

Board 66: Impact of ChatGPT on Student Writing in Construction Management: A Study of Applied Risks

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Since the launch of ChatGPT by OpenAI on November 30, 2022, its adoption in educational settings has attracted significant academic interest. However, less attention has been focused on its use in writing-intensive construction courses. This paper reviews and summarizes the key applications, policy approaches, and potential academic challenges associated with the development of ChatGPT to improve writing skills managed by practitioners in the construction industry. It explores contentious topics such as the trustworthiness of AI-generated content, the efficacy of content screening methods, and concerns about academic integrity. This paper also provides essential firsthand information for the forthcoming research on academic strategies and countermeasures.

This study includes a survey distributed to 110 students from two writing-intensive courses in the Department of Construction Management at East Carolina University. The aim is to assess their use of ChatGPT and their ability to screen AI generated content. The results validate concerns about the reliability of information extracted by ChatGPT, noting a considerable number of inaccuracies. The research also points out the difficulty in recognizing AI-generated texts in construction writing, emphasizing the urgent need for detailed guidelines on the use of AI detection tools and formulation of relevant policies.

Keywords: ChatGPT, AI writing, Construction Management, Integrity Policy, Critical Thinking

Introduction

In recent years, the emergence of advanced natural language processing (NLP) technologies, and especially its sub-field, natural language generation (NLG) dramatically reshaped the way information is disseminated. NLG techniques are used in many downstream tasks such as summarization, dialogue generation, generative question answering (GQA), data-to-text generation, and machine translation. Increasingly, customer service, logistics management, design, data processing, automation of routine tasks, code generation, and document generation are increasingly being handled by AI robots. This approach to production, which focuses primarily on the automation, digitization, and real-time connectivity of production systems, opens up a new era of production in Industry 4.0 [1]. Among these revolutionary technologies, OpenAI has developed a cutting-edge language model, ChatGPT, which is a groundbreaking language model because of its ability to create coherent and contextually relevant files. Its capability extends to writing essays, gathering domain insights, drafting e-mails, providing customer support through chatbots, creating blogs and files, drafting resumes, assisting with coding and programming tasks, summarizing lengthy texts and files, and providing creative writing help and tips. Some studies have shown that it is even capable of earning a university degree (e.g., in the United States) [2]. Since its launch on November 30, 2022, ChatGPT has experienced explosive growth. As of December 2023, ChatGPT had approximately 180.5 million users. Reports show that it is used by around one-third of university students [3], and this percentage continues to grow. The wide user market has given rise to a large number of related products. For example, Chrome AI extensions, Chatbot

Integrations, Writing Assistants, AI image generators, Coding Assistance Tools, and Content Creation Tools are just the tip of the iceberg. In addition to ChatGPT, there is a myriad of other tools and platforms in the AI landscape. AI Writer, ChatPDF, WebChatGPT, WiseoneAI, ChatDoc, Paper Digest, Gamma, Youtube summary with ChatGPT, Scholarcy, and TXYZ are just a few examples among a vast array of innovative solutions in the field. The AI ecosystem is continuously evolving, with each tool offering unique features and capabilities to cater to various needs and preferences.

The ChatGPT presented in this paper is based on the generative pre-trained Transformer version 3.5 (GPT-3.5). In this study, the literature reviewed includes journal papers, conference proceedings, and selected online publications from databases such as IEEE Xplore, Scopus, Web of Science, and Google Scholar. Each of these databases allows ChatGPT, writing, and construction to be used as a search string for terms that include these terms in the title, abstract, or keywords. Each of these databases uses ChatGPT, writing, and construction as a search string for papers that include these terms in the title, abstract, or keywords. The timeframe for the publications extends from late 2022 through the present.

