

Generative AI in higher education: Seeing ChatGPT through universities' policies, resources, and guidelines

Hui Wang^a, Anh Dang^a, Zihao Wu^{b,*}, Son Mac^c

^a Second Language Acquisition and Teaching, University of Arizona, 1103 E. 2nd St, Tucson, 85721, AZ, United States

^b School of Computing, University of Georgia, 415 Boyd Research and Education Center, Athens, 30602, GA, United States

^c Department of Electrical & Computer Engineering, University of Arizona, 1230 E. Speedway Blvd, Tucson, 85721, AZ, United States

ARTICLE INFO

Keywords:

Generative Artificial Intelligence
AI in education (AIED)
Technology in education
Higher education
Educational resources

ABSTRACT

The advancements in Generative Artificial Intelligence (GenAI) can provide opportunities for enriching educational experiences, but at the same time raise concerns regarding academic integrity. Many educators have expressed anxiety and hesitation when it comes to integrating GenAI in their teaching practices. Thus, recommendations and guidance from institutions are needed to support instructors in this new and emerging GenAI era. In response to this need, this study explores different U.S. universities' academic policies and guidelines regarding the use of GenAI tools (e.g., ChatGPT) for teaching and learning, and from there, gains understanding of how these universities respond and adapt to the development of GenAI in their academic contexts. Data sources include academic policies, statements, guidelines, and relevant resources provided by the top 100 universities in the U.S. Results show that the majority of these universities adopt an open but cautious approach towards GenAI. Primary concerns lie in ethical usage, accuracy, and data privacy. Most universities actively respond and provide diverse types of resources, such as syllabus templates, workshops, shared articles, and one-on-one consultations; focusing on a range of topics, namely general technical introduction, ethical concerns, pedagogical applications, preventive strategies, data privacy, limitations, and detective tools. The findings provide four practical pedagogical implications for educators when considering GenAI in teaching practices: 1) accepting GenAI presence, 2) aligning GenAI use with learning objectives, 3) evolving curriculum to prevent misuse of GenAI, and 4) adopting multifaceted evaluation strategies. For recommendations toward policy making, the article suggests two possible directions for the use of GenAI tools: 1) establishing discipline-specific policies and guidelines, and 2) managing students' sensitive information in a transparent and careful manner.

1. Introduction

The development of artificial intelligence (AI) led to the rapid advancement of large language models, including a variety of conversational agents and text generation tools (Achiam et al., 2023; Team et al., 2023; Touvron et al., 2023). In November 2022, OpenAI first released ChatGPT,¹ which is a powerful language model-based chatbot that can process human conversation and generate human-like texts. Since its release, ChatGPT has gained significant attention as well as vigorous discussion across a wide range of fields. In educational contexts, it can be used for various purposes, including generating ideas, revising grammatical errors, providing instant feedback, and evaluat-

ing and grading writing assignments (Abdullayeva & Musayeva, 2023; Fuchs, 2023; Rudolph et al., 2023). However, the automatic generation of human-like texts also poses potential risks to academic integrity, especially when faced with writing-intensive assignments and language courses (Perkins, 2023; Sullivan et al., 2023). Some scholars express additional concerns about the potential misuse by students, suggesting that students' critical thinking and problem-solving skills can be impacted if they rely heavily on ChatGPT for their learning (Kasneji et al., 2023). Due to constant changes and updates with any new technology, many educators have also expressed anxiety and hesitation in using GenAI for their teaching practices, and are in need of recommendations and guidance from their universities on the effective implementation of GenAI

* Corresponding author.

E-mail address: zihao.wu1@uga.edu (Z. Wu).

¹ <https://openai.com/blog/chatgpt>.

tools. Thus, the question now is not only about what GenAI can do but also what universities can offer and what faculty can apply in terms of guidance and strategies on the use of GenAI in educational academia. Specifically, it is necessary to examine how universities and educators are currently perceiving, adapting to, and applying the use of GenAI technology in higher education.

This study aims to investigate policies, guidelines, and resources currently provided by U.S. universities for their educators, teacher trainers, students, and researchers to adopt GenAI, especially ChatGPT, in their teaching, learning, and research. The findings will address numerous educators' needs by informing AI-assisted teaching practices and guiding future policy-making; thus impact the application of GenAI in higher education.

2. Literature review

Generative Artificial Intelligence (GenAI) and Natural Language Processing (NLP) have emerged as groundbreaking technologies and gained attention in various fields worldwide (Kalla & Smith, 2023; Ray, 2023; Rice et al., 2024). ChatGPT, a revolutionary technology created by OpenAI, is an advanced chatbot that uses AI and NLP techniques to generate coherent and human-like responses (Kalla & Smith, 2023). Using deep learning and neural networks, this technology is equipped to process, analyze, and produce responses to a wide variety of prompts, including questions, statements, or academic inquiries, all within a few seconds.

GenAI has been increasingly affecting higher education, as it has the potential to enhance learning experiences and create new opportunities for innovation in educational practices (Dempere et al., 2023; Grassini, 2023; Onal & Kulavuz-Onal, 2023). These tools can encourage students to ask questions, clarify their needs, and delve into various topics as a self-regulated learning approach (Chiu, 2023; Cooper, 2023; Rasul et al., 2023; Wu et al., 2024). For example, in a study conducted by Ng et al. (2024), students were taught to use ChatGPT at home to learn science concepts. The chatbot served as a resource to provide students with science-related examples and explanations, as well as helped plan their learning process by setting goals, suggesting learning strategies, and promoting time management skills (Ng et al., 2024). Another frequent pedagogical application of GenAI is as an assistant in teaching and learning academic writing (Crompton & Burke, 2023; Dempere et al., 2023; Imran & Almusharraf, 2023). They can assist student writers during the planning, drafting, and revising phases of academic writing, and provide suggestions that address their writing needs from linguistic nuances to genre-specific features (Alharbi, 2023; Liu et al., 2024; Mahapatra, 2024; Yan, 2023).

As GenAI tools have been widely available for students at different capacities, concerns regarding academic integrity and copyright infringement have become prominent in many discussions (Eke, 2023; Gao et al., 2023; Baek & Kim, 2023; Peres et al., 2023). Some expressed that adopting AI-generated content without critical evaluation, rephrasing, and citation can constitute plagiarism and is deemed unacceptable (Eke, 2023; Jarrah et al., 2023). In addition, overreliance on GenAI tools can also cause a decline in students' critical thinking and learning motivation (Escalante et al., 2023; Harunasari, 2022; Mahapatra, 2024; Song & Song, 2023). Therefore, it is important to consider what the misuse of GenAI means for the educational context and how to address these issues accordingly. Institutions as well as teachers of higher education need to examine, adopt, and revise policies and strategies in their teaching contexts to honor academic integrity, prevent plagiarism, and promote ethical implementations of GenAI tools.

Meaningful conversation on academic integrity and ethical use of GenAI can be difficult for teachers who teach in higher education institutions, especially when paired with the overwhelming learning curve of new GenAI tools. Thus, teachers can be put in a position filled with anxiety and hesitation when dealing with GenAI in their classroom (Barrett & Pack, 2023). Studies by Iqbal et al. (2022) and Kiryakova and Angelova (2023) reported that a large portion of educators considered

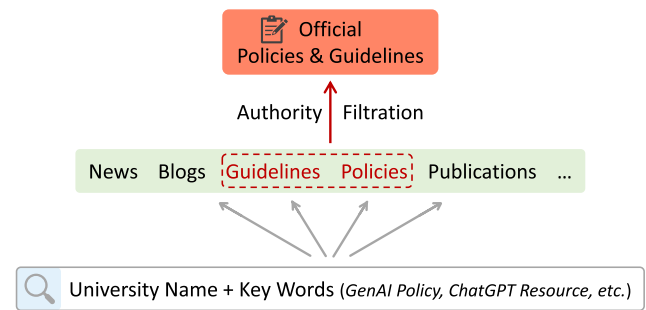


Fig. 1. Data collection process with inclusion and exclusion criteria.

