

Large Language Models Like ChatGPT Bring New Challenges to Higher Education

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ABSTRACT

This paper presented the advancement of technology and the concerns about its impact on higher education. The combined emergence of Large Language Models (LLMs) and Generative Pre-Trained Transformer has resulted in applications like ChatGPT which have revolutionized higher education, offering unprecedented access to information and facilitating rapid document generation and summarization. Since the output is written in a tone that appears objective and unbiased, there is a temptation among its users to trust its quality and publish its contents verbatim despite its known propensity to hallucinate with unsubstantiated claims. At the same time, this technology raises concerns about plagiarism and the potential for individuals to claim authorship of LLM-generated content. To address these concerns, universities must work together to adapt learning assessment methods that promote responsible LLM usage to ensure academic integrity and foster deeper scholarship.

KEYWORDS: Large Language Models, AI-assisted learning, Intellectual integrity

Introduction

With the release of ChatGPT 3.5 by OpenAI in November 2022, teachers and students worldwide discovered that Large Language Models (LLMs) coupled with Generative Pre-Trained Transformers (GPT) give rise to a new and versatile technology (ChatGPT) that can tap information from a variety of resources on the internet and provide personalized assistance and learning experiences. ChatGPT has passed the Turing test (by producing output that appears to be human generated) and already outperforms many humans in numerous domains. ChatGPT 3.5 has passed standardized academic tests (such as SAT, GMAT, and the California Bar Exam) with at least a B grade or scores more than the 80th percentile. Preliminary tests with ChatGPT 4.0 suggest that the latest version significantly improves the performance over that of version 3.5.

(OpenAI, 2023d) Within one year of the launch of ChatGPT 3.5, global development based on this and similar technologies has launched over 5,000 unique apps and services (Futurepedia, 2023) which can access one or more of the nearly 16,000 LLMs that are currently available. (Gao, 2023). All this rapid development signals the dawn of a new era of AI applications and smart computers. This paper attempts to trace the key milestones that have led to this development, explores the massive changes this technology will bring to higher education, and makes recommendations to promote fairness and effectiveness as human interact with this technology.

The Development of Language Models

ChatGPT, and other apps like it, relies on large language models created from a

massive collection of documents that has been restructured to represent all the ways a language has been used while also linking the key concepts together. The resulting LLMs can be used to interpret questions, identify key points, and model the style of reports to be generated. This is the result of over a century of research and development starting with the earliest attempts at developing language models by Andrey Markov, a Russian mathematician, who demonstrated in 1913 a statistical pattern where the measured probabilities of transitions between possible subsequent steps could be used to predict the next most-likely step within a network of concepts or ideas. (Markov, 1913)

When Markov chains are applied as a model to describe sequences of words in sentences, the selection of the next word is based on the probability of words in observed word sequences. Even though this level of Markov processing did not consider the part of speech or position within a sentence, it could suggest the most-likely word to follow and calculate the likelihood of the resulting sentence. This can be demonstrated with the following toy Markov chain that represents the interaction between the 9 words in the first 6 sentences of McGuffey's Eclectic Primer. (McGuffey, 1909)

1. a rat.
2. a cat.
3. Ann has a cat.
4. the cat has a rat
5. the rat ran at Ann.
6. the cat ran at the rat.