Academic usage and risks of ChatGPT

The use of AI tools naturally extends to all aspects of education, including writing-intensive programs. In the field of construction management, the American Council for Construction Education (ACCE) outlines 17 Student Learning Outcomes (SLOs) for construction education programs. The first SLO, SLO-1, emphasizes the ability to "create written communication appropriate to the discipline of construction. This SLO focuses on ensuring that students are able to effectively communicate ideas, plans, and concepts through written means. This is a key skill in the construction industry to ensure that a variety of stakeholders, including clients, contractors, and regulators, can communicate clearly and accurately [4]. Higher demands naturally bring greater challenges. As a result, assignments in writing courses are often very challenging for students, especially those requiring critical analysis and technical writing skills. In this context, ChatGPT can provide valuable support for providing ideas, refining grammar and sentence structure, and enhancing overall writing quality. Scholars generally recognize the usefulness of AI tools such as ChatGPT in enhancing the efficiency and quality of writing. For example, features such as assisting in file searching, document translation, data management, generation of references and citations, and the use of AI tools such as ChatGPT to improve the efficiency and quality of writing [5], [6], [7], [8], [9], [10], reviewing and correcting grammatical errors [2], [11], [12], [13], accelerating writing and outlining [14], generating formatted professional documentation [1], retouching text, and adding details to help improve writing [6], [15], [16] are also potentially useful for students completing writing tasks. All of these features require only a few lines of commands written in natural language for ChatGPT to complete in less than a minute, and what's more, the author can continue to send commands multiple times to ask ChatGPT to make targeted changes until the user is satisfied.

While ChatGPT has flourished, many scholars have raised concerns about the potential risks of ChatGPT as an educational resource. The main concerns relate to the potential for plagiarism, dissemination of misinformation, and loss of originality. Scholars have argued that completing writing tasks through ChatGPT may make students lazy and turn to steal ideas directly from other people (e.g., the use of ChatGPT as an educational resource) and that the use of ChatGPT as an educational resource can lead to a loss of creativity [6], [12], [17], [18], [19], [20]. Because ChatGPT is trained on a large corpus of files, students may be tempted to believe the opinions confidently given by the AI, to inherit biases, or even to simply copy the language created by the artificial intelligence model, rather than to think critically and

develop their own unique ideas. When we understand enough about the decision-making of AI systems and the reasoning processes behind them, these problems may be effectively managed and mitigated. However, it is clear that this information is not yet transparent.

Second, ChatGPT's up-to-date knowledge is limited; its corpus does not contain information beyond 2022, which leads it to be unaware of what has happened in the last two years [18]. These missing data, outdated rankings, and outdated technical information are fatal to the ever-changing field of engineering.

In addition, there are concerns about the accuracy of ChatGPT information, as it lacks the ability to access information from external storage or databases is unable to distinguish between factual, fictional, and unreliable information, and may even fabricate answers [9], [18], [19], [21]. Such incorrect or even illogical answers may in turn lead to problems with privacy, security [7], [10], [17], [22], [23], and social biases such as racial, gender, and textual biases [12], [17].

University policies

Many institutions of higher education were quick to express concern when ChatGPT was first released, such as New York City public schools, which banned ChatGPT in early 2023, and many universities have since mapped out strategies for controlling ChatGPT in the classroom in order to more appropriately deal with the academic risks associated with using ChatGPT. Overall, more and more schools are embracing AI technology tools in a more open and inclusive manner, and some schools are continuing to update their policies after a period of caution [24]. For example, according to current public information on Google, New York City public schools lifted bans on ChatGPT from May 2023, all universities in China will be allowed to use ChatGPT after August 2023, and Japan and the UK have lifted their bans on ChatGPT from July 2023 onwards. Some schools, such as the University of Michigan, are at the forefront of embracing AI technology. It has developed M-Write, an intelligent writing tutor, to provide feedback on students' writing [24].

After compiling the rules of many organizations regarding the use of ChatGPT, the authors found that the debate at a growing number of universities has shifted from whether to ban ChatGPT to how best to regulate its use (see below) [24]. The current attitude of most schools is to give instructors the final say on how ChatGPT is applied in their courses, with institutional policies serving only as a point of reference [25]. Even training courses using the ChatGPT methodology have begun to be offered at universities [26]. The term "Age of Intelligence" is now beginning to be used extensively in universities to describe current events.