ChatGPT both a threat and an opportunity for teaching and learning, and expressed caution when using them for their own contexts. From the interviews in the study conducted by Iqbal et al. (2022), many teachers pointed out that the lack of training and support from their institutions on the effective use of GenAI was a major obstacle in its application in the classrooms. Similarly, Barrett and Pack (2023) emphasized that unclear GenAI policies and guidance from institutions could cause some instructors to hold off on fully embracing GenAI, due to ethical concerns and uncertainty about how to appropriately use these tools. Participating faculty in Van Wyk (2024) advocated that more resources, such as webinars, should be provided for faculty and students to raise GenAI awareness and literacy.

In addition, to expand the conversation regarding the use of GenAI, numerous studies are calling for further research on different principles, strategies, and resources to harness GenAI as a value-driven opportunity to enhance learning (Ali et al., 2023; Firat, 2023; Lee et al., 2023; Michel-Villarreal et al., 2023; Van Wyk, 2024). We echo this by emphasizing the importance and urgency of providing teachers with effective guidelines in using GenAI for their teaching practices. However, to make this more systematic, there first needs to be an examination on the current available policies and resources on GenAI use in different teaching contexts. In this study, we focus specifically on the context of higher education. Limited research has explored how higher education institutions are currently perceiving, adapting to, and applying the use of GenAI in their local contexts. This study fills the research gap by investigating publicly available policies, statements, guidelines, and resources regarding GenAI provided by the top 100 universities across the U.S., and from there, discussing implications and suggestions for educators in policy-making and teaching practices.

3. Research questions

- What are the top 100 U.S. universities' perceptions on the integration of GenAI tools in higher education based on their policies and management approaches?
- What resources and guidance do U.S. universities provide on the use of ChatGPT and other GenAI tools for teaching practices?
- How do the school ranking tiers and academic specializations influence the trends in perceptions and resource provision regarding the use of GenAI in higher education?

4. Methods

4.1. Data collection

As the origin of ChatGPT in late 2022 and home to many leading GenAI companies and research institutions, the U.S. had the highest number of ChatGPT users globally in 2022-2023 (Similarweb, 2024). This early and widespread adoption may result in U.S. institutions experiencing the most immediate and significant impact from GenAI technologies, making them key sites for observing initial responses to GenAI

Table 1
Coding scheme for analyzing university policies and statements.

Parent Codes	Child Codes	Definition
University Decision	Undecided/Unclear	The university has not made a clear decision or taken a definitive stance regarding GenAI.
	Allow use with Conditions	The university permits the use of GenAI with conditions, such as appropriate citations.
	Ban Use	The university prohibits the use of GenAI.
Instructor Decision	Instructor Decides	The university allows the use of GenAI depending on the instructor's decisions.
	Prohibition by Default	The use of GenAI is generally not allowed unless explicitly permitted by the instructor.
	Permissibility by Default	The use of GenAI is generally allowed unless explicitly prohibited by the instructor.
Education Purpose	Neutral	The university relies on the instructor's decision without a specific stance.
	Plagiarism Prevention	To prevent students from directly copying texts generated from GenAI.
	Authorship and Attribution	To require acknowledge AI-generated content in student academic assignments.
Research Purpose	Limitations	To address limitations, including biased, inaccurate, unreliable, or falsely cited information generated by AI.
	Intellectual Property	To highlight the importance of acknowledging AI-generated content in professional research settings.
	Data Privacy and Security	To address the confidentiality and security of data when using GenAI in professional research.

Table 2
Coding scheme for analyzing guidelines and resources provided by the universities.

Parent Codes	Child Codes	Definition
Target Audience	For Students	Resources provided specifically for students.
	For Faculty	Resources provided specifically for faculty.
	For General Audience	Resources provided specifically for the wider university community and public.
Types of Resources	Syllabus Templates and/or Examples	Suggested syllabus templates and/or examples shared on the resource and guideline pages.
	Practical Training Workshop	Training workshops that train instructors and/or students to learn and try various functions of GenAI.
	Dialogues and Discussions	Open dialogues and discussions for instructors and/or students to share their opinions.
	Shared Articles and/or Blogs	Referenced articles and/or blogs that help instructors and/or students to further explore relevant topics.
	One-on-one Consultations	Individual email, Zoom, and/or in-person consultations with school administration offices or representatives.
Content Analysis	General Technical Introduction	An overview focusing on the functions and technical aspects of GenAI.
	Ethical Considerations	An introduction of ethical concerns on the use of GenAI.
	Pedagogical Applications	Exploration of how GenAI can be incorporated into teaching and learning.
	Preventive Strategies	Strategies to prevent students from using GenAI inappropriately.
	Data Privacy	Guidelines for protecting instructors' and students' privacy when using GenAI for teaching and learning.
	Limitations	Concerns on limitations, including biased, inaccurate, unreliable, or falsely cited information generated by AI.
	Detective Tools	Introduction of available detective tools for detecting the use of GenAI.

in higher education. Therefore, the data in this study consists of policies, statements, resources, and guidelines regarding the use of GenAI, especially ChatGPT, from the top 100 U.S. universities listed in the 2024 U.S. News Best National University Rankings. We chose to examine U.S. national universities over smaller institutions (e.g., liberal arts colleges, regional colleges, community college, etc.) because they provide more degree programs (including bachelor's, master's, and doctoral degrees) across multiple disciplines. This isn't to say that the universities on our list are representative of all higher education institutions across the U.S. and worldwide nor it can be generalized for all policies related to GenAI in higher education. While we acknowledge the limitation in our dataset, we believe that policies and resources from these universities might influence practices in other universities and colleges globally, and we hope this study can spark discussions about the resources needed to effectively navigate GenAI across the broader landscape of higher education.

To collect the data, we first identified the top 100 universities ($n = 104$) in the U.S. via the 2024 US News Best National University Rankings. Then we performed a systematic search using a list of keywords (e.g., GenAI policy, GenAI guidelines) together with the name of each university. In this step, all information presented on the universities' official websites—such as guidelines, policies, news articles, blog posts, and etc. — were retrieved as part of this study. We then evaluated and applied our inclusion and exclusion criteria to filter out those that did not meet our study's focus (see Fig. 1). The inclusion criteria in red contain 1) data from official university sources, such as the Office of Provost, Academic Senate, Center of Teaching and Learning, and Library Resources; 2) university-wide policies and statements regarding the use of GenAI tools and academic integrity; 3) guidelines and resources in

relation to the use of ChatGPT and other GenAI tools in teaching, learning, and research. The exclusion criteria in black include: 1) articles from online news, and blog posts; 2) sources from a specific department or program of each university.

This study specifically focuses on data from official university sources as mentioned in the previous paragraph. Official sources often offer authoritative insights that can reflect the university's stance and strategic direction. These policies and guidelines typically emerge from discussions among university policy makers or official committees comprising faculty, staff, and students, who serve as the university's representatives. Additionally, these official sources are provided directly by each university and are accessible to both internal and external members of the school community, which may indicate the university's endorsement and support for the public information on their official websites. Furthermore, a number of universities regularly update the information presented on their websites based on the change in the technology itself or other aspects related to the technology. Therefore, we believe that policies from official university sources can reflect a current picture of how these universities perceive new GenAI technologies. The guidelines from these official sources can also offer valuable insights into how these universities guide and support faculty and students to integrate GenAI in their teaching and learning.

It is important to note that the policies and guidelines collected in this study are up until April 2024. We acknowledge that the development of GenAI policies and resources is dynamic and there will be changes regarding these policies in the future, however, as for our study, the current dataset serves as the foundation for our analysis. For those interested in exploring this dataset further, it is accessible at [the dataset of university policies and resources](#).