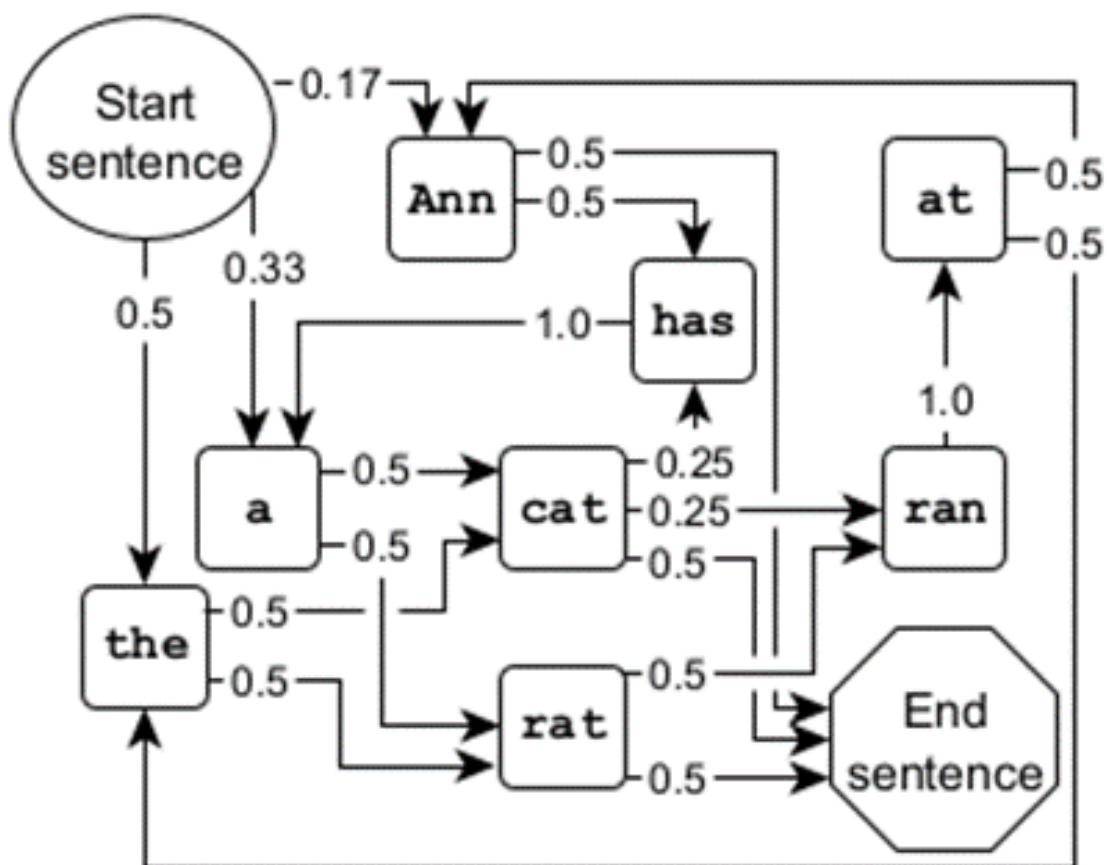


Figure 1. Markov chain that represents the first 6 sentences of McGuffey's Eclectic Primary Reader. (Numbers represent the probability of being the next link).

The corresponding Markov chains are shown in Figure 1 and sample sentences generated from this chain are shown in Table 1. This model can reproduce the original sentences, but it also generates many other grammatically correct but unsubstantiated statements (such as "Ann has a rat"). This kind of response is often called a hallucination as

the message is written with authority and sounds correct, but the content is based on a misapplication of the facts. At the same time, this model can also generate an infinite number of nonsense and / or ungrammatical word sequences. More rules and contextual information were needed to make this approach practical.

Table 1. Some sample sentences generated by the Markov chain shown in Fig.1.

Score	Text of the Sentence
<i>Original Sentences</i>	
0.08250	a rat.
0.08250	a cat.
0.06250	the cat has a rat.
0.04250	Ann has a cat.
0.03125	the rat ran at Ann.
0.01719	the cat ran at the rat.
<i>Plausible but unverified sentences</i>	
0.02125	Ann has a rat.
0.01563	the cat ran at Ann.
0.01563	the rat ran at the cat.
<i>Nonsense sentences:</i>	
0.03125	the cat has a cat
0.03125	the rat ran at the rat.
<i>Repetitions:</i>	
0.00391	The cat ran at Ann has a cat.
0.00049	The cat has a rat ran at Ann has a rat.
0.00003	The cat has a rat ran at Ann has a rat ran the cat has a cat has a rat.

In the 1950s and 1960s, researchers began to develop more sophisticated language models using machine-learning techniques. One notable early model was the perceptron algorithm, (Rosenblatt, 1957) which used a neural network to learn patterns in data and classify inputs. This provided the computer with the ability to

scripting rules to transform the input into questions that would attempt to engage the user in a conversation. (Weizenbaum, 1976) However, the system was designed to respond to comments in limited ways without building any model of the body of information being discussed. As seen in Table 2, conversations were often shallow, limited, and repetitive. (Wallace, 1999)

In the 1970s and 1980s, researchers developed more complex models such as Hidden Markov Models (HMMs) and context-free grammar to better establish the

explore the context and focus on the machine-generated text. Analysis of scripts of human conversations lead to the development of Eliza, a computer program designed to emulate a Rogerian psychotherapist. Eliza would accept responses from the user and apply a few

context and precise meaning of user responses. These models were used in early speech recognition and machine translation systems that could capture information from conversations with human customers within specific problem domains like booking rooms for meetings or making reservations for haircuts. By the mid-1990s, automated speech recognition systems had given rise to automated travel and hotel booking systems that could take reservations over the telephone. (Rosen, 1997) At the same time, text editing

software was expanded to support exhaustive dictionaries that contained all forms of words in the target languages.

