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Widen the debate: What is the academic community's perception on ChatGPT?

Yingying Jiang[1] · **Lindai Xie**[2] · **Guohui Lin**[3] · **Fangfang Mo**[1]

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Abstract
ChatGPT has surprised academia with its remarkable abilities but also raised substantial concerns regarding academic integrity and misconduct. Despite the debate, empirical research exploring the issue is limited. The purpose of this study is to bridge this gap by analyzing Twitter data to understand how academia is perceiving ChatGPT. A total of 9733 tweets were collected through Python via Twitter API in three consecutive weeks in May and June 2023; and 3000 most relevant ones were analyzed in Atlas ti. 23. Our findings reveal a generally supportive attitude towards using ChatGPT in academia, but the absence of clear policies and regulations requires attention. Discussions primarily focus on academic integrity, learning effectiveness, and teaching efficiency. Tweets from influencers with over one million followers were analyzed separately. The significance of these findings and the limitations of the study are included.

Keywords AI · Education · Teach · Learn · ChatGPT · Ethics

1 Introduction

Education and technology share intertwined development. The improvement of technology revolutionizes education regarding teaching pedagogy and learning methods (Koehler et al., 2007; Raja & Nagasubramani, 2018). In turn, the development of education cultivates capable scholars, researchers, and professionals who contribute

✉ Yingying Jiang
jiang214@purdue.edu

[1] Department of Educational Studies, Purdue University, West Lafayette, IN, USA

[2] Department of Counseling and Special Education, Virginia Commonwealth University, Richmond, VA, USA

[3] Department of Computer Science, Virginia Commonwealth University, Richmond, VA, USA

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to innovating and advancing technology. The emergence of ChatGPT, a Generative Pretrained Transformer language model, marked a significant milestone in the field of artificial intelligence and natural language processing has demonstrated the connection (Shen et al., 2023; Lund & Wang, 2023). ChatGPT showcased remarkable capabilities in generating human-like text responses, ushering in a new era of AI-driven conversational agents (Cai et al., 2023) with its initial release in November 2022 (Baidoo-Anu & Owusu Ansah, 2023). Its ability to engage in coherent and contextually relevant conversations garnered widespread attention and enthusiasm (Lund & Wang, 2023). This debut was followed by the rapid upgrade of ChatGPT- ChatGPT-4 in March 2023, further fueling the discourse surrounding AI chatbots (Teebagy et al., 2023; Törnberg, 2023).

2 ChatGPT's impact on academic practices

2.1 AI's role in learning and teaching

In academia, ChatGPT and similar AI language models, with their impressive natural language processing capabilities have rapidly gained prominence and sparked discussions about their applications in education (Kumar, 2023; Lo, 2023). Indeed, students have been using it to improve writing, and teachers utilize it to plan class activities and assess students' work (Baidoo-Anu & Owusu Ansah, 2023; Fauzi et al., 2023). Fitria's (2023) research reviews ChatGPT's English essay writing ability and finds it considering essay structure and writing orders by using explanatory sentences after a main idea and summarizing the conclusion in the last paragraph. Researchers describe ChatGPT's writing as coherent, (partially) accurate, informative, and systematic, and this led to its assistance in students' assignments, content questions, language learning, receiving feedback, and even dealing with career and life-related issues (Chen et al., 2023; Imran & Almusharraf, 2023; Zhai, 2022).

On the educators' side, AI such as ChatGPT reduces teachers' workload when educators use it to develop lecture materials, designing course plans and activities, as well as grading or writing feedback (Baidoo-Anu & Owusu Ansah, 2023; Gamage et al., 2023; Kasneci et al., 2023; van den Berg & du Plessis, 2023; Taecharungroj, 2023; Zhai, 2022). Teachers reported that the assistance of AI improves their ability to construct intricate academic arguments, teaching efficiency, and critical thinking capabilities environment (Baskara et al., 2023; van den Berg & du Plessis, 2023). Additionally, Sohail et al. (2023) and Hsu and Ching (2023) highlight ChatGPT's role in enabling educators to explore new research areas and tailor content to meet individual student needs, promoting a more collaborative and customized education. Further supporting this perspective, Koonchanok et al. (2023) analyzed sentiments towards ChatGPT across various occupations, finding that the teaching profession exhibited the highest proportion of positive sentiments (39.9%).