Research approach

This paper provides an in-depth exploration of the risks of using ChatGPT in construction writing and a survey to understand students' use of ChatGPT and their ability to discriminate AI-generated content. Finally, the paper also discusses current policies related to the use of AI detection tools.

1. The application exploration aspect of ChatGPT was accomplished on the online platform of ChatGPT 3.5. The authors sent commands to ChatGPT, which involved literature search and comprehension. This part focuses on analyzing the reliability of information sources for ChatGPT-generated content and comprehension tests. All topics were common construction field

topics and there was no specific personal preference for selection. All ChatGPT-generated results were checked on the websites of the citing journals and reviewed on Google Scholar.

2. A total of 110 students from five classes enrolled in the intensive writing program in the Department of Construction Management at East Carolina University were selected to participate in the survey. These students came from second and third years of college and had some knowledge of writing assignments in the construction field. The survey was distributed in class by the instructor of the writing course and explored students' use of ChatGPT, their attitudes, and their ability to recognize machine-generated content. The survey was posted anonymously on the Qualtrics platform and responses were collected. Two rounds of survey were conducted, with the first survey [24] consisting of 19 questions for all 110 students in the two constructed writing courses. A Likert scale survey was used to understand the understanding, use, and attitudes towards the ChatGPT. The design of the survey followed the five-point Likert scale, i.e., strongly agree-agree-neutral-disagree-strongly disagree. The focus of this paper is on the second survey. The second survey consisted of six questions that examined students' ability to discriminate between genuine human-generated content, mildly machine-enhanced content, and completely AI-generated content in constructed writing. Participating students were required to have some knowledge of ChatGPT, i.e., they had either watched an introduction to its use or tried it out for themselves. The human-generated content was selected by the course instructor from authentic writing course assignments. Each paragraph contained 50-100 words and 3-5 information points. Given the AI tool's refinement of grammar and spelling errors when generating content, these selected paragraphs were required to be free of easily recognizable grammar and spelling errors. The teacher then manually extracts this information and sends instructions to ChatGPT to generate similar-length paragraphs containing this information, which are fully AI-generated paragraphs. As for the machine-enhanced content, in order to avoid the linguistic style tendency of AI tools due to the limitation of the corpus, the authors chose to optimize the fluency mode of another well-known writing tool, QuillBot, which is the machine-enhanced paragraph. Students were required to complete four comparison groups, select what they considered to be genuine human-generated content in each group, and give their post-test rationale for their choice and post-test confidence in distinguishing human-generated content from machine-generated content.

Results and discussion


ChatGPT in literature search

In addition to the applications of ChatGPT for brainstorming, checking grammar, and expanding text mentioned in the introductory section, ChatGPT also has the potential for literature collection and organization. And the reliability of the content it generates has been a concern for scholars. This section documents the results of a survey analyzing the reliability and comprehension of citations and references generated by the ChatGPT chatbot. The authors posed questions to ChatGPT on topics that are common to the construction field and were not specifically chosen for a reason. The questions included asking it to collect three typical examples of Q1-3D-printed buildings around the world in the past 10 years, Q2-analyzing the growth trend of road infrastructure in the United States in the past 5 years, and Q3-the impact of water facilities on local economies.

Q1

 **You**

Please collect 3 typical examples of 3D-printed buildings around the world in the last 10 years.

 **ChatGPT**

As of my last knowledge update in January 2022, here are three examples of notable 3D-printed buildings from around the world in the last decade:

1. The Yhnova Project (Nantes, France):

- In 2018, the city of Nantes in France witnessed the completion of the Yhnova project, which involved the construction of a 3D-printed house. This project was a collaborative effort between the University of Nantes and the construction company Bouygues Construction. The house was printed on-site using a 3D-printing robot named BatiPrint3D. The Yhnova project aimed to explore the feasibility of 3D printing in the construction of affordable and sustainable housing.