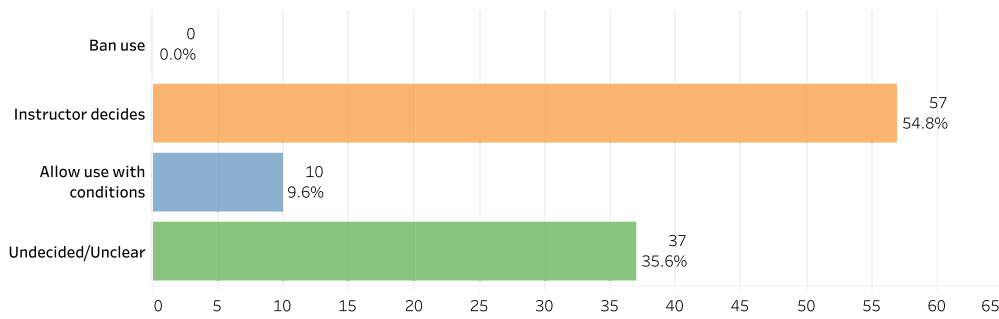


Fig. 2. Policies and stances adopted by different universities regarding GenAI.

Table 3
University perception scale on AI usage.

University policies and decisions	Scale points
Ban use	-5
Undecided/Unclear	0
Allow use with conditions	5
Instructor decides (prohibition by default)	1
Instructor decides (neutral)	2.5
Instructor decides (permissibility by default)	4

4.2. Coding schemes

This study employed a mixed-methods research approach, integrating quantitative and qualitative methods to analyze academic policies, statements, guidelines, and relevant resources provided by the top 100 universities in the U.S. For the quantitative analysis, we measured the number of universities implementing various policies and resources. Prevalent approaches and emerging trends were identified from examining the frequency and types of these policies and resources across different institutions.

For qualitative analysis, thematic analysis (Braun & Clarke, 2006) was conducted to identify the themes related to universities' perceptions and the availability of the provided resources. Table 1 presents the coding scheme along with the definition for each code, designed for analyzing university policies and statements.

Table 2 shows the codes and definitions designed for analyzing resources and guidelines provided by the universities regarding the use of GenAI.

After the data collection process, the primary researcher thoroughly examined part of the data and then induced the initial child codes and broader parent codes. The codes were presented along with definitions in a table and introduced to other researchers in this study. Then other researchers reviewed and finalized the two coding schemes. Next, the coding schemes have been applied to the entire data for comprehensive analysis. The researchers had regular meetings to verify the coding results and discuss discrepancies. Throughout data analysis, the researchers adopted a collaborative and iterative approach to ensure the reliability of the coding process.

4.3. Scale and point systems

This study further delves into how school ranking tiers and academic specializations shape the trends in perceptions and resource provision for GenAI in higher education. For this purpose, we developed a scale system in order to quantify different universities' perceptions, from proactive embrace to cautious hesitance (see Table 3). The perception points are assigned according to each university's policy stances, with '0' representing 'Undecided/Unclear' policies to reflect a *neutral and open* position towards the use of GenAI. Various negative and positive scores in the range of [-5, 5] illustrate the spectrum from *cautious hesitance* to *strong endorsement* respectively.

Another scoring system extends to quantify the comprehensiveness of resources provided by these institutions. The comprehensiveness of resources is important because it helps reflect the scope of GenAI-related resources across different universities. We believe that assessing the comprehensiveness of the resources could reveal the extent to which institutions are prepared to support GenAI integration and reflect universities' readiness and attitudes toward GenAI. For example, a diverse range of resource types and content might indicate a proactive institutional approach to equipping students and faculty with the necessary knowledge and skills to effectively engage with GenAI. This is achieved by evaluating the breadth and depth of the resources, considering the target audience, the variety of resource types, and the range of content categories provided in Table 2. Specifically, universities accumulate scores based on their available resources across the three dimensions. For instance, for the target audience category, a university earns one point for each distinct group for whom resources are provided, including students, faculty, or the general audience, with a maximum of three points available in this dimension. For the types of resources category, a university gains one point for each type they provide, such as syllabus templates and workshops, allowing for up to five points in this dimension. Similarly, regarding the content analysis category, universities are awarded one point for each topic or theme covered, such as technical introductions and ethical considerations, for up to seven points for this dimension. We acknowledge that the limitation exists because institutions may vary in their document transparency, and some institutions may not fully disclose their resources in public places. However, from the publicly available data, we hope to highlight how institutions vary in their preparation for integrating GenAI into their curricula, and from there, foster discussions on the trends in resource provision and preparedness across diverse academic contexts. Both the quantitative scale and point systems are used specifically in Section 5.3 for exploring how key variables (ranking and academic specialization) affect the trends in perceptions and resource provision.

5. Results

5.1. Policies, management approaches, and perceptions from U.S. Universities

To answer RQ1, this section introduces the current policies, and management approaches adopted by the top-ranked U.S. universities, as well as the perceptions and implications derived from these policy statements. Fig. 2 summarizes policies and stances adopted by the top 100 universities ($n = 104$) in the U.S. regarding the legality and application of ChatGPT and other GenAI tools in higher educational contexts. None ($n = 0$, 0.0%) of the top 100 universities have completely banned these tools, reflecting a general acceptance or openness towards GenAI. The majority ($n = 57$, 54.8%) give this decision-making agency to individual instructors, indicating a contextualized and faculty-centric approach. Meanwhile, a modest 9.6% ($n = 10$) had implemented conditional use policies with proper citations, and 35.6% ($n = 37$) remained either undecided or had not clearly announced their policies or stance. These

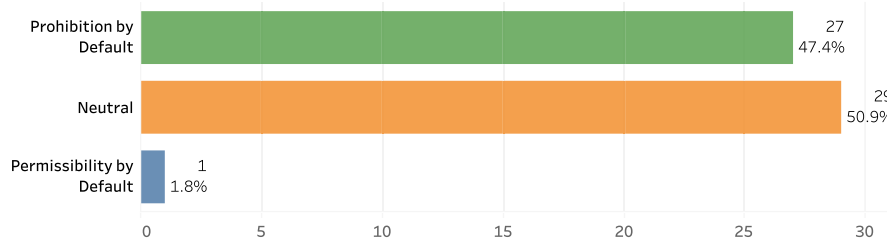


Fig. 3. Default policies when universities encourage instructors to decide.

responses demonstrate a diverse but flexible approach to integrating AI in higher education contexts in general.

However, it should be highlighted that no decision or no clear policy does not imply indifference toward GenAI on the part of these universities. Instead, many of them often present an open and objective introduction of ChatGPT and/or other AI writing tools, which represent their neutral perceptions. For example, the University of Illinois at Urbana-Champaign outlines both the benefits and challenges of using GenAI and advises that careful thoughts and considerations should be kept in mind when incorporating GenAI into coursework. While these universities are not refusing AI tools completely, they often stand in a neutral position and share all resources in a balanced way.

When selecting the “instructor decides” policy towards GenAI, a more cautious trend emerges, as illustrated in Fig. 3. Among the 57 “instructor decides” universities, 27 (47.4%) adopt a stance of Prohibition by Default, only allowing the use of such tools when an instructor explicitly permits it. If the instructor has not presented any policy statements on the use of GenAI, using GenAI in homework and essays is generally not allowed and may be under the circumstance of plagiarism. If the instructor allows it, students must cite appropriately and take responsibility for their responses. This option reveals the universities’ more cautious perceptions and evident concerns about the impact of GenAI on academic integrity.

Twenty-nine (50.9%) universities adopt a more open and neutral stance, granting instructors the autonomy to decide and addressing transparency in their own GenAI policy-making. This approach signals a more balanced and pragmatic perspective towards GenAI tools and also reflects the universities’ considerations for the diverse needs of different disciplines. University of California, Irvine (UCI)’s statement serves as an example, showing the essence and rationale behind this approach.