In addition, learners and educators in the study conducted by Ali et al. (2023) reached a consensus that ChatGPT motivates English language learners to improve their reading and writing skills. Other research supported this perspective, they highlight that ChatGPT offers considerable opportunities for educators and educational

institutions to enhance language teaching and assessments, leading to more personalized learning experiences; among learners, ChatGPT acts as an effective study partner, and encourages group study and research efforts (Hong, 2023; Hsu & Ching, 2023).

2.2 Ethical considerations

While some view ChatGPT as a tool with the potential to enhance teaching and learning experiences, concerns about misuse of this tool have risen which include interfering with learning progress, violating academic integrity, shifting teaching focus, and diminishing educational effectiveness (e.g., Cotton et al., 2023; Sullivan et al., 2023). Additionally, there's debate on its role in automating tasks traditionally performed by educators and call for ethical guidelines in its implementation (Dave et al., 2023; Liebrenz et al., 2023; Livberber & Ayvaz, 2023; Zhuo et al., 2023).

This debate also extends beyond teaching and learning to include ethical considerations in academic research. Lund et al. (2023) examined AI-generated research papers and provided examples of commonly encountered ethical dilemmas including issues related to authorship, copyright, and plagiarism. Hosseini and Horbach's (2023) study adds on the literature from the other side of perspective: editors and reviewers. They illustrate the effectiveness of using ChatGPT in scholarly peer review and indicate potential bias, confidentiality-related problems, and issues with reproducibility (Hosseini & Horbach, 2023). In addition, concerns associated with policy, economics, and culture have arisen (Farina & Lavazza, 2023). Bias in AI, particularly towards certain ethnic, religious, or gender groups, has been highlighted as a significant concern (Farina & Lavazza, 2023; Gross, 2023). Therefore, researchers generally emphasize the recommendation for users to exercise caution when utilizing AI tools, especially since the content generated by AI may contain biased or discriminatory elements. As ChatGPT continues to evolve, its influence on education and research remains a topic of heated discussion and exploration within academic circles.

2.3 Specialized fields

ChatGPT is also found to be applied in specialized fields, like computer science for identifying programming bugs (Surameery & Shakor, 2023), and in public health as a tool for information dissemination (Biswas, 2023). Research attention also spans various professional domains, including Pharmacy practice (Hammour et al., 2023); Medicine (Kim et al., 2023); Engineering (Qadir, 2023) examining perceptions, practices, and concerns regarding ChatGPT.

3 Policies

A survey of 1,000 college students revealed that approximately 70% of college students use ChatGPT multiple times a month, and 41% use it weekly. However, only 29% reported receiving guidance from their universities on its usage (College Rover,

2023). Since January, numerous school districts, from New York and Los Angeles in the United States to Queensland and New South Wales in Australia, have started banning the software (Johnson, 2023). These decisions led to debates on whether banning is the appropriate solution, and the New York Department of Education reversed the ban in May (Mehta, 2023; Rosenzweig-Ziff, 2023). Some academic journal publishers have updated their submission guidelines, for example, the International Committee of Medical Journal editors forbids researchers from listing ChatGPT as a co-author (Leopold et al., 2023), while many others still lack specific regulations in this regard.

4 Research problem

The absence and inconsistency in policies and regulations on using ChatGPT require a broader debate and empirical research into this tool and similar AI tools. Despite the surge in research surrounding ChatGPT, particularly in 2023, empirical studies that focus on the academia's perspective are still limited. The majority of existing work consists of conceptual and opinion-based discussions (e.g., Farrelly & Baker, 2023; Hsu & Ching., 2023; Sohail et al., 2023; Yu, 2023), along with quantitative surveys aimed at specific groups (e.g., Hammour et al., 2023; Tangadulrat et al., 2023). Additionally, although some research has leveraged Twitter data to capture a wider view of ChatGPT's early adoption through topic and sentiment analysis (e.g., Koonchanok et al., 2023; Leiter et al., 2023; Taecharungroj, 2023), a comprehensive data-driven inquiry into how specifically academia perceives and utilizes ChatGPT is still lacking. In response to this gap, our study proposes to use Twitter data for an in-depth examination of the academic community's perceptions and engagement with ChatGPT, with the intention to widen the debate, enrich future research on AI in education, and inform policy decisions, ultimately aiming to enhance the understanding of ChatGPT's impact and potential within the educational landscape. This research will primarily focus on addressing the following three research questions:

1. How do people in academia perceive ChatGPT?

    1.1 What is the overall sentiment of tweets about ChatGPT?
    1.2 How do Twitter users perceive and discuss issues of equity and ethics in relation to ChatGPT in academia?