2. Dubai's Office of the Future (Dubai, UAE):

- Dubai is known for its ambitious architectural projects, and the "Office of the Future" is one such example. Completed in 2016, it is considered the world's first fully functional 3D-printed office building. The structure was printed layer by layer using a 20-foot tall 3D printer and a special mix of concrete, fiberglass, and plastic. The Office of the Future serves as a hub for the Dubai Future Foundation and showcases the potential of 3D printing in construction.

3. Apis Cor's Residential House (Stupino, Russia):

- Apis Cor, a construction 3D printing company, gained attention in 2017 by successfully 3D printing a residential house in Stupino, Russia. The entire structure, including the walls and partitions, was printed in just 24 hours. The project demonstrated the efficiency and speed that 3D printing can bring to construction. The technology used by Apis Cor allows for the printing of entire buildings on-site, reducing construction costs and time.

Please note that developments in 3D printing technology and construction projects may have occurred since my last update in January 2022.

Figure 1 ChatGPT information-gathering Q1

Upon review, sources were found online for all three cases. After a detailed comparison, the details of all three cases provided by ChatGPT were consistent with the source data. The messages were available. However, ChatGPT also shows at the bottom of the results "Please note that developments in 3D printing technology and construction projects may have occurred since my last update in January 2022." to alert the user to the lateness of the message.

The authors also tried the application in terms of 3D printed bridges, asking ChatGPT to collect 3 typical cases of 3D printed bridges worldwide in the last 5 years. The results are below.



You

Please collect 3 typical examples of 3D-printed bridges around the world in the last 5 years.



ChatGPT

As of my last update in January 2023, here are three examples of 3D-printed bridges around the world in the last few years. Please note that additional projects may have been initiated or completed since then.

1. Gemini Bridge, Netherlands:

- **Location:** Gemert, Netherlands
- **Year:** Completed in 2017
- **Details:** The Gemini Bridge, also known as the Gemert Circular Bridge, was a collaboration between Eindhoven University of Technology and construction company BAM Infra. It was printed using a concrete 3D-printing technique. The bridge has a unique, looping design and showcases the potential for innovative architectural forms through 3D printing.

2. The Wisdom Tooth, China:

- **Location:** Shanghai, China
- **Year:** Completed in 2019
- **Details:** The Wisdom Tooth is a pedestrian bridge in the Wisdom Bay innovation park in Shanghai. Built by construction company Winsun, it demonstrates the capabilities of large-scale 3D printing. The bridge has an organic, flowing design and is part of China's exploration of 3D printing for construction purposes.

3. The Oversteek, Netherlands:

- **Location:** Nijmegen, Netherlands
- **Year:** Completed in 2018
- **Details:** The Oversteek, also known as the Nijmegen Bridge, is a cyclist bridge that spans the Waal River. It was constructed using a 3D-printing technique called MX3D. The process involved robotic arms "drawing" the bridge in mid-air by depositing layers of molten metal. The innovative method allows for more complex and free-form designs.

Figure 2 ChatGPT information-gathering Q2

The results are not ideal. First, ChatGPT emphasizes here that the last data update was in January 2023, which contradicts January 2022 in the previous question, creating confusion of information. Second, ChatGPT extends the search to 2017, which is inconsistent with the requirement of "the past 5 years". However, there were actually answers that fit within this time period. For example, Striatus, which was completed in July 2021[27]. In addition, the name of the second example was not found in the report[28], and even in the newsletter of the college of the project leader or in the report of the project site, only the Wisdom Bay Pedestrian Bridge was used to refer to this bridge, not the Wisdom Tooth Bridge. And the third example is equally problematic. Several of the reports found by the authors specify that the bridge is located in Amsterdam and not Nijmegen[29], even the official website of the

construction company MX3D states that the bridge is located "in the center of Amsterdam"[30]. All of these English-language stories are available on Google, and there are no language barriers or local news limitations.

Q2

Although some scholars have indicated direct access to web links or references in ChatGPT[10], the current ChatGPT already states that it does not have direct access to databases or specific peer-reviewed sources. Thus, it cannot cite your sources. Even if the author removes the "cite peer-reviewed sources" and replaces it with going to it to mention sources, it only provides general research directions and data source suggestions, not links or citations. These limits fabricated citations to a great extent. The same is true for question 3, which will not be repeated here.