“Individual faculty will need to make decisions based on the context of their course, course objectives, students’ academic progression, and disciplinary-specific goals of their students’ learning experiences” (UCI Generative AI for Teaching and Learning²).

In summary, the different approaches of the top 100 universities on the use of GenAI (see Fig. 4) illustrate that these universities tend to show a generally open but cautious stance with a strong tendency towards encouraging instructors to manage the use of ChatGPT according to their own teaching contexts. The diversity in how these statements were crafted can also reflect the uncertainty and complexity of adopting AI in higher education practices.

We are also interested in exploring the main topics covered in the existing policies regarding GenAI technologies. Fig. 5 introduces the purposes and focuses of the universities’ existing policies on the use of GenAI in higher education. The data reveals a focus on addressing educational challenges and concerns, with higher attention to issues such as plagiarism ($n = 35$, 33.7%), inadequate proper attribution and citations ($n = 38$, 36.5%), and the limitations of AI tools ($n = 31$, 29.8%). On the other hand, topics related to professional research writing, such as intellectual property ($n = 13$, 12.5%) and data privacy ($n = 28$, 26.9%), have received comparatively less attention in these policies. This trend reveals that policy development in higher education institutions across

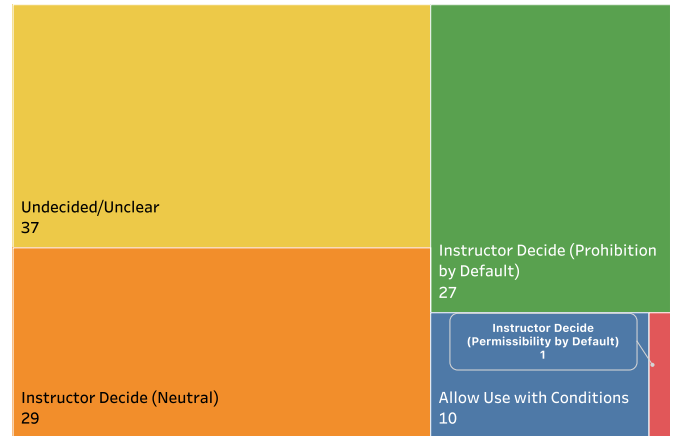


Fig. 4. Policies from the top 100 US universities regarding GenAI.

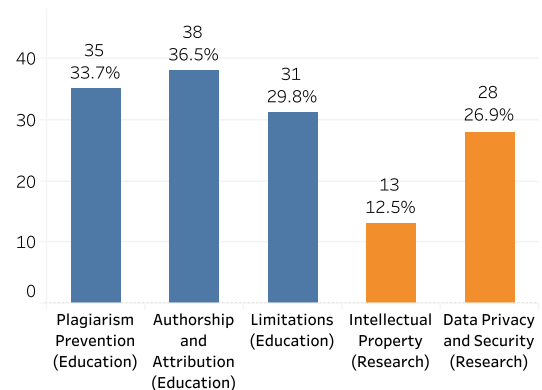


Fig. 5. Purposes and focuses of the policies.

the U.S. may often pay more attention to educational areas. Professional research writing and publication in academia may need more guidelines from institutions.

5.2. Guidelines and resources for the applications of GenAI

RQ2 focuses on the guidance and resources provided by the universities in our dataset regarding the use of GenAI tools. This section unpacks the different categories within these resources, namely the target audience, the types of resources provided, and the analysis of GenAI related content. There will also be discussions on the limitations, pedagogical applications, and prevention strategies of GenAI tools in teaching and learning provided by these universities.

5.2.1. Target audience

We first analyzed these universities’ statements to understand more about their target audience (see Fig. 6). The results show that 70 (67.4%) of 104 universities across the U.S. have resources and guidelines explicitly designed for faculty and instructors. A smaller portion of 19

² <https://dtei.uci.edu/chatgpt>.

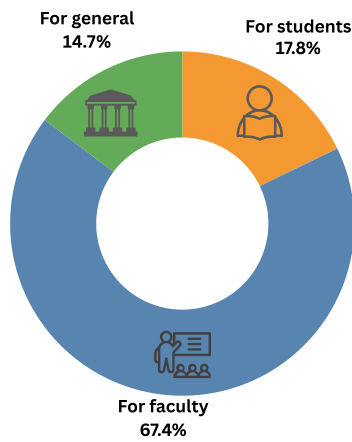


Fig. 6. Policies from the top 100 US universities regarding GenAI.

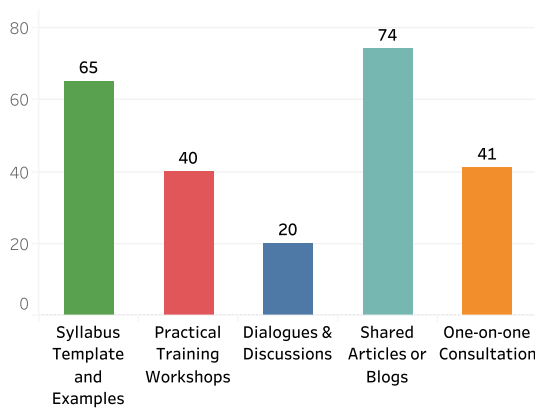


Fig. 7. Types of resources regarding ChatGPT provided by the top 100 universities.

(17.8%) universities offer resources aimed at students, and 15 universities (14.7%) provide guidance for the broader audience, including faculty, students, and staff, without specifying a particular audience. The findings show an emphasis on resources crafted for faculty and instructors to incorporate GenAI tools into their teaching practices. Relatively fewer resources address and guide students on the appropriate application of GenAI tools in their learning. This discrepancy highlights the need to establish a more in-depth guidelines for students when using GenAI.

5.2.2. Types of resources

Fig. 7 illustrates the different types of resources provided by the top 100 universities ($n = 104$) regarding GenAI, with the resource “Shared Articles or Blogs” being the most prevalent type ($n = 74$, 71.1%). This type of resource includes research papers, news articles, other universities’ websites, and blog posts, and is often featured as additional readings at the end of a resource page or as embedded links within a resource page content. The “Shared Articles or Blogs” resource category can cover a wide range of topics, such as opportunities and challenges of GenAI for education, educators’ and students’ reactions to GenAI innovations, and teaching strategies with the use of ChatGPT. These resources are important for instructors to gain additional knowledge about emerging technologies aside from the information already available to them on the university’s resource page.

It appears from our data that 65 (62.5%) universities have offered syllabus templates and examples to help instructors and teacher trainers with their policy decisions for their own teaching contexts. These templates typically showcase three distinct policy perspectives on the use of GenAI in the classroom to accommodate for instructors and disciplines’

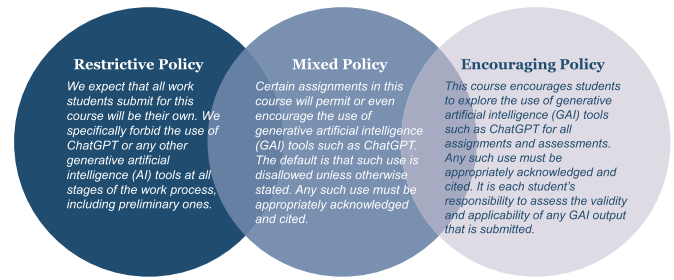


Fig. 8. Syllabus samples from Harvard University.

preferences. These three perspectives are: 1) restrictive, 2) mixed, and 3) encouraging. Harvard University’s syllabus samples³ exemplify this approach (see Fig. 8). Universities usually encourage all instructors to explicitly include a clear policy in course syllabi regarding the use and misuse of ChatGPT and other GenAI tools. Open and explicit communications are crucial to help students understand the boundaries and expectations when they interact with GenAI tools in learning.