2. What are the popular ways for people in academia to use ChatGPT?
3. How do Twitter influencers (with more than one million followers) perceive and discuss ChatGPT in academia?

5 Methods

5.1 Data source

To address the research questions, this study utilized empirical Twitter data that represented academic discourse. Twitter is a publicly accessible platform which is effective in capturing real-time discussions and sentiments within the academic community regarding AI technologies.

The data collection procedures employed in this study involve extracting 9733 tweets via the Twitter API (Basic Access Tier) in three consecutive weeks, May 25th, June 1st, and June 8th. The researchers were restricted to extracting the most recent 7-day data from Recent Search Endpoint due to the unavailability of the Academic Research tier at the time of the study (Twitter Community, 2023). The API functions as a computer interface that enables the automated retrieval of public Twitter data, such as tweets and user metadata, each extraction gathered the most recent 7-day tweets, ensuring a coherent set of data.

5.2 Data collection

A dedicated Python crawler script was developed, utilizing the Requests library to handle HTTP request-response protocols. This script was specifically designed to interact with the Twitter API and extract pertinent data.

The Twitter API affords various filtering options to refine query results. The following filters were applied when the Python script requested data from Twitter API:

Language To focus the study on the English-speaking academic community, only English tweets were included.

Keywords In constructing the research instrument for Twitter data collection, researchers strategically developed keywords grounded in the extensive literature review, including keywords such as learning, teaching, ethics, and broader academic engagement, including research, publications, language, and assignments. Twitter has a 512-character limit with keywords. This strategy ensured the comprehensive and focused representation of academic discourse with ChatGPT in this study.

Exclusion criteria Retweets, quotations, and replies are excluded to reduce duplicated tweet content. Additionally, tweets containing the Chinese word "账号" (account), predominantly linked with advertisements, and tweets using ChatGPT for sports-related rankings were filtered out leveraging Twitter's annotation functionality, as they were not directly pertinent to the research objective and prevailed in the returned data.

The complete search query is (OpenAi OR ChatGPT OR GPT) (educate OR educator OR education OR student OR study OR studying OR studies OR ethics OR plagiarism OR citation OR equity OR learn OR learning OR learner OR teach OR teaching OR teacher OR curriculum OR professor OR pedagogy OR grading OR

class OR academic OR academia OR scholar OR research OR researcher OR publication OR journal OR dissertation OR thesis OR assignment OR exam OR university OR college OR language OR School) lang: en -is: retweet -is: reply -is: quote -账号 -basketball[1].

5.3 Data cleaning

Given that the Twitter API returns data in JSON format, a text-based data-interchange convention for C-family programming language (Crockford, 1996), data cleaning and processing were completed in the order of:

Data conversion The raw JSON data is converted into a Pandas DataFrame, a tabular data structure allowing efficient data transformation.

Data merging Three raw JSON datasets – tweet contents, user profiles (e.g., username, follower count, etc.), and tweet attachment details (e.g., images, videos) – were merged into a single DataFrame. The shared tweet ID was used as the unique key to combine these datasets into an aggregated set.

Desensitization After merging, sensitive and personal information, including username and profile information, were removed to protect user privacy.

Removal of duplicates Duplicate records were identified and removed to ensure data integrity and eliminate redundancy.

Export The cleaned dataset was exported as an Excel file to facilitate further analysis by the research team.

5.4 Analysis

For this study, researchers analyzed 3000 tweets (the first 1000 most relevant tweets from three consecutive weeks) in Atlas.ti 23. A codebook was developed based on search keywords (Table 1). An initial meeting was scheduled for researchers to clarify the definitions of the codes. The same 100 tweets were coded by three researchers and achieved inter-rater reliability of 96%. Note that a degree of agreement was accepted when codes belonged to the same level-1 category. A follow-up meeting was held to discuss disagreement, “Policy” and “Attitude” codes were added to better answer the research questions.