The late 1990s saw the introduction of early speech-operated programs that would later evolve into systems like Siri, Hey! Google, and Alexis which could recognize basic oral commands, perform a task, and read out the results. The concurrent growth of the internet and the explosion of digital text data allowed researchers to develop more advanced language models based on statistical techniques and the use of large corpora to

train more effective and precise models. The introduction of the n-gram model, which compares the frequency of words within a sequence of words, gave language models the ability to gather related facts from various parts of the corpus. Comparison of these frequencies helped to improve the accuracy of responses to specific questions as well as improve attempts at translation between languages. Chatbots were introduced during this time to apply these technologies to a growing number of automated help-desk functions. Text editing software also began to check and correct basic grammatical mistakes.

Table 2. The beginning lines of a conversation with Eliza.

Speaker	Text
Eliza	Hello, I am Eliza. I am your personal therapy computer. Please tell me your problem.
Visitor	I am feeling frustrated.
Eliza	Did you come to me because you are feeling frustrated?
Visitor	I thought you could help.
Eliza	We were discussing you, not me.
Visitor	Actually, my dog is the problem
Eliza	Can you elaborate on that?
Visitor	She ran away chasing a cat and did not come back
Eliza	What does that suggest to you?
Visitor	My dog does not love me.
Eliza	I see.
Visitor	She never comes when I call.
Eliza	What do you think?
Visitor	Maybe it is hopeless
Eliza	Can't you be more positive?
Visitor	No, I am sure that my dog is being stubborn!!!
Eliza	Do you believe it is normal to be sure that your dog is being stubborn?
Visitor	Probably not
Eliza	Tell me more...
Visitor	She does this all the time
Eliza	What does that suggest to you?

Table 3. A sample ChatGPT response

Prompt: Describe how ChatGPT works and write the response in the rhyme and rhythm of Dr. Suess.
ChatGPT Response: <p>Well hello there, my friend, don't you fret, I'm ChatGPT, here to help you yet! I'm a language model, quite grand, With a brain built by the OpenAI brand.</p> <p>My job is to understand what you say, And answer your questions in a helpful way. I've been trained on a lot of text, So my knowledge is vast, you can bet!</p> <p>When you type out your query to me, I analyze it carefully, you see. I look for patterns and key phrases, And try to understand what your request says.</p> <p>Then I get to work, in a flash, Using my knowledge to craft a response with panache. I'll write out an answer that's clear, And hopefully, it will bring you some cheer!</p> <p>So that's how I work, it's plain to see, I'm here to help you, just like a good friend should be.</p> <p>So whenever you need some advice, Just type out your question, it's really quite nice!</p>

In 2010, IBM developed the Watson computer to extract textual data from the Internet in a way that could answer questions on Jeopardy, a television game show. In 2011, Brad Rutter and Ken Jennings, the all-time champions of Jeopardy, were invited to play wits against the IBM Watson. In the end, they lost to the computer. Since then, Watson has been trained on the world's body of medical data and has been used to assist medical diagnosis, improve the quality of health care, and reduce the cost of medical diagnosis and treatment in hospitals around the globe.

In the last decade, deep learning-based models such as Convolution and Recurrent Neural Networks (CNN and RNN, respectively) have become increasingly popular for language modeling tasks, reducing the size of datasets while improving their utility. CNN models have improved the learning of complex patterns resulting in spoken text that sounds

significantly more natural than earlier rule-based models. In 2020, Google announced that their speech recognition could be accomplished with preprocessed datasets in the range of 100 KBytes instead of previous services requiring processed datasets of over 5 GBytes. The smaller size made it easier and faster for Mobile and Internet of Things (IoT) devices to respond to oral commands even when offline. Adversarial machine learning techniques were also introduced to identify and deal with factors that cause misunderstandings and ambiguities, giving rise to more accurate and less ambiguous language models. At the same time, text editing software acquired the ability to test for tone, mode, and level of the language used and could suggest improvements to manuscripts that would improve the readability and acceptance of the documents produced.