 **You**

Please cite peer-reviewed sources that analyze the growth trends in U.S. road infrastructure over the past five years

 **ChatGPT**

I currently don't have direct access to external databases or the internet to provide real-time citations. However, I can guide you on how to search for peer-reviewed sources that analyze the growth trends in U.S. road infrastructure over the past five years.

1. Academic Databases:

Utilize academic databases such as PubMed, JSTOR, IEEE Xplore, or Google Scholar. Enter keywords like "U.S. road infrastructure growth trends" to find relevant articles.

2. Government Publications:

Explore reports from government agencies like the Federal Highway Administration (FHWA), the U.S. Department of Transportation (USDOT), or the Congressional Research Service (CRS). These reports often provide comprehensive analyses.

3. Transportation Journals:

Check reputable transportation journals such as the "Journal of Transportation Engineering" or "Transportation Research Record" for articles on road infrastructure trends.

4. Industry Reports:

Industry reports from organizations like the American Society of Civil Engineers (ASCE) or the National Academies of Sciences, Engineering, and Medicine may provide insights.

When searching, make sure to filter results by publication date to ensure you get the most recent information. Additionally, include variations of your keywords to broaden your search.

Figure 3 ChatGPT information-gathering Q3

Survey

A total of 73 responses were received to the first survey. Detailed results of the 19-question survey can be found at [24], only some of the conclusions and results are quoted here.

About 35% of the 110 students had personally used ChatGPT, and of these, about 45% had tried using it to assist in writing tasks. All the students found it unavoidable to double-check the references collected and organized by ChatGPT. Students were generally confident in distinguishing between ChatGPT-generated writing content, with only 10% of students believing they were unable to do so. The authors developed a second survey to address this point.

The second survey required students to have some level of knowledge of ChatGPT, including having watched tutorials on it or having used it. It received 36 responses. The survey consisted of four questions comparing true human-generated content, machine-enhanced content, and fully AI-generated content. It concluded by asking students to rank the basis on which they discerned human-generated content and reassess their confidence in discerning it after the test. The options were purposely ranked in reverse order, i.e., fully AI-generated content, machine-enhanced content, and genuine human-generated content, to prompt students to read all three options before selecting genuine human-generated content. The 4 sets of comparison questions are summarized below:

Survey Q1

The fully AI-generated content instructions and process are shown below. It is worth noting that ChatGPT's first generated content ignored the 50–100-word limit required in the directive, resulting in a first paragraph of only 43 words. Thus, the authors added the word requirement instruction and the newly generated paragraph reached 76 words.

“Please rank the following options in terms of what you believe to be genuinely created by humans, machine-enhanced, or entirely generated by AI.

- A. This essay provides a comprehensive examination of the pressing challenges faced by the construction industry, notably the scarcity of skilled labor. It explores forward-looking strategies to address these issues, shedding light on the pivotal roles played by employer policies and organizations such as the AGC. By emphasizing the industry's proactive measures, it seeks to inspire and attract young individuals to consider fulfilling careers in construction, contributing to a sustainable and thriving future for the sector.
- B. The significance of students thinking about professions in the construction business is emphasized in this essay. It will look at the main issue facing the construction industry, which is a lack of competent labor, how the sector has tried to meet the needs of the newest generation, and what possible reforms have been suggested for the future. It explores the ways in which employer policies impact the career decisions of young individuals and the part that associations such as the AGC play in resolving such issues.
- C. This essay highlights the importance of students considering careers in the construction industry. It will explore the prominent challenge that the construction sector faces, which is the shortage of skilled workers and how the industry has made efforts to cater to the demands of the latest generation and what potential changes have been proposed for the future. It delves into how

employer policies influence young people's career choices and the role of organizations like the AGC in addressing related concerns.”