Table 1 Codebook

Perspective	Teachers	Published tweets expressed the perceptions of ChatGPT from the perspective of K12 teachers in academic community
	Students	Published tweets expressed the perceptions of ChatGPT from the perspective of students in academic community
	Faculty	Published tweets expressed the perceptions of ChatGPT from the perspective of university faculty in academic community, & about faculty
	Researcher	Published tweets expressed the perceptions of ChatGPT from the perspective of researchers in the academic community
	Other_people	Published tweets expressed the perceptions of ChatGPT from individuals in academic community but not listed in above category, for example, journal editors.
Learning	Learn_General	Learners utilize ChatGPT to assist with general learning
	Learn_STEM	Learners utilize ChatGPT to assist with STEM majors-related learning
	Learn_Testing	Discussion around learners and tests such as practice ChatGPT-designed quizzes to prepare for exams.
	Learn_Adavancement	Learners utilize GPT or other software that is equipped with GPT to assist with advanced learning such as training GPT to do certain tasks
	Learn_Language	Use ChatGPT to learn a language or help with translation
Teaching	Teach_General	Teachers utilize ChatGPT to assist with general teaching such as design class activities
	Teach_STEM	Teachers utilize ChatGPT to assist with STEM major-related teaching
	Teach_Technology	A specific technology is mentioned to be equipped with GPT to assist teaching, e.g., use Kahoot with ChatGPT for quizzes.
Research	Research_Reliability	Tweets discuss comparing ChatGPT's reliability with human writing and analysis, come up bias and accuracy of use ChatGPT to assist research
	Research_General	Research utilizes GPT to assist with general research such as designing research paper outline
	Research_STEM	Research utilizes GPT to assist with STEM-related research
Ethics	Ethics_General	From academic perspectives, Tweets discuss ethical concerns of utilizing ChatGPT
	Ethics_Plargirism	From academic perspectives, Tweets discuss utilizing ChatGPT result plagiarism or using it to plagiarism
Equity	Equity_General	Tweets discuss the use of ChatGPT and its' impact on educational equity
Policy	Policy_Educational	Tweets discuss policy and the use of ChatGPT in the Educational field
Attitude	Att_Support	Support the use of GPT in academia
	Att_Against	Against the use of GPT in academia
	Att_Debatable	Open to discussion, and further deliberation is needed to reach a consensus or gain a better understanding of different perspectives in academia.

6 Results

6.1 RQ1.1 attitudes towards ChatGPT

Researchers incorporated three codes Att_support, Att_debatable, and Att_against (Table 1) to address sentiments. A total count revealed a ratio of 191:191:42 for tweets expressing support for ChatGPT, advocating further discussion or debate, and expressing opposition to ChatGPT within the academic community (Table 2). In other words, there are 4.5 times more tweets leaning towards supporting and inviting discussions for ChatGPT than opposing it in academia (examples in Table 3).

6.2 RQ1.2 Ethics, equity, and policy

6.2.1 Ethics

Out of 3,000 analyzed tweets, 152 were coded as related to "Ethics". Of these, 31 were specifically about plagiarism. Strong opinions were formed around the plagiarism issue, with tweets describing ChatGPT as a "plagiarism machine". Educators shared frustration over students' dependence on ChatGPT "ChatGPT is my worst nightmare as an English teacher. It's clear these kids are using it to get answers on their work. I know 10th graders aren't going to use phrases like 'the glasses symbolize the fragility of civilization." There were also incidents that triggered many discussions on Twitter, such as a professor who wrongly accused an entire class of plagiarism based on ChatGPT investigation, leading to a temporary hold on diplomas pending investigation.

However, some users expressed a more progressive perspective, seeing this controversy as an opportunity for change.

> Hopefully the ChatGPT in academia plagiarism debate will give rise to better forms of assessment than essays or coursework - you can't plagiarise an in-person debate that would really test knowledge of the subject matter. Maybe the time for improvements to assessments is upon us?

Indeed, some individuals reported changes in their assessment formats, such as a shift from computer exams to paper-and-pencil tests. Others shared resources, like the studies by Lanford (2023) and Nikolic et al. (2023), advocating for changes in assessment in Physics and Engineering Education.

Table 2 Coding report on number of data in attitudes types and code groups

	Against	Debatable	Support
Learn	11	23	81
Teach	3	20	30
Research	7	20	26
Ethics	7	21	2
Equity	0	3	2
Policy	0	1	2