Launch of ChatGPT 3.5

In November 2022, ChatGPT 3.5, an artificial intelligence (AI) chatbot

developed by OpenAI was launched for public use. This tool uses Generative Pre-trained Transformer (GPT) technology (Bubeck et al., 2023) linked to a large language model to understand the user request, gather the relevant information, transform the information, and deliver the results in various formats ranging from notes, outlines, essays, musical lyrics, and virtually any other conceivable format. (Kirmani, 2023) In less than one minute, ChatGPT can compose an essay of publishable professional quality or simulate homework in the language of a Primary 2 student depending on the expressed requirements given in the user's prompt. It can also write software in a programming language of the user's choosing. The user can also add commands to prompt ChatGPT to transform the output in various ways such as translating the output into another language, assessing the quality and completeness of the work, or setting the rhyme and rhythm to match the lyrics of a popular song or the style of a popular author, as shown in Table 3.

Using ChatGPT to write academic publications

Within 3 months of release, over 200 books were written by or partially authored by ChatGPT and sold on Amazon. (Muhammad, 2023) The basic structure of these publications was generated in response to a request for an outline of the key points of a topic and their related issues. Subsequent prompts to ChatGPT would delve into the nature of each issue until all the key issues have been thoroughly discussed and summarized. The collected responses were combined and edited into their respective sections. ChatGPT was then asked to provide the outline and questions for the chapter review sections. Even though ChatGPT 3.5 only delivered a few hundred words at a time, technical books and novels were written this piece meal fashion. More recent LLMs and apps can deliver multimodal, multipage responses. Thus, it is possible to develop an entire paper or book written in minutes with some prompting of the researcher/author. This

transforms the writing process for developing academic publications into something that resembles a conversation between colleagues engaged in an informal, brainstorming session. This innovation reduces the time and effort needed to draft research review papers, essays, and research grant proposals.

As a result, ChatGPT can be found in the heart of many online services. For example, 10Web (2023) uses the mission and vision statement to generate a full draft of an organization's multipage website, complete with relevant stock photos. Decktopus(2023) which creates a set of slides and speaker notes for a talk in response to statement of the topic, the length of time scheduled for the talk, and some a description of the target audience. ChatGPT was designed to query the LLM and generate statements as a probable sequence of ideas considered as an appropriate response to the prompt provided. This technology creates an accurate synopsis of concepts contained within a document or the large language model, but would not be expected to propose new, novel, cutting-edge applications or theories. Instead, the responses tend to represent the prevailing ideas represented in the LLM. James Donovan (2023) demonstrated this by creating discrete LLMs based on different key reference text such as Gray's Anatomy, Organic Chemistry, and The Hitchhiker's Guide to the Galaxy. As expected, the responses from each LLM reflected the expertise and tone of their respective LLM, i.e. the precision of medical autopsies, the details of a chemical engineering report, and the dark, sarcastic world-view of Douglas Adams. Using the wrong LLM would result in irrelevant, but grammatically correct responses.

Controversy over Naming ChatGPT as a Co-author

When OpenAI launched its product, they cautioned the public that their product emits text outputs that, while less capable than humans in many real-world scenarios, exhibits human-level performance on

various professional and academic benchmarks. (OpenAI, 2023c) However, the public response to ChatGPT has been overwhelming, often forcing OpenAI to waitlist new registrants until the server capacity could keep up with the demand. By January 2023, 4 papers were published in professional journals naming ChatGPT as a co-author. Elsevier and Cambridge University Press officially recognized ChatGPT as a professional-grade author. At the same time, the editors of Nature and Science took steps to exclude papers co-authored by ChatGPT in their journals. By Feb 2023, over 200 books sold online on Amazon were written by or partially authored by ChatGPT. (Muhammad, 2023) Book printers and distributors like Designrr (2023) have launched training videos, online workshops, webinars, and other support services to encourage the publication of ChatGPT output. This has sparked spirited debates to discuss the ethics, potential, and future of ChatGPT. (Lund et als, 2023) While some advocate widespread adoption to assist in the development of publications, others caution that ChatGPT's hallucinations cannot be trusted and require expert reviews to identify and prevent the harmful effects that could arise if the output were accepted.

Maximizing the informational value of ChatGPT

Users of ChatGPT3.5 have quickly discovered that this tool produces very different results from that of a typical Google web search. While Google searches generate a list of appropriate websites and URLs related to the specific details contained in the query, ChatGPT works by casting a wider search for related information and summarizing the information that closely matches the requirements spelled out in the user prompt. Google works best with detailed descriptions, but ChatGPT works best with open-ended queries, especially ones that would help to build a story. Google searches return a list of references to be read and evaluated, but ChatGPT summarizes its findings in a well-written report that

contains an introduction, detailed descriptions, a summary, and a conclusion. The quality and breadth of the answers generated by ChatGPT depend on the quality of the engineering of the query prompt. ChatGPT provides optimal results when queries are posed as a conversation that leads to a response that follows a storyline, such as illustrated below:

1. Engage ChatGPT in an actual conversation instead of asking for specific information. Focusing on the reasons why encourages ChatGPT to set the information within the context of a story while a search for details will focus only on specific details.