Additionally, forty-one (39.4%) universities include one-on-one consultations as a type of resource for instructors and/or students. They are conducted with the institution’s GenAI specialists and/or representatives from centers such as the Teaching and Learning Center to address attendees’ specific concerns and help them navigate GenAI tools application in their own teaching and learning contexts.

Furthermore, it is evident in Fig. 7 that a smaller proportion of universities offer workshops ($n = 40$, 38.5%) and discussions ($n = 20$, 19.2%) regarding the use of ChatGPT and other GenAI tools. This might be due to the fact that many of these workshops and discussions are internal, hence the lack of their representations in our dataset. As for any new and emerging GenAI tool, workshops and discussions are crucial for familiarizing educators with its positive applications and educational implications (De Winter et al., 2023). The results could reflect that there is a possible demand for increasing the frequency and accessibility of these events.

5.2.3. Content analysis of resources and guidelines

Fig. 9 summarizes the focuses and purposes of the existing resources and guidelines regarding the use of ChatGPT and other GenAI tools in higher education. The majority of the universities start by introducing general information about GenAI ($n = 85$, 81.7%), such as having a section on “What is ChatGPT?” or “What is GenAI in Education?” This approach indicates the institutions’ intention in familiarizing faculty, students, and staff with GenAI tools and enhancing their understanding of these technologies. Six-two (59.6%) universities discuss the ethical implications of implementing GenAI in higher education, including their apprehensions about the misuse of GenAI when it comes to plagiarism, academic integrity, and student evaluation. This discussion highlights the necessity for instructors to monitor and guide the use of ChatGPT and other GenAI tools in their classes to prevent possible cheating and plagiarism (Huallpa et al., 2023).

Fifty-six (53.8%) universities explicitly list the inherent limitations of the current GenAI model and 38 (36.5%) universities address issues related to data privacy. These constraints are not exclusive to a particular area in higher education, as they can influence teaching approaches, learning experiences, and research activities. Acknowledging these limitations and issues is the first step in establishing a more responsible and ethical implementation of GenAI in education (Kasneci et al., 2023). The limitations mentioned by the universities in our dataset primarily include:

- Inaccuracy or misleading information;

³ <https://oue.fas.harvard.edu/ai-guidance>.

Table 4
Pedagogical applications and prevention strategies of AI in teaching and learning.

Pedagogical Applications Effectively incorporate AI in teaching and learning	Prevention Strategies Prevent inappropriate use of AI in teaching and learning
• Ask students to analyze and evaluate AI-generated texts. • Ask students to compare and evaluate the different versions of texts generated by different AI tools. • Ask students to compare/contrast AI-generated texts with human writing. • Ask students to revise and edit AI-generated information. • Ask students to debate or argue with AI and reflect on their learning. • Use AI as a resource for students to receive feedback on their drafts • Use AI tools to brainstorm initial teaching ideas and activities. • Use AI tools to generate additional examples of certain concepts. • Use AI tools to summarize long or difficult text. • Use AI tools to generate writing prompts, grading rubrics or quiz questions based on the course materials.	• Ask students to explain their thought processes as they solve problems. • Ask students to reflect on their personal learning experiences and opinions. • Ask students to connect with their personal knowledge and life experiences. • Ask students to include and provide proper academic citations. • Ask students to reference class materials, notes, or sources that are unavailable online. • Ask students to complete assignments in class. • Ask students to present their answers in multimodal ways, such as hand drawing, or audio threads. • Include visual prompts in assignments. • Design assignments related to current events or discussions in the specific academic field. • Divide the larger project into multiple smaller tasks.

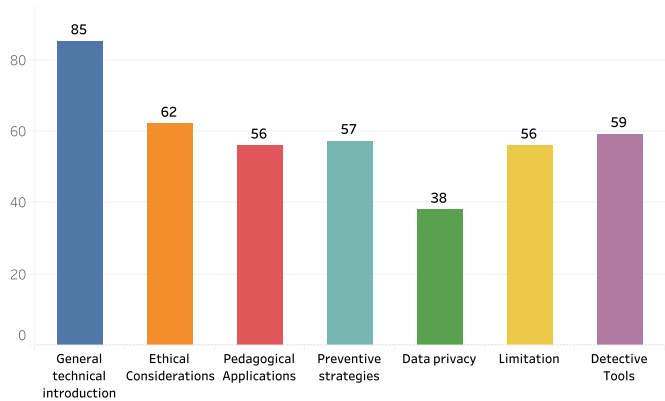


Fig. 9. Content analysis of resources and guidelines from the top 100 universities.

- Biased opinions based on the training data;
- Fake information and/or hallucinations: especially when generating citations and references;
- Limited knowledge of recent information and specific academic fields;
- Absence of citations and references.

Another area that receives great attention from these universities is the pedagogical application and preventive strategies of GenAI tools for teachers and educators. Fifty-six universities on our list (53.8%) have offered resources on how to effectively incorporate GenAI tools into the classroom for enhancing student learning experiences. At the same time, fifty-seven universities (54.8%) have provided strategies on how to avoid the misuse of GenAI tools by students. Table 4 provides a summary of major pedagogical applications and prevention strategies sourced from these leading universities. Both approaches highlight the significance of cultivating students' critical thinking skills and problem-solving abilities, which are essential competencies in today's rapidly advancing, technology-infused world.

Another trend that emerges from the data is the discussion of using GenAI detection tools or GenAI detectors to identify AI-generated text in students' work. Fifty-nine (56.7%) universities discuss the available common detective tools, such as Turnitin and GPTZero. However, it is worth noting that none ($n = 0, 0\%$) of the universities in this study view the use of detective tools as a completely reliable method to identify AI-generated information, and none ($n = 0, 0\%$) of them support instructors to use of the tools to evaluate students' academic integrity and

determine plagiarism. While GenAI detectors are designed to identify AI-generated language patterns, the research conducted by Sadasivan et al. (2023) shows that they are not reliable in many real-world scenarios. This is particularly evident when the detective tools are faced with paraphrasing attacks, which refer to applying a light paraphraser to generated texts. Even a minor rephrasing can significantly affect the performance and accuracy of the entire detection system (Sadasivan et al., 2023). Additionally, universities in this study raise further concerns regarding the use of GenAI detectors, including the potential violation of students' intellectual property rights and the risk to data privacy once their work is submitted to the detective tools. Some universities also believe that relying on such tools might undermine the relationship of trust between students and teachers as well.

5.3. Trends in perceptions and resource provision of GenAI

RQ3 examines how universities' perceptions and resources on the use of GenAI are affected by two possible factors: 1) institution ranking tiers; and 2) institution academic specializations. We will discuss the pedagogical implications that can be drawn from these findings.

5.3.1. Perception and available resources across different tiers

This section employs the scale and point system described in method Section 4.3 to examine the relationship between three dimensions, including perceptual stances, resource diversity, and university rankings. We divide the top 100 universities ($n = 104$) into three tiers to examine the disparities in perceptions and resources across different tiers of higher education institutions. Tier 1 includes the top 1-33 universities ($n = 34$); Tier 2 comprises the subsequent top universities ranked 34-66 ($n = 32$); and Tier 3 includes the remaining universities ranked 67-100 ($n = 38$).

In terms of the results, Fig. 10 illustrates the correlation between the perceptions and resources regarding GenAI across the three ranking tiers. We find that a majority of the top 100 universities have developed a diversity of resources and guidelines for integrating GenAI, demonstrating a proactive approach towards applying this technology to their education. However, the figure shows that there is no significant correlation between the universities' rankings and the depth of perceptions and resources related to GenAI. The trend also indicates that a large number of universities present unclear and cautious perceptions toward GenAI. These perceptions might be due to uncertainties and controversial features of GenAI in higher education.