Table 3 Quotation example in attitude types and code groups

	Against	Debatable	Support
Learn	I don't believe all this nonsense about AI. I think our elites are frankly, stupid. These machines are actually not intelligent and I don't believe artificial intelligence is a threat. Chatgpt is also hilariously stupid. I tested it with bar exam questions, poetry, chess, etc.	Artificial intelligences like ChatGPT can change education: concerns about plagiarism and students becoming reliant on AI are common but there are opportunities too.	ChatGPT is still the king of language models. Complete transformed my life, especially with the additions of plugins and browsing capabilities. It's the biggest revolution since computers, internet and mobile phones. The future is advancing in a very accelrated rate now!
Teach	I need a cute name for the class I'm teaching this fall and chatgpt isn't helping...	ChatGPT is tsunami across higher ed. All good if it forces profs' return to humble work of teaching. Knowing students personally. Lecturing with tutoring. Then in-person oral exams w/no ChatGPT. Critical thinking must be taught/learned personally.	The advent of ChatGPT won't destroy educational standards. We can use AI to improve our teaching methods and provide deeper academic experiences.
Research	ChatGPT writes medical research abstracts can fool scientists	ChatGPT can be a powerful tool, but it's important to remember that it may provide misleading or unverifiable information. Research and skepticism remain essential.	Chatgpt now has web browsing making it the most far advanced tool for research in human history. The era of excuses is now over.
Ethics	Lawyers using ChatGPT for research get nailed for filing motions citing, non-existent cases. AI Lies. AI provides falsehoods. AI deceives. AI says whatever is necessary to accomplish its goal.	ChatGPT's popularity may cause concern about AI enabling cheating. But … says it instead raises questions about how we're actually teaching and assessing physics students.	ChatGPT can give students a platform to learn and practice without the worry of cheating...
Equity	0	It's amazing how smart these language models appear, but what's the actual process behind it all?	#AI is transforming the education sector, making learning more personalized and interactive.
Policy	0	The New York City public schools are loosening the reins on emerging technologies such as ChatGPT, while putting new rules and resources in place Thursday to promote artificial intelligence in classrooms.	EdTech revolution with AI chatbots! Discover how tools like #ChatGPT, #GoogleBard, and #MicrosoftBingChat can personalize learning experiences for each student. Remember, consult your school leaders & respect data privacy laws.

6.2.2 Equity

While Australia has banned the use of ChatGPT in public schools, some private schools are incorporating ChatGPT in teaching and learning (Duffy, 2023). This decision sparked debate on the potential 'digital divide'. Many tweets highlighted the ChatGPT's usefulness for untraditional college students and lower-income individuals who may not afford a college education, therefore fostering educational equity. "As someone who couldn't afford to go to college, I'm astounded by the vastness (and speed) of ChatGPT's knowledge. How different my life would have been with this kind of access. As a learning tool, it's the great equalizer".

Several U.S. universities also opt out of AI detection software, as it also flags non-AI student works and harms students' digital rights. However, concerns were raised about AI's unintentional bias, particularly towards non-English speakers, and the potential gender bias inherent in language, "Nearly 44% of Californians speak a language other than English—and they're being left behind in the AI revolution. That's why I'm pushing for these technologies to be developed more equitably"; and "AIs like ChatGPT carry inherent gender biases that can affect HR-related tasks, such as job descriptions or performance reviews. [We need to] learn strategies to spot these biases and ensure an equitable approach in your workplace".

6.2.3 Policy

Discussion around policy relating to the use of ChatGPT was minimal in the dataset, with only seven out of 3,000 tweets addressing this topic. Several tweets shared the ban of AI tools in schools across Australia, New York, and Los Angeles.

6.3 RQ2 Popular uses in academia

6.3.1 Learning

Improve Learning Effectiveness. Among the 3000 analyzed tweets, recorded attitudes towards using ChatGPT for learning are mostly positive (72) rather than negative (11). Popular opinions include that it helps save time and the process is similar to interacting with a knowledgeable person. Reports on using ChatGPT in different professional exams proved its capabilities: "ChatGPT's AI passed a Master of Business Administration (MBA) exam that was at the beginning of the year now imagine how much better it is 6 months later and how many versions are already out…" One user generated a game to assist exam preparation: "Created this game with quizalize and chatgpt to help my daughter study for the U.S. History regents exam. Took about 5 minutes to create. There are definitely benefits to AI for education"; another user explained how they used ChatGPT for learning:

> I did not use chatGPT to write my discussion post for my class [because] that would be wrong. What I did do was after I submitted my discussion post I fed

> chatGPT the prompt, what I wrote, and several of the other students' submissions and I made it tell me which one was best and why.

Assisting with Language Learning. Because of ChatGPT's ability to generate human-like content, learners often use it specifically for language learning which includes grammar correction, vocabulary or phrase selection, and translation. A tweeter who was learning English wrote that ChatGPT enhances their English proficiency by refining their expressions more native, "One of the best ways to make my English more natural is to get rid of phrases and expressions that I learned through Japanese English education. Every time I use them, ChatGPT fixes them, saying it's not natural."

Assisting with STEM Learning. ChatGPT's strengths and weaknesses were shown in its application in STEM learning. Users shared it was a great help in learning computer science subjects,"

> I've been using ChatGPT to help me write code for new concepts but I prioritize 2 main constraints. (1) I rewrite the entire code and explain it to myself. (2) if I don't understand or know something I ask it to explain it….