 **You**

Write a 50 to 100-word paragraph expressing the following: This essay looks at the current challenges in the construction industry, including manpower shortages and how to look to the future, and in turn, highlights the role of employer policies and organizations such as the AGC in attracting young people into the construction industry.

 **ChatGPT**

This essay delves into contemporary challenges within the construction industry, particularly workforce shortages, and explores future strategies. It underscores the significance of employer policies and organizations like the AGC, illustrating their crucial roles in enticing the younger generation to pursue careers in construction.

 **You**

Please expand it to more than 50 words and less than 100 words.

 **ChatGPT**

This essay provides a comprehensive examination of the pressing challenges faced by the construction industry, notably the scarcity of skilled labor. It explores forward-looking strategies to address these issues, shedding light on the pivotal roles played by employer policies and organizations such as the AGC. By emphasizing the industry's proactive measures, it seeks to inspire and attract young individuals to consider fulfilling careers in construction, contributing to a sustainable and thriving future for the sector.

Figure 4 ChatGPT-generated content for Survey Q1

Survey Q2

The fully AI-generated content instructions and process are shown below.

“Please rank the following options in terms of what you believe to be genuinely created by humans, machine-enhanced, or entirely generated by AI.

- A. The burgeoning construction industry holds undeniable appeal with its low entry barriers, diverse job opportunities, and lucrative pay. This sector is evolving, embracing a new trend that places a premium on reasonable working hours. In this discussion, we will explore the significance and impact of this emerging approach within the construction landscape.
- B. Construction is a continually developing and changing sector. It can appeal to people from all walks of life and allows anyone to succeed if they so choose. The industry provides workers

with job pleasure, allows them to travel, pays well, and has a diverse range of employment, among other things. Changes in the sector will be discussed in depth, such as how having acceptable hours attracts new employees.

- C. Construction is an industry that is constantly growing and ever-changing. It can be appealing to any person with a diverse background and allows anyone to succeed if it is desired. The industry allows people to feel satisfaction through jobs, allows people to travel, earn good wages, and has a broad scope of work, etc. Changes to the industry will be talked about in-depth, for example, having reasonable hours appeals to new people in the industry.”



You

Write a paragraph of 50 to 100 words expressing the following:

Construction is a growing and attractive industry. It has advantages such as low background requirements for participants, a wide range of jobs, and high pay. Here, we will discuss in depth the new trend in the industry that values reasonable working hours.



ChatGPT

The burgeoning construction industry holds undeniable appeal with its low entry barriers, diverse job opportunities, and lucrative pay. This sector is evolving, embracing a new trend that places a premium on reasonable working hours. In this discussion, we will explore the significance and impact of this emerging approach within the construction landscape.

Figure 5 ChatGPT-generated content for Survey Q2

Survey Q3

The fully AI-generated content instructions and process are shown below.



You

Write a paragraph of 50 to 100 words expressing the following:

Although the construction industry is relevant to everyday life and has a large number of employees, the construction industry is currently facing a labor shortage and a shortage of leaders. This paper will present several ideas to help alleviate these problems.



ChatGPT

Despite its everyday relevance and a substantial workforce, the construction industry is grappling with a dual challenge—labor shortages and a scarcity of leaders. In response to this pressing issue, this paper aims to propose and explore several ideas that could serve as viable solutions to mitigate these critical problems within the construction sector.

Figure 6 ChatGPT-generated content for Survey Q3

“Please rank the following options in terms of what you believe to be genuinely created by humans, machine-enhanced, or entirely generated by AI.

- A. Despite its everyday relevance and a substantial workforce, the construction industry is grappling with a dual challenge—labor shortages and a scarcity of leaders. In response to this pressing issue, this paper aims to propose and explore several ideas that could serve as viable solutions to mitigate these critical problems within the construction sector.
- B. The construction sector is now experiencing a labor shortage, and organizations are having difficulty recruiting strong leaders for the next generation of construction professionals. In this article, some ideas will be presented that could help ease these challenges and assist construction organizations in finding qualified workers to fill a variety of roles throughout the construction industry. The construction sector is an essential aspect of everyday life and the source of income for many people.
- C. There is currently a labor shortage in the construction industry and companies are finding it difficult to find strong leaders for the next generation of construction professionals. In this piece several ideas will be stated that could help alleviate these issues and help construction firms find quality individuals to fill many distinct roles across the construction profession. The construction industry is a vital part of everyday life and the livelihoods of many different people.”