2. Suggest queries to ChatGPT as ideas to be debated by actual characters who will test the ideas based on their respective roles. The characters could represent historical figures like Einstein or Bill Gates or specific positions within a company. This forces ChatGPT to critique the idea from different perspectives.

3. Encourage ChatGPT to tap its ability to tell stories and think creatively. Instead of asking for a specific list of facts, set a context for the answer, and let ChatGPT find the content and relate the story.

4. Encourage ChatGPT to give the broadest, complete general response before drilling down on details. This allows ChatGPT to explore the problem domain for new ideas that may not have been considered. In addition, the initial results are used as a context for subsequent queries.

5. Avoid blindly accepting the first response. Because ChatGPT will create a different response every time it is queried, mediocre responses can be challenged, and the system will attempt to correct subsequent responses appropriately. Tweaking the prompts or adding more detail can change the scope and focus of the conversation. Also, using new command words, adding adjectives, and/or varying the verb choices will elicit different responses.

Known weaknesses of ChatGPT

To the naive and casual user, ChatGPT responds with impressive speed and in assertive tone of authority. However, the developers at OpenAI have shown that the current version of ChatGPT generally scores grades around 80% on most standardized tests and exhibits several design errors. Because the technology is just 1 year old, published peer-reviewed analysis are only beginning to appear in professional journals papers. However, the developers of ChatGPT at OpenAI have published their research notes of their qualitative and quantitative evaluations of GPT-4. The results of these studies provide useful insights about the capabilities, limitations, and risks of this technology, and have helped to prioritize development efforts to build safer versions of ChatGPT. The key concern at OpenAI has been to minimize the ability of ChatGPT to produce incorrect, harmful, and/or irrelevant answers due to the various shortcomings listed below. (OpenAI, 2023d)

- Hallucinations that occur as ChatGPT renders an explanation that is not based on facts but conjecture.
- Harmful content arising from hurtful expressions, inappropriate content, racial slurs, ethnic or religious prejudices as well as bad or misapplied advice. Users are known to bait ChatGPT into making mistakes.
- Harm to representation, allocation, and quality of service arise

because LLMs amplify biases and perpetuate stereotypes.

- Disinformation and influence on operations because the authoritative and assertive tone of the output hides problems with the validity of the data and logic.
- Proliferation of conventional and unconventional weapons because ChatGPT cannot detect the intent of user queries, it is dangerous to provide detailed instructions about the manufacture and use of weapons.
- Privacy violations when sensitive data is revealed.
- Potential for risky emergent behaviors because ChatGPT cannot assess the intent of pop culture trends any response that promote dangerous activities even if they are popular Cybersecurity and Interactions with other systems are a source of concern the software could provide unintended access to information on connected systems.
- Economic impact as the system is not always sensitive to the intent of its users it could create unfair market competition.
- Acceleration in the popularity of ChatGPT escalates expectations to levels that exceed the testing and development of a safe service.
- Overreliance by users who do not critically scrutinize the output of ChatGPT.

Table 4. Shortcomings of ChatGPT Adapted from (Rangoli, 2023)

Shortcomings of ChatGPT
<ul style="list-style-type: none">• ChatGPT can provide wrong answers and even lie about facts.• ChatGPT is very formal and can sound like machine-generated text.• ChatGPT just summarizes and is often not very detailed.• ChatGPT is not a human expert.• ChatGPT could be monetized.• ChatGPT report writing style can seem too wordy.

ChatGPT often fails in the role of a learned colleague or assistant because of its inability to detect its own shortcomings and unsupported claims. In addition, not everyone agrees with the style of the output. Table 4 shows the most discussed shortcomings in social media. Many of these arise because ChatGPT has been designed to tell stories and many users require training to instruct ChatGPT about their personal preferences on how stories should be told. However, some of these shortcomings arise because of deeper design weaknesses of ChatGPT.