On the other hand, another user pointed out its weakness in simple statistics "The way ChatGPT works makes it very good at writing things like prose and lengthy exam answers, but not so good at solving even simple math problems".

Needs of Appropriate Prompts. Among the tweets discussing the use of ChatGPT to learn, "prompts" is frequently mentioned. They emphasized the importance of using appropriate prompts to maximize ChatGPT's effectiveness. Many users who had experiences asking ChatGPT with various tasks refined and shared prompts on Twitter to benefit others, "Getting crap results from ChatGPT? Give it a chance to learn, and feed it with tons of information. This is one of my favorite prompts. Feel free to use it for yourself down…" Some users perceive ChatGPT as a writing tutor that can assist them with paper assignments and emails. One Twitter user described ChatGPT as a professional writer and shared their approach, "I teach the AI before I ask anything. I revise and rephrase what it writes. I add details specific to what I'm writing…ChatGPT is great to produce a rough draft/structure. But you should always rewrite/edit." To summarize while affirming the ability and helpfulness of ChatGPT, users generally reached a consensus that (1) it is necessary to provide ChatGPT with sufficient information and accurate questions, and (2) the answers/output of ChatGPT needs to be manually rechecked and revised for the purpose of effective learning and complete tasks with high-quality.

6.4 Teaching

The Potential of Integrating AI in Transforming Teaching Practice. Among the 3000 tweets, 232 tweets discussed topics related to teaching. The overall sentiment reflected a majority of positive opinions (30 tweets) and debatable perspectives (20 tweets) rather than negative (3 tweets) about the use of ChatGPT in teaching-related activities.

The first theme is the extensive discussions on the integration of AI technologies in teaching practice. These discussions span across various educational domains, encompassing STEM education and art education. Additionally, there is an exploration of the implications of AI for enhancing student support, fostering, and developing digital literacy as highlighted in this tweet, "More news from Class! We are working closely with the education community to develop best practices and later this year, we will make available our ChatGPT API-based Teaching Assistant to improve learner engagement, focus, and outcome…".

Furthermore, concerns surrounding the need and ethical considerations to adapt teaching practices in an AI-driven world are also raised. Educators reflected on the ethical aspects of incorporating ChatGPT into their teaching approaches and how to effectively communicate these considerations to their students, for example, "I have been thinking about how to talk to my students about the ethics of using ChatGPT."

Teacher Professional Development and Learning. Teacher professional development and learning emphasize the crucial need for training programs that empower educators with the essential knowledge and skills required for the effective integration of AI tools, such as ChatGPT within the classroom. This emphasis extends to the recognition of the importance of furnishing educators with resources and conducting workshops designed to equip them with the necessary proficiency to harness the potential of AI for enhancing teaching and learning outcomes. This perspective finds clear expression in the following tweets, "Teachers: What does linguistic competence mean in times of machine learning? Join us for a 5 part professional development series to learn about adding game-based learning…and ChatGPT to your lesson planning and curriculum design"; and "ChatGPT uses for high school sports coaches: design a small group workout."

Teachers' Perspective on Student Engagement and Learning Experiences. Educators also discuss how AI technologies can enhance student engagement and provide new learning opportunities. The discussion highlights the use of AI tools in facilitating personalized learning experiences, promoting critical thinking, encouraging student exploration and creativity, supporting student inquiry and problem-solving, as well as aiding in understanding real-world connections and relevance. As one tweet wrote, "Learn how to generate custom quiz questions using ChatGPT and effortlessly import them into Kahoot for an engaging learning experience". Also, another tweet said:

> I quite often use C Basic and Python when teaching students in STEM, and seeing how they can now take functions and code from other platforms then convert it for Arduino or RPI really opens up a whole new realm of possibilities.

6.4.1 Research

In the analysis of 3,000 tweets, 272 of them were found to discuss the utilization of ChatGPT in research-related contexts. According to tweets, ChatGPT demonstrated proficiency in handling "a range of monotonous jobs," showcasing its versatility in tasks such as brainstorming ideas or drafting an outline for a research paper. Among

the various applications discussed, one of the most popular and widely acknowledged uses involved employing ChatGPT to support the literature review section. Users reported that the tool proved helpful in summarizing important articles, with one tweet expressing, "[ChatGPT is] helping me with the literature review, saving me time searching for journals." This highlights the tool's perceived efficiency in assisting with literature-related tasks and the time-saving benefits acknowledged by users in the research community.