Survey Q4

The fully AI-generated content instructions and process are shown below.



You

Write a paragraph of 50 to 100 words expressing the following:

Humanity's own behavior, such as the massive emissions from the construction industry, invites climate change. This paper analyzes government policies to reduce the environmental impact of the construction industry and makes recommendations for potential solutions.



ChatGPT

Human activity, exemplified by the substantial emissions from the construction industry, plays a significant role in driving climate change. This paper delves into an examination of government policies aimed at mitigating the environmental impact of the construction sector. Additionally, it puts forth recommendations for potential solutions to address the ecological challenges posed by the industry's activities.

Figure 7 ChatGPT-generated content for Survey Q4

“Please rank the following options in terms of what you believe to be genuinely created by humans, machine-enhanced, or entirely generated by AI.

- A. Human activity, exemplified by the substantial emissions from the construction industry, plays a significant role in driving climate change. This paper delves into an examination of government policies aimed at mitigating the environmental impact of the construction sector. Additionally, it

puts forth recommendations for potential solutions to address the ecological challenges posed by the industry's activities.

- B. Climate change poses a significant threat to humanity and is caused by human actions. The construction industry has contributed to the problem and is responsible for significant emissions. The government and its agencies have implemented policies to address this issue by limiting the environmental impact of development. This article will look at some of these policies, how they've been received, and what future alternatives might be.
- C. Climate change is one of the greatest existential threats humanity has faced, and its source is the result of human actions. The construction industry has played a role in contributing to the issue and is responsible for large amounts of emissions. Policies enacted by the government and its agencies have sought to remedy this by reducing the impact construction has on the environment. This paper will explore some of these policies, their reception, and suggest potential options for the future.”

The statistics of the number of people for each option of each question which was selected as human-generated content are shown below:

Table 1 Human-generated content vs. machine-generated content differentiation test results

	AI-generated	Machine-enhanced	Human-generated	Skip	Correct
Q1	11	12	10	3	28%
Q2	10	10	11	5	31%
Q3	8	12	12	4	33%
Q4	9	13	6	8	17%
Sum	38	47	39		

The percentage of correctness is very low as seen by the last column. As can be seen by summing the numbers in each column, the largest number of students mistook machine-enhanced content for human-generated content, while the number of students who chose AI-generated content and genuine human-generated content as human-generated content was roughly equal. Moreover, several students chose to skip each question because they found it unanswerable.

The authors further explored the basis for the students' judgments. The 9 options were ranked as follows.

Table 2 Discriminatory Basis Statistical Results

1	Language complexity
2	Creativity and originality
3	Emotional depth
4	Contextual understanding
5	Consistency in tone
6	Factual accuracy
7	Logical coherence
8	Cultural nuances
9	Intuition and subjectivity

Among them, the first item Language complexity and the second item Creativity and originality received 19 and 15 votes respectively, which means that half of the students thought that this

item was the most helpful for them in distinguishing human-generated content from AI-generated content, while the last item Intuition and subjectivity received 15 votes, which means that nearly half of the students believed that this item was the least helpful for them to distinguish between human-generated content and AI-generated content. It is worth noting that the vote type for each option was relatively concentrated, with no tie-breaker situation, which the authors believe is representative of the vote type.

When asked if they were confident in their response, at which point the students did not know the correct answer, 49% gave a positive response, 32% were neutral, and the remaining 19% indicated that it was challenging.