The various weaknesses and shortcomings of ChatGPT can cause it to fail in many ways. Statistical logic can infer connections between facts that do not exist in real-life causing hallucinations. As a language model, ChatGPT is even known to fabricate and cite non-existent sources for the sake of telling the story. Lacking built-in calculator functions causes ChatGPT to guess the result of many multi-step math calculations, often with an incorrect result. In addition, ChatGPT 3.5 was trained on information gathered on 21 September 2021 and could not reference information and events that have occurred since that cutoff date. Having trademarked and copyrighted sources in the training set of information could potentially lead to legal litigation if the output violates non-disclosure agreements or other rights of intellectual property holders.

However, critics of ChatGPT have expressed concerns that ChatGPT cannot describe the logic that led to its conclusions

and cannot provide the user with the chain of inferences to explain the steps in its chain of reasoning. This makes it difficult to judge the correctness of the output, especially since the reasoning can fail in numerous ways. The current version of Bing Chat attempts to address this by providing a summary of the analysis of the prompt and hints about the key references it has used.

Despite the success of ChatGPT, OpenAI has repeatedly issued clear warnings that this is a work in progress and cannot be fully trusted. The output is clearly marked that it is provided without warranty or guarantee. OpenAI stamps all output of ChatGPT with a legal notice that warns users to carefully review and scrutinize the output for issues that might cause harm or lead to a negative impact. OpenAI goes to the extent to include this strong statement on all responses from ChatGPT:

ChatGPT may produce inaccurate information about people, places, or facts. (OpenAI, 2023b)

The Urgency for Universities to Develop Guidelines about ChatGPT

Despite OpenAI's warnings about the potential misuse of ChatGPT, its usage has grown rapidly, raising concerns about over-reliance and blind trust in its output. Recent case studies have shown that ChatGPT facilitates the process of creating reports and papers but must be scrutinized by the authors to ensure that the statements adopted from ChatGPT output conform to the findings and conclusions of their research. (Aly and Aly, 2023; Kalla and Smith, 2023) Many universities, with their

emphasis on tradition and outdated regulations, are ill-equipped to address the challenges posed by AI-driven tools. This raises the risk of exposure to harmful and fraudulent practices. At the same time, universities must foster critical thinking and collaborations between humans and machines worldwide to pursue and publish advances in understanding and knowledge in a way that ensures that breakthroughs are proven to be safe and effective, fully documented, consistently acknowledged, and fairly rewarded. (OpenAI, 2023a).

While ChatGPT has gained significant attention, it's important to remember that it's not the only AI language model available. A vibrant landscape of language models has emerged, each offering unique capabilities and tailored experiences

- Microsoft Bing (2023), Google Bard (2023a), Phind (2023), and Claude (2023) have established themselves as popular choices, each drawing upon distinct textbases to create their LLMs.

- Mobile apps continue to increase the interaction between users and language models, with Socratic (Google, 2023b) dedicated to education, ChatDS (2023) empowering data science exploration, and Colossal-AI (HPC-AI Tech, 2023) facilitating faster and more cost-effective decision-making.

- Creative frontiers are being pushed as well, with Dall-E2 (OpenAI, 2023a) harnessing GPT prompts to generate remarkably imaginative artwork.

- Recent partnerships between OpenAI and leading mathematical organizations have sparked exciting advancements in mathematical reasoning and functions that calculate solutions, drawing upon the expertise of Wolfram/Alpha (Wolfram, 2022) and Khan Academy (Khan, 2023).

- ChatGPT 4.0 has further expanded its versatility by accepting multimodal prompts, incorporating not only text but also images and audio clips to create a richer, more nuanced understanding of user intentions.

- The anticipated arrival of GPT 5 hints at a future where language models effortlessly traverse multiple modalities, comprehending and generating text, images, sound, and video. Imagine a kitchen robot, seamlessly consulting GPT 5 to identify a meal from the contents of your fridge and cabinets, and masterfully preparing the dish based on GPT 5's expertly crafted instructions. The possibilities for multimodal AI to transform our interactions with technology are boundless

ChatGPT offers a gateway to vast amounts of information, not merely providing encyclopedia-like summaries but also presenting material through dialogues, reorganizing information into novel frameworks, and testing comprehension in a manner akin to that of a mentor or a knowledgeable colleague. Despite its occasional errors, ChatGPT remains a valuable learning tool. While it can often self-correct, human expertise may be necessary to identify flaws in its reasoning. However, the independent use of ChatGPT by students raises concerns about inconsistencies in its responses and the potential for diverse sets of errors that will create a different educational experience for each student.