6.5 RQ3: Influencers' perception

Among the 65 tweets with one million followers and above, the majority still maintain a positive attitude towards ChatGPT. Top tweets praised ChatGPT's productivity enhancements and valuable plugins, highlighting the transformative impact of AI on human interactions and cognition. Several prominent topics emerged from the analysis. Firstly, many top tweets discussed the impact of ChatGPT on Teaching and Learning. These findings align with the results from the other 3000 Twitter data, "Explore the impact of ChatGPT in higher education, including personalized learning, cost-effectiveness & ethical implications while addressing challenges such as limited human interaction & data privacy." Secondly, these tweets showcased diverse applications of ChatGPT beyond education, including enhancing social skills, providing job interview support, and assisting in crypto research, "A Stanford University computer science student, has created a ChatGPT-enabled monocle that uses AI to provide you charisma on demand." Lastly, the importance of responsible AI use and ongoing research to effectively address ethical challenges is mentioned, "Should you use ChatGPT in class? [Here] is a short guide explaining what ChatGPT is, the pitfalls of using it, and some classroom policy options for handling it."

7 Discussion

As many experts said, AI is here to stay. Historically, AI has been utilized in Education like computerized adaptive testing and word-processing auto-corrections (Czerkawski et al., 2023; Mujtaba & Mahapatra, 2020). Now with more sophisticated but accessible AI emerging into our daily lives, it is time for us to rethink how AI can and will shape education. Furthermore, there's been a noticeable shift in education's priorities these days. Rather than placing emphasis solely on achievement scores, there's a growing focus on understanding students' learning journeys and their overall wellbeing (Jie et al., 2023). It is indeed the right time and opportunity to incorporate AI in discussing the transformation in education.

After analyzing the most relevant and relatively recent discussion of ChatGPT with Twitter data, our research not only provides a glimpse of academic perceptions of ChatGPT how teachers, faculty, learners, and professionals are perceiving and using this forefront AI, but also solicits discussion regarding policy and regulation development to ensure the people know what should and should not do with AI and how AI can be wisely used to assist Education reformation.

7.1 Navigating between innovation and ethics

Our data confirmed that the overall reaction to ChatGPT and its subsequent versions has ranged from excitement to apprehension (Fuchs, 2023), with twice more people in our data being identified with a welcoming, positive, and sustaining attitude towards ChatGPT versus those who held negative and resisting attitudes. However, as the AI community celebrates the progress in natural language generation, there are also concerns about ethical implications, misuse, and the potential impact on different domains (Ray, 2023; Zhou et al., 2023). Our Results reveal the primary discussion topics included concerns related to ethics, especially plagiarism, and hindered equity issues with AI. We see these issues with teachers expressing frustration with students' dependence on ChatGPT on course assignments, and discussions about the misuse of ChatGPT, also the misuse of the AI-generated plagiarism machine to detect bot-processed languages. However, these issues exist largely due to the absence of government-specific policies on the use of AI, as well as the absence of university-level regulations for incorporating AI in class and in research. It's worth noting that many university-level policies are currently in development and are available for internal consultation, indicating a move towards more structured and guided use of AI in educational contexts. Future research should focus on evaluating the effectiveness of developed guidelines for the responsible use of AI and examining whether a clear understanding of these guidelines has been successfully communicated to its users, specifically educators and students.

7.2 Enhancing learning with AI

Our findings indicate that the integration of AI for learning has been increasing with the widespread usage and popularity of ChatGPT. Our results align with previous findings that AI can enhance the learning experience when used responsibly and appropriately (e.g., Baidoo-Anu & Owusu Ansah, 2023; Javaid et al., 2023). However, we also noticed a critical aspect of effective ChatGPT use for learning: the art of prompt asking. Precise and thoughtful prompting is essential for acquiring tailored and accurate answers- this requires learners to ask accurate questions and provide relevant background information. Additionally, some tweets encourage learners to critically assess the responses from ChatGPT. This aligns with Rospigliosi's (2023) perspective that when interacting with ChatGPT, learners should assess, integrate and comprehend. Finally, as AI tools like ChatGPT become a regular part of students' academic lives, it is crucial for educators to understand how to steer students toward leveraging AI's advantages effectively while navigating away from risks such as academic dishonesty, this could involve strategies such as introducing creative discussion prompts, designing reflection-focused assignments, and demonstrating effective prompt formulation (Sun & Hoelscher, 2023). Avocating changes for assessment is also shown in our results; as Malik et al. (2023) suggest that restructuring assessments by providing in-class assessments or oral exams, designing test questions based on problems or case studies, and conducting more testing done in the subject matter context are also methods to reduce concerns about academic dishonesty in this

era. Future research should continue to explore and understand learners' experiences with AI, focusing on its effective and responsible use within various domains.