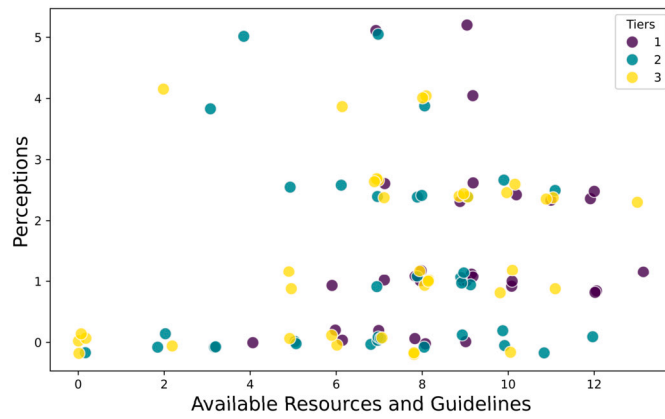


Fig. 10. Perception scores vs. available resources across different tiers.

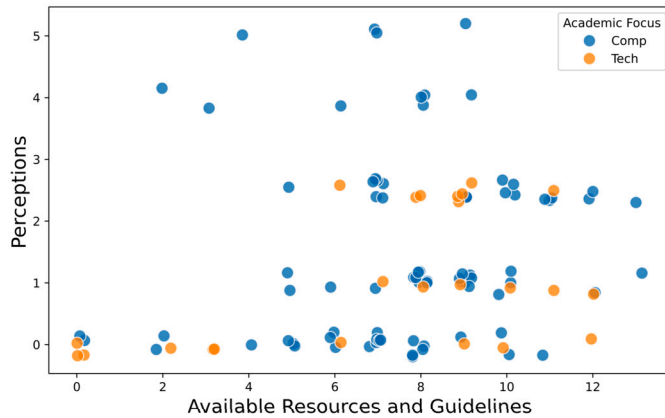


Fig. 11. Perception and available resources across different types of academic focuses.

5.3.2. Perception and available resources across different academic focuses

We have also examined how different academic focuses of the universities affect their perceptions and resource provision regarding GenAI tools. We divide the top 100 universities ($n = 104$) into two groups. Institutions recognized for their programs in technology, engineering, and science, such as the California Institute of Technology, are categorized as “technology-oriented universities” ($n = 24$). Conversely, universities known for their broader and comprehensive academic subjects, covering areas such as arts, social sciences, and humanities alongside other fields are classified as “comprehensive universities” ($n = 80$), such as Harvard University.

An evident trend emerges when comparing the perceptions and resources across the two groups (see Fig. 11). The technology-oriented universities show a higher level of caution and careful consideration in their policies. In addition, these universities also have more comprehensive and diverse guidelines and resources, which reflect an active engagement with GenAI’s implications for their academic contexts. For example, as programming homework is prevalent in STEM courses, there might be more concerns about academic dishonesty due to GenAI’s ability to provide definitive solutions (Michel-Villarreal et al., 2023). On the other hand, there are a number of comprehensive universities that show a more welcoming and supportive stance towards the use of GenAI. This variation may indicate that the academic specialization of a university might affect its approach in managing and integrating GenAI tools for academic purposes. Considering the nature of different academic disciplines and contexts, the results highlight the importance of developing discipline-specific policies and guidelines that can accommodate the differences and challenges of each academic domain. In addition, the integration of GenAI in educational practice needs to align with the

objectives of each discipline to effectively enhance student learning experiences.

6. Discussion and practical implications

The integration of ChatGPT and other GenAI tools in educational contexts has been viewed as both an opportunity and a challenge. To advocate for a more ethical and responsible direction of GenAI incorporation in higher education, this study analyzes the top 100 U.S. universities’ currently available policies, statements, guidelines, and resources on the use of GenAI tools. The results show that most of the universities in our dataset have the tendency to approach GenAI usage with careful consideration, especially in evaluating the impacts of GenAI for their own contexts, and often offer a diversity of resources for teaching and learning with GenAI. This reflects a timely effort to increase awareness and preparation for GenAI tools usage while still allows these institutions to observe the changes of the technology accordingly.

6.1. Implications for educators in teaching practices

The study offers a comprehensive overview of the primary policies and resources regarding using GenAI in higher education. Specifically, we find that the top 100 U.S. universities ($n = 104$) have a generally open but cautious approach to GenAI, with none ($n = 0, 0\%$) of them having imposed a complete ban on GenAI tools. This is likely due to the reality that it would be almost impossible to prohibit GenAI usage among university students nor it would be necessary to do so (Sullivan et al., 2023). Thus, educators are now in a position of needing to accept, adapt, and embrace GenAI presence in their teaching contexts. This process, however, does not come easy, and would require training, support and active engagement on the university’s part.

From analyzing the resources on GenAI, the study shows that a majority of universities (81.7%) provide resources including the general technical information on GenAI tools and GenAI usage. Instructors can leverage this type of information to gain foundational knowledge of the new technology, and from there explore what GenAI tools can do for their teaching contexts. In addition, we find that numerous universities ($n = 56, 53.8\%$) focus on the potential benefits of GenAI and propose pedagogical applications that can be helpful for instructors wanting to integrate GenAI in their teaching preparation and practice (see Table 4). Together with that, over half of the universities on our list ($n = 57, 54.8\%$) allows instructors to determine their own GenAI policies in the classroom. While these all seem to be an approach that honor instructors’ agency and choice regarding GenAI usage, we believe that there needs to be more specific guidance on how instructors can do that effectively and meaningfully. For example, implementing GenAI into an existing lesson might require instructors to not only understand the technology but also know how to align that said technology with their current pedagogy and classroom content. Drawing on the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra et al., 2023), AI-assisted instruction should extend beyond simply using specific tools. It should require instructors to align GenAI tools with their course content, and to recognize their pedagogical affordances to develop a more streamlined learning process. Further teaching observations and classroom-based research are needed to explore the pedagogical applications and impacts of GenAI across different courses in higher education.

In addition to the pedagogical applications of GenAI in higher education, the findings also reveal information related to ethical concerns among these universities, namely plagiarism, and GenAI limitations (e.g., *inaccurate information, biased opinions, limited knowledge, and the absence of references generated by GenAI*). To address these concerns and limitations, 65 (62.5%) universities have offered templates or examples for syllabus language that could help instructors develop their GenAI policies and guidelines for their own teaching contexts. Establishing clear policies and guidelines regarding the use of GenAI in course syllabi can allow students know explicitly what they can and cannot do

with GenAI from the beginning. Moreover, the results suggest that educators can consider applying strategies to prevent the inappropriate use of GenAI in their classes. For example, instructors can tailor their assignment prompts to focus more on students' personal knowledge and experiences. These assignments can ask students to reference available class materials, or make connections to students' prior experiences. It would also be helpful for instructors to divide their assignments into smaller steps, such as brainstorming, first draft, second draft, peer review, reflection. This would allow students to engage in learning throughout the course, instead of relying on one big submission at the end of their course. As students will need guidance on GenAI tools, it is essential for classroom assignments and activities to account for both the complexity and the responsibility of using these tools through scaffolding and preparation.

The discussion of GenAI detection tools is also a topic that receives a lot of attention in our review of universities' guidelines and resources. While 59 (56.7%) universities introduced common detective tools, they generally do not recommend that instructors use these tools to evaluate and determine plagiarism. This cautious approach aligns with findings from (Elkhatat et al., 2023; Weber-Wulff et al., 2023), which address that the current GenAI detection tools are not reliable enough to be widely adopted by universities for determining plagiarism. Keeping this in mind, teachers can adopt multifaceted evaluation strategies to assess students' work. One practical approach can be to assess students' written work based on their previous and in-class performance. AI-generated content cannot fully replicate the unique writing style of individual students, which often includes word selection, phrase usage, language patterns, and students' personal insights developed over the course of the semester. Some prevention strategies discussed in the results section (see Table 4), such as asking students to explain their answers in multimodal ways (e.g., *presentations, audio threads, podcasts*), can be applied to avoid the inappropriate use of GenAI. It is important to note that instructors should treat each student's work as a learning opportunity, thus, providing feedback at multiple levels and asking students to reflect on how they make changes to their assignments can be beneficial for students' learning process while preventing the excessive use of GenAI. In addition, some universities indicate that relying on GenAI and its detection tools might undermine the relationship between students and teachers. Accusing students of using GenAI needs to be addressed with caution and care, in order to maintain a trusting relationship between students and their instructors. More guidance on how to establish these harder conversations between faculty and students needs to be discussed and developed further.