ChatGPT has gained popularity among faculty and students in Thailand, being perceived as a time-efficient tool for producing papers, books, and responses. Similar observations were reported by Wang in Canada (Wang, 2023). However, there is a concerning trend of omitting attribution or acknowledging the role of ChatGPT in the development of academic documents submitted for evaluation. This omission poses a risk to universities, as it could lead to the endorsement of individuals who lack a genuine understanding of the concepts they present, relying solely on technology to produce work beyond their academic capabilities. As the new LLMs continue to facilitate the creation of papers and books, the time is coming when the volume of publications is no longer an accurate reflection of the true achievement and qualifications of faculty members.

The issue lies not with the technology itself, as technology has long been instrumental in enabling and enhancing human academic performance. Calculators and computers have become indispensable tools in accounting and statistics courses, while spell checkers and grammar tools are widely used to refine the quality of written documents. Similarly, musical chord analyzers have proven valuable in composing new music. However, when technology becomes capable of producing work indistinguishable from human creations, it can tempt individuals to claim authorship of such work to reap the benefits associated with achieving such exceptional quality and excellence.

This is particularly evident in the context of student term papers, which have traditionally served as a means for students to explore topics in depth and develop mastery in specific areas. Now that ChatGPT can generate essay-length documents of high technical quality, many students mistakenly believe that term papers can be generated automatically. This misconception necessitates a reevaluation of the role and grading of term papers by instructors. To ensure the continued effectiveness of term papers as an educational exercise, clear descriptions of the expected level of scholarship and verification of cited references will be essential.

Table 5. Suggested Roles for AI Tools in Higher Education (adapted from (Sabzalieva et al., 2023).

Administrative assistant: where ChatGPT assists in the grant proposal and report writing and fills out forms based on the core documents of a project.
Co-designer: where ChatGPT assists throughout the design process.
Community engagement consultant: where ChatGPT provides strategies for effective interaction with specific target groups.
Critic: where ChatGPT acts as an opponent to develop and argue ideas.
Data analyst: where ChatGPT suggests themes to be tested statistical and AI methods and write the software code needed to visualize and model the data and verify the validity of the model.
Data explorer: where ChatGPT provides datasets and the tools to explore and interpret its meaning.
Data integrator: where ChatGPT searches the archives for relevant data and provides translation as needed.
Dynamic assessor: where ChatGPT can provide educators with a profile of each student's current level of knowledge.
Editor: where ChatGPT can evaluate the content and structure of a student document.
Mentor: where ChatGPT acts as a guide to navigate physical and conceptual spaces.

Plagiarism is already a pervasive issue in universities, and ChatGPT's ability to generate human-quality documents without detection is poised to exacerbate this challenge. ChatGPT relies on non-deterministic methods to create output that is unique for each query and renders automated plagiarism checks ineffective. Moreover, the legal concept of plagiarism may not strictly apply to ChatGPT output, as the source of the stolen ideas is a computer with no legal rights. This suggests that current anti-plagiarism rules and regulations may be unenforceable in the context of ChatGPT-generated work. Furthermore, the text base upon which ChatGPT draws may contain copyrighted materials, including patents, intellectual property, and other protected works, for which explicit permission from the copyright holders was not obtained.

Given these concerns, universities must proactively develop new rules, regulations, and incentives to promote genuine academic achievement and discourage the misuse of ChatGPT. This may involve:

- Articulate the expectations regarding the use of AI-generated content and establishing guidelines for incorporating such content into academic work.

Motivator: where ChatGPT offers games and challenges to extend learning.

Personal tutor: where ChatGPT tutors each student and provides feedback on progress.

Research designer: where ChatGPT assists in the development of the key research questions and hypothesis.

Study buddy: where ChatGPT helps the student reflect on the meaning and application of the material being studied.

- Investing in advanced plagiarism detection tools capable of identifying AI-generated content.
- Promoting ethical AI usage by covering AI ethics education into the student curricula, emphasizing the responsible and ethical use of AI tools in academic settings.
- Rethinking assessment methods by exploring alternative assessment methods that emphasize critical thinking, problem-solving, and creative expression, (skills that AI tools cannot easily replicate).
- Rewarding genuine achievement, fostering a culture that values original thought and intellectual integrity.