7.3 Enhancing teaching with AI

Our findings, align with the study of Kostka and Toncelli (2023), highlighting the potential positive impact of integrating AI, particularly ChatGPT in teaching. The sentiment echoes this positivity, indicating widespread interest and consideration of the applicability of AI tools across various educational domains, from STEM to art education. The range of benefits in our study suggest personalized learning, promotion of critical thinking, encouragement of exploration and creativity, support for inquiry and problem-solving, and the enhancement of students' understanding of real-world connections (Exintaris et al., 2023; Limo et al., 2023; Morath et al., 2023). Moreover, our findings reveal that with the assistance of AI, teaching can be more effective in designing engaging curricula and preparing personalized materials to aid students in succeeding academically (Meron & Araci, 2023). Furthermore, our findings emphasize the crucial need for corresponding training and professional development for teachers. Educators on Twitter acknowledged the importance of acquiring the necessary knowledge and skills for the effective integration of AI tools (Malik et al., 2023) .

Looking ahead, future studies could focus on developing professional development programs to enhance teachers' efficacy in using AI such as ChatGPT in classrooms (Chen et al., 2023). There is also potential for future research to delve into practical implementation strategies and address potential drawbacks of AI integration in classrooms.

7.4 Research with AI

We acknowledge that over the past year, diverse research fields have explored ChatGPT including Environmental Research (Zhu et al., 2023), Physics Education (Kieser et al., 2023); Psychiatry (Cheng et al., 2023); Healthcare Education (Sallam, 2023) and more. ChatGPT, as a conversational AI, has fundamentally altered how information is retrieved (Wei et al., 2023), and revealed its benefits in improving writing skills and identifying key themes (Shidiq, 2023). Our findings from the analysis of 3,000 tweets underscore the significant role ChatGPT plays in assisting research activities, particularly in expediting the literature review process. Tweeter users' experiences highlight the AI's capabilities in brainstorming ideas, drafting research outlines, and, notably, summarizing critical articles for literature reviews.

However, as previous literature suggests challenges include the potential for encountering fabricated information and outdated domain knowledge alongside concerns about decision-making accountability and the opportunity cost of excessive reliance on ChatGPT (Walters & Wilder, 2023). Based on the positive perception and utility of using ChatGPT in our results, we argue that the burgeoning reliance on ChatGPT prompts considerations for future research. It would be valuable to explore the nuanced impact of AI-driven assistance on the quality and originality of research outputs in the future. Exploring potential ethical concerns surrounding the integration

of ChatGPT in the research workflow and strategies to mitigate fabricated information risks are pivotal areas for future inquiry.

7.5 Limitation and research direction

Our findings offer a nuanced understanding of how academics view the incorporation of AI tools, more specifically ChatGPT in educational practices. The study highlights a general optimism towards the potential of AI to enhance teaching, learning, and research. However, it also reveals concerns regarding ethics, discrimination, and absence of regulations. By providing empirical evidence of these perceptions, the study calls for a more informed policy-making process that considers rapidly developing AI technologies and experiences of the academic community. In addition, our research methodology, utilizing Twitter as a lens to examine academic discourse, demonstrates the value of social media data in revealing academia's reaction to emerging technologies. This approach not only enriches our understanding of current attitudes and engagement towards AI in academia but also demonstrates the utility of social media analytics as a dynamic tool for conducting rapid and exploratory research. Some notable limitations include a bias towards "tech-savvy" academics represented in the Twitter data and a three-week data collection period that may not fully capture changing/evolving attitudes.

Future research should utilize a more in-depth research approach to address these limitations. Additionally, our findings suggest that future investigations should focus on several key areas: the impact of regulation and guided practices in education; addressing ethical issues and discrimination in practice and understanding the perceptions of students and educators regarding these matters. Furthermore, the exploration of learning prompts, professional development for educators on AI tools, and the specific use of AI in research should be explicitly addressed in future studies.

Data availability The data for this study was sourced from Twitter. Due to Twitter's usage restrictions and terms of service, the sharing of raw data is potentially constrained. Interested parties should refer to Twitter's data usage policies for further information.

Declarations

Conflict of interest No funding was received for this research project. The authors declare no conflicts of interest in relation to this study.

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