article.

How would you apply critical thinking skills when reading this article? (Select all that apply).

Pick **all** of the correct answers

Recognize the possibility of humanity being wiped out and prepare for the worst.

Compare the likelihood of asteroids and comets to hit Earth, which makes the likelihood of that comet hitting Earth to be far less likely.

This answer choice is wrong because comparing the likelihood of asteroids and comets hitting Earth doesn't directly address the specific claims made about the unidentified comet. This response also does not evaluate the lack of credible sources in the article, which is a key aspect of critical thinking. Instead, one should assess the quality and reliability of the information presented by seeking additional evidence from reputable sources to confirm or refute the claims.

Seek out credible academic material on comets and use that to deduce if the newspaper article is exaggerating or not.

Consider the possible motivations of the newspaper company for publishing an article like this, such as exploiting public fear for sales.

Try Again

Incorrect

You have either missed some correct answers or selected some incorrect answers.



UCF



Lessons Learned

- The hard part is human learning!
 - "What do we really want GPT to do? (Precisely)
- ChatGPT is not so great and creating questions while sticking to a single learning objective.
 - Lots of hallucinations
 - Not great for science
 - Paid access for open AI now provide many different GPTs including those trained on physics and astronomy which were not available at the start of the project



Project Highlights

- Positive SPIs in AST 2002 with *decreasing* average grade!
- Students expressed appreciation toward the assessment problems in PHY 1038 (particularly the ones related to misinformation on climate change).



Evaluation Plans/Results (PHY 1038)

We will analyze student responses to the misinformation questions.

- Did students correctly identify most relevant evidence to support their claim?
- Did students identify the logical fallacies in the misinformation?
- What were the common themes in student responses? (thematic analysis)

We will examine SPI data and look for students' comments on the changes in the courses.



Evaluation Plans/Results (AST 2002)

We will analyze scientific literacy pre- and post- class assessments taken from the Test of Scientific Literacy Skills (TOSLS)

- Data has been taken during:
 1. Fall 2021
 2. Fall 2022
 3. Fall 2023 (Test banks implemented)
 4. Spring 2024 (Test banks implemented)

Preliminary data taken during 1 – 3 shows average learning gains of 20% from pre to post test (course is effective) but no evidence of improvements due to test banks alone.



Thank you!