6.2. Recommendations for educators in crafting policies and guidelines

For teacher trainers and educators who take on the challenge of crafting policies and guidelines related to GenAI tools, this study suggests consideration of policies that account for the differences between disciplines. The results reflect that the perceptions and resources on GenAI can vary based on academic specializations (see section 5.3.2). This can indicate that different disciplines and contexts may influence how educators manage and integrate GenAI tools. While many universities allow instructors to decide their own course policies regarding the use of GenAI ($n = 57, 54.8\%$), it can be overwhelming for instructors as they already have to consider the needs of their students and also the ongoing changes of these tools (Chiu, 2023; Zastudil et al., 2023). Adding labor on top of that to include discipline-specific policies might be putting too much work on solely the instructors. Thus, to help with establishing policies and guidelines, policymakers can engage with educators across various departments to understand how they currently teach and prepare to teach, what assignments and activities their students are working on, and what ethical considerations are needed for each discipline. From there, guidelines that are explicit in dealing with each context can be established. We argue that developing GenAI policies and resources should be a shared effort between instructors and administrators. Depending on

their programs' special contexts and needs, educators should be encouraged to discuss, evaluate, and refine the policies to support the specific needs of their teaching contexts.

The results also highlight the universities' concerns regarding data privacy issues when integrating GenAI into academic settings. It is important to take precautions when managing sensitive or proprietary information, whether faculty their own or that of their students. The findings highlight a dual concern in higher education regarding data privacy: students may unintentionally expose sensitive information by uploading it to GenAI tools, while instructors also face risks when submitting students' works to detection tools. This situation highlights the need for comprehensive guidelines that explicitly discuss the inherent privacy risks of GenAI. To address the concerns, guidelines and resources should clearly outline what types of information are safe to share with GenAI and what should be kept confidential. Establishing training on how to protect sensitive information and students' personal information if GenAI is integrated into teaching can be another venue to consider. Moreover, while current guidelines primarily focus on the ethical use of GenAI in teaching and learning, we hope that future resources can extend beyond pedagogy, and include the principles, behaviors, and ethics observed in research as well. More explicit policies and guidelines are necessary to raise researchers' awareness of which information is considered sensitive and personal and to address the appropriate ethical boundaries for using GenAI in research in higher education.

7. Conclusion

This study delves into the academic policies, resources, and guidelines of the top 100 U.S. universities ($n = 104$) regarding ChatGPT and other GenAI tools in higher education, and thereby informs educators in teaching practices as well as future policy-making. Data was collected from publicly available official university sources, such as the Office of Provost and the Center of Teaching and Learning. The results reveal an open yet cautious and thoughtful attitude toward the integration of GenAI tools, with concerns focusing mainly on ethical issues such as plagiarism and data privacy, and GenAI limitations for teaching and learning. A number of universities encourage instructors to develop their own policies and guidelines for the use of GenAI ($n = 57, 54.8\%$), respecting the specific contexts and needs of their disciplines. For resources and guidelines, most popular teaching support includes syllabus samples and templates ($n = 65, 62.5\%$), workshops ($n = 40, 38.5\%$), articles ($n = 74, 71.1\%$), and individual consultations with topics on technical introduction ($n = 41, 39.4\%$), pedagogical applications ($n = 56, 53.8\%$), prevention strategies ($n = 57, 54.8\%$), limitations ($n = 56, 53.8\%$), and detection tools ($n = 59, 56.7\%$), to help instructors adapt their teaching practices in the age of GenAI. These efforts highlight a variety of opportunities and challenges presented by GenAI, and from there, invite further conversations for developing more appropriate guidelines and resources for GenAI usage in higher education.

In this era of GenAI, what we should avoid is to stay stagnant. Actively engaging with these technological advancements is crucial for maximizing their potential while effectively mitigating their risks. The findings of this study offer important implications for educators in both teaching practices and policy designs. For educators in teaching practices, the pedagogical implications include accepting, adapting, and embracing the presence of GenAI, aligning its use with specific learning objectives, updating the curriculum to guide and prevent students from misuse, as well as applying multifaceted evaluation strategies instead of relying on GenAI detectors. For educators who need to make policies for their own classes and/or departments, we recommend designing policies according to their discipline-specific contexts and take precautions when managing sensitive information.

This study has several limitations. We acknowledge that the focus on the top 100 U.S. universities may not fully represent the broader higher education landscape in the U.S. or globally, as smaller or regional institutions that may have different approaches or face distinct challenges

concerning GenAI. Additionally, due to the rapid pace of AI development, the policies and resources analyzed in this study may be impacted, requiring institutions to update their strategies to address emerging ethical, pedagogical, and privacy concerns. We hope future research could explore a wider range of educational contexts to better examine the evolving discourse on GenAI across the broader landscape of higher education and to develop more effective support strategies for instructors and students.

CRedit authorship contribution statement

Hui Wang: Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anh Dang:** Writing – review & editing, Writing – original draft, Formal analysis. **Zihao Wu:** Writing – original draft, Visualization, Supervision, Formal analysis. **Son Mac:** Formal analysis.

Statements on open data and ethics

The data used in this study is sourced from publicly available databases. No private or confidential data was accessed or used in this study.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Not applicable.

Data availability

The authors declare that the data supporting the findings of this study are available within the paper.