Conclusion

ChatGPT and software like it represent the next wave of progress and hold out promise for engaging even more students through relevant and interesting homework assignments. Because the technology is only months old, there has been a general lack of literature to document best practices and guidelines for safe and effective use of ChatGPT in higher education. UNICEF has issued a preliminary practical Quick Start Guide for instructors and administrators compiled from the suggestions of educators from various universities around the globe. (Sabzalieva et als, 2023) The UNICEF Quick Start Guide suggests some roles for ChatGPT within institutions of higher education which have been summarized in Table 5.

ChatGPT 4 was launched to a selected number of people on 14 March 2023. This version corrected many of the shortcomings of the current version and provides access to newer data, math calculators, calculus engines, a larger text base, and the ability to generate. (OpenAI2, 2023a) In short, the potential, and

challenges associated with ChatGPT will quickly escalate. Universities cannot ignore this growing Sunami in higher education. Those that attempt to ignore these pending changes will struggle with the confusion that AI technology will bring. However, those that can harness the power and potential of this technology will learn to reduce its risks and will become leaders in the future.

In a related case study, Wang (2023) followed the adoption and use of ChatGPT by students and colleagues at Canada West University. He concluded that as long as computers increase in their computing ability, students and researchers will continue to explore the novel aspects of new AI driven information systems in a way that could facilitate novel trains of thought that could lead to new breakthroughs. However, if students only use these AI tools as mere search engines and report generators, they will miss the true power of this technology and fail to master the concepts they have retrieved. The authors of this paper feel that Universities must aspire to challenge and train their faculty and students to harness GPT and such technologies to explore and understand current information better and ask new questions that will lead to new discoveries. Failure to embrace and master such AI technologies could render many traditional universities redundant, and obsolete as the public begins to use LLMs and tools like GPT as tutors and gateways to the rapidly expanding networks of human information and understanding

Recommendation

Now that the world has had a year to experiment and use ChatGPT, the time is right for universities to think strategically about how this technology will impact the methods and scope of higher education. Strategic guidelines are needed to harness

this technology as a tool that does not undermine academic integrity but rather augments and facilitates learning and intellectual development. Organizations like the Association of Private Higher Education in Thailand are well-suited to create forums where the following 4 areas of concern can be considered and addressed.

- **Maintain the intellectual integrity of the university.** Now that machines can produce on-demand essays that sound objective and unbiased, users tend to trust the output and incorporate the output into their work unchanged. Both faculty seeking academic awards and credentials, and students seeking grades fall subject to this temptation and may unwittingly commit plagiarism and/or copyright infringement or circulate a false or unsubstantiated narrative. New measures and incentives are needed to counter this temptation.

- **Revise academic ranking rules to encourage true scholarship and achievement** Situations where individuals are ranked more by the number of papers instead of the impact of their writing are ripe for the promoting the misuse of AI tools as academic paper mills. Good research takes effort, and critical thinking to explore a subject deep enough to understand the critical principles at work and to recognize the shortcomings of raw research results. Onboarding support for new faculty members is needed to address the pressure to produce published papers without encouraging the use of shortcuts that would develop a paper mill and the loss of reputation for the institution.

- **Keep classroom experience and assignments relevant.** LLMs and interfaces like ChatGPT makes it possible for educational exercises and assignments to be dynamic and interactive in a way that promotes true learning and mastery of a subject. Foreign language conversations with LLMs can act as language tutors to

improve fluency. Students can generate their own review sheets and practice tests. LLMs can be used to evaluate and suggest improvements to written assignments. Universities would do well to explore the UNICEF recommendations for integrating these tools within their institutions (Sabzalieva, 2023) and share best practices with each other

- **Find ways to encourage transparency and honesty in professional publications.** Scholarly journals should consider including some statements about the role of ChatGPT and other AI products in the drafting and development of the articles they publish. In the spirit of full disclosure, the following section is an example of this paper's statement.

The coming months will be critical as universities work out practical and effective means of using ChatGPT to augment classroom instruction and assist in research and development and provide administrative support. As local universities experiment with implementing these roles, the authors of this paper hope that this will also lead to increased sharing and cooperation between universities both regionally and world-wide

Technology used in the development of this paper

The research for this paper was first conducted on Google and ChatGPT to identify key papers and references. The outline and content of this paper were drafted as a Markdown document developed while reading the cited documents. The analysis of the Markov chain example was taken from the output of an application one author (RPB) wrote in Ruby. Sample outputs of Eliza and ChatGPT were included as Tables 2 and 3, respectively. The manuscript was checked for grammar and spelling mistakes using Grammarly. ChatGPT was used to assess the writing quality and suggest improvements to this paper's scope.

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