References

- Abdullayeva, M., & Musayeva, Z. M. (2023). The impact of chat gpt on student's writing skills: An exploration of ai-assisted writing tools. In *International conference of education, research and innovation* (pp. 61–66).
- Achiam, J., Adler, S., Agarwal, S., Ahmad, L., Akkaya, I., Aleman, F. L., Almeida, D., Altenschmidt, J., Altman, S., Anadkat, S., et al. (2023). Gpt-4 technical report. arXiv preprint, arXiv:2303.08774.
- Alharbi, W. (2023). AI in the foreign language classroom: A pedagogical overview of automated writing assistance tools. *Education Research International*, 2023, 1–15.
- Ali, F., et al. (2023). Let the devil speak for itself: Should chatgpt be allowed or banned in hospitality and tourism schools? *Journal of Global Hospitality and Tourism*, 2, 1–6.
- Baek, T. H., & Kim, M. (2023). Is chatgpt scary good? How user motivations affect creepiness and trust in generative artificial intelligence. *Telematics and Informatics*, 83, Article 102030.
- Barrett, A., & Pack, A. (2023). Not quite eye to AI: Student and teacher perspectives on the use of generative artificial intelligence in the writing process. *International Journal of Educational Technology in Higher Education*, 20, 59.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77–101.
- Chiu, T. K. (2023). The impact of generative AI (genai) on practices, policies and research direction in education: A case of chatgpt and midjourney. *Interactive Learning Environments*, 1–17.
- Cooper, G. (2023). Examining science education in chatgpt: An exploratory study of generative artificial intelligence. *Journal of Science Education and Technology*, 32, 444–452.
- Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education*, 20, 22.
- De Winter, J. C., Dodou, D., & Stienen, A. H. (2023). Chatgpt in education: Empowering educators through methods for recognition and assessment. In *Informatics*. MDPI (p. 87).
- Dempere, J., Modugu, K. P., Hesham, A., & Ramasamy, L. (2023). The impact of ChatGPT on higher education. *Frontiers in Education*, 8, Article 1206936.
- Eke, D. O. (2023). Chatgpt and the rise of generative ai: Threat to academic integrity? *Journal of Responsible Technology*, 13, Article 100060.
- Elkhatat, A. M., Elsaid, K., & Almeer, S. (2023). Evaluating the efficacy of AI content detection tools in differentiating between human and ai-generated text. *International Journal for Educational Integrity*, 19, 17.
- Escalante, J., Pack, A., & Barrett, A. (2023). AI-generated feedback on writing: Insights into efficacy and ENL student preference. *International Journal of Educational Technology in Higher Education*, 20, 57.
- Firat, M. (2023). What chatgpt means for universities: Perceptions of scholars and students. *Journal of Applied Learning and Teaching*, 6, 57–63.
- Fuchs, K. (2023). Exploring the opportunities and challenges of NLP models in higher education: Is chat gpt a blessing or a curse? In *Frontiers in education*. Frontiers (p. 1166682).
- Gao, C. A., Howard, F. M., Markov, N. S., Dyer, E. C., Ramesh, S., Luo, Y., & Pearson, A. T. (2023). Comparing scientific abstracts generated by chatgpt to real abstracts with detectors and blinded human reviewers. *NPJ Digital Medicine*, 6, 75.
- Grassini, S. (2023). Shaping the future of education: Exploring the potential and consequences of AI and chatgpt in educational settings. *Education Sciences*, 13, 692.
- Harunasari, S. Y. (2022). Examining the effectiveness of AI-integrated approach in EFL writing: A case of chatgpt.
- Hualpa, J. J., et al. (2023). Exploring the ethical considerations of using chat gpt in university education. *Periodicals of Engineering and Natural Sciences*, 11, 105–115.
- Imran, M., & Almusharraf, N. (2023). Analyzing the role of chatgpt as a writing assistant at higher education level: A systematic review of the literature. *Contemporary Educational Technology*, 15, Article ep464.
- Iqbal, N., Ahmed, H., & Azhar, K. A. (2022). Exploring teachers' attitudes towards using chatgpt. *Global Journal for Management and Administrative Sciences*, 3, 97–111.
- Jarrah, A. M., Wardat, Y., & Fidalgo, P. (2023). Using chatgpt in academic writing is (not) a form of plagiarism: What does the literature say. *Online Journal of Communication and Media Technologies*, 13, Article e202346.
- Kalla, D., & Smith, N. (2023). Study and analysis of chat gpt and its impact on different fields of study. *International Journal of Innovative Science and Research Technology*, 8.
- Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., Hüllermeier, E., et al. (2023). Chatgpt for good? On opportunities and challenges of large language models for education. *Learning and individual differences*, 103, Article 102274.
- Kiryakova, G., & Angelova, N. (2023). Chatgpt—a challenging tool for the university professors in their teaching practice. *Education Sciences*, 13, 1056.
- Lee, G. G., Shi, L., Latif, E., Gao, Y., Bewersdorf, A., Nyaaba, M., Guo, S., Wu, Z., Liu, Z., Wang, H., et al. (2023). Multimodality of AI for education: Towards artificial general intelligence. arXiv preprint, arXiv:2312.06037.
- Liu, M., Zhang, L. J., & Biebricher, C. (2024). Investigating students' cognitive processes in generative ai-assisted digital multimodal composing and traditional writing. *Computers and Education*, 211, Article 104977.
- Mahapatra, S. (2024). Impact of chatgpt on esl students' academic writing skills: A mixed methods intervention study. *Smart Learning Environments*, 11, 9.
- Michel-Villarreal, R., Vilalta-Perdomo, E., Salinas-Navarro, D. E., Thierry-Aguilera, R., & Gerardou, F. S. (2023). Challenges and opportunities of generative AI for higher education as explained by chatgpt. *Education Sciences*, 13, 856.
- Mishra, P., Warr, M., & Islam, R. (2023). Tpack in the age of chatgpt and generative AI. *Journal of Digital Learning in Teacher Education*, 39, 235–251.
- Ng, D. T. K., Tan, C. W., & Leung, J. K. L. (2024). Empowering student self-regulated learning and science education through chatgpt: A pioneering pilot study. *British Journal of Educational Technology*.
- Onal, S., & Kulavuz-Onal, D. (2023). A cross-disciplinary examination of the instructional uses of chatgpt in higher education. *Journal of Educational Technology Systems*, 00472395231196532.
- Peres, R., Schreier, M., Schweidel, D., & Sorescu, A. (2023). On chatgpt and beyond: How generative artificial intelligence may affect research. Teaching, and practice.
- Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: Chatgpt and beyond. *Journal of University Teaching & Learning Practice*, 20, Article 07.
- Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J., Sun, M., Day, I., Rather, R. A., & Heathcote, L. (2023). The role of chatgpt in higher education: Benefits, challenges, and future research directions. *Journal of Applied Learning and Teaching*, 6.
- Ray, P. P. (2023). Chatgpt: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. In *Internet of things and cyber-physical systems*.
- Rice, S., Crouse, S. R., Winter, S. R., & Rice, C. (2024). The advantages and limitations of using chatgpt to enhance technological research. *Technology in Society*, 76, Article 102426.
- Rudolph, J., Tan, S., & Tan, S. (2023). Chatgpt: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning and Teaching*, 6.
- Sadasivan, V. S., Kumar, A., Balasubramanian, S., Wang, W., & Feizi, S. (2023). Can ai-generated text be reliably detected? arXiv preprint, arXiv:2303.11156.

- Similarweb (2024). Audience geography for chat.openai.com. https://pro.similarweb.com/#/digitalsuite/websiteanalysis/overview/website-performance/*999/1m?webSource=Total&key=chat.openai.com.
- Song, C., & Song, Y. (2023). Enhancing academic writing skills and motivation: Assessing the efficacy of chatgpt in ai-assisted language learning for EFL students. *Frontiers in Psychology*, 14, Article 1260843.
- Sullivan, M., Kelly, A., & McLaughlan, P. (2023). Chatgpt in higher education: Considerations for academic integrity and student learning.
- Team, G., Anil, R., Borgeaud, S., Wu, Y., Alayrac, J. B., Yu, J., Soricut, R., Schalkwyk, J., Dai, A. M., Hauth, A., et al. (2023). Gemini: A family of highly capable multimodal models. arXiv preprint, arXiv:2312.11805.
- Touvron, H., Martin, L., Stone, K., Albert, P., Almahairi, A., Babaei, Y., Bashlykov, N., Batra, S., Bhargava, P., Bhosale, S., et al. (2023). Llama 2: Open foundation and fine-tuned chat models. arXiv preprint, arXiv:2307.09288.
- Van Wyk, M. M. (2024). Is chatgpt an opportunity or a threat? Preventive strategies employed by academics related to a genai-based LLM at a faculty of education. *Journal of Applied Learning and Teaching*, 7.
- Weber-Wulff, D., Anohina-Naumeca, A., Bjelobaba, S., Foltýnek, T., Guerrero-Dib, J., Popoola, O., Šigut, P., & Waddington, L. (2023). Testing of detection tools for ai-generated text. *International Journal for Educational Integrity*, 19, 26.
- Wu, T. T., Lee, H. Y., Li, P. H., Huang, C. N., & Huang, Y. M. (2024). Promoting self-regulation progress and knowledge construction in blended learning via chatgpt-based learning aid. *Journal of Educational Computing Research*, 61, 3–31.
- Yan, D. (2023). Impact of chatgpt on learners in a l2 writing practicum: An exploratory investigation. *Education and Information Technologies*, 28, 13943–13967.
- Zastudil, C., Rogalska, M., Kapp, C., Vaughn, J., & MacNeil, S. (2023). Generative AI in computing education: Perspectives of students and instructors. In *2023 IEEE frontiers in education conference (FIE)*. IEEE (pp. 1–9).