Overall, students were overly optimistic about discriminating human-generated content from AI-generated content, and they tended to overestimate the quality of human-generated content and, arguably, underestimate the fluency and realism of AI-generated content. Especially for generic texts such as the ones used in this study, when the text style is more academic and professional but does not involve special terminology, students generally reported that they did not find any obvious grips, and the difficulty of differentiation increased steeply. This implies that AI-generated content is highly applicable in construction writing tasks with a strong academic and professional style, but for writing instruction, it will be a very difficult task for teachers to differentiate between students' human-generated content and AI-generated content. Finally, when the answers were revealed, most students expressed disbelief.

Academic integrity

In order to cope with the possible impact of ChatGPT on academic integrity, scholars have proposed a number of coping strategies. For example, plagiarism detection software can be used to ensure the originality of a text [6], information can be cross-reviewed and validated through a variety of information sources [6], [20], [31], or, increase manual review to prevent plagiarism [19], [32]. However, the effectiveness of these initiatives largely hinges on teachers' familiarity with their students. Teachers need to be familiar with their students' knowledge levels, language patterns, and idiomatic expressions. For example, the authors received a report from a student who, along with friends, was mislabeled by AI detection software. Despite utilizing multiple detection software, including the well-known ZeroGPT, they initially struggled to prove that they had authored the paper themselves rather than copying and pasting from the AI's response. However, they eventually accessed the "Version history" feature of Google Doc, which allowed them to demonstrate the originality of their work, thus averting the penalty of failing the entire course. The student was able to communicate with the instructor immediately and gained the instructor's understanding and support, but the miscarriage of justice caused distress and extra time and effort for both the instructor and the student involved. This process is even more difficult for students who do not have a history of their writing and revision process. And these flagged student assignments are by no means an isolated case. As it stands, the balance between teaching theory and embracing the convenience of new technology needs to be explored more. Writing course instructors may need to adjust the way they grade writing assignments for essay length, grammar, spelling, and fluency, and educational institutions need to put in place better guidelines for the process of reviewing using AI detection software.

Conclusion and future work

This paper contributes to the ongoing discussion concerning the integration of AI technologies into educational settings, with a particular focus on writing-intensive construction management programs. The aim is to utilize AI tools such as ChatGPT to complement and enhance the learning experience rather than replace fundamental teaching methodologies; to embrace new technologies rather than to remain stagnant and closed-minded. After examining the primary applications of ChatGPT and the responses of various accredited higher education institutions worldwide, this study validates the significant controversies surrounding ChatGPT in writing-intensive courses, including standardized construction, and assesses student attitudes from a pragmatic standpoint. This paper advocates the proactive utilization of ChatGPT as a writing aid while underscoring the imperative need for the establishment of comprehensive assessment and policy frameworks. Furthermore, it calls upon instructors to assess and adapt their grading and evaluation criteria to mitigate any potential adverse effects associated with the use of ChatGPT.

Currently, ChatGPT is designed to carefully control the ability to generate citations directly and provides cautionary notice after the answers to the relevant commands. This brings benefits in preventing students from gullibly or even directly using the literature or data it generates. However, the situation of ChatGPT fabricating content remains serious. Much of the information appeared confusing and misleading, and these tested cases were also mainly related to English content, let alone other languages. A high level of vigilance is still required for content generated or extracted by ChatGPT.

The study found that Students were generally overly optimistic about recognizing ChatGPT-generated content. Especially for the generic text used in this study, the difficulty of discerning AI-generated content rises steeply when the text style is more academic and professional but does not involve special terminology. This implies that AI-generated content is highly applicable in construction writing tasks with a strong academic and professional style, but not for writing instruction and student practice. This presents a substantial challenge for educators in distinguishing between student-created and AI-generated content.

Furthermore, the use of AI detection tools must be standardized. Currently, many AI detection tools have been adopted, with some even mandated in specific courses. Instructors unquestionably play a pivotal role in this process, but policies must keep pace for both instructors and students alike. It is crucial to establish clear guidelines for the application scenarios and permissions of AI detection tools, as well as protocols for reviewing flagged works and determining appropriate penalties. However, it is also imperative to avoid introducing confusion and unnecessary educational burdens for both teachers and students in writing courses.

Building on the findings, this paper identifies several areas warranting further debate and deeper discussion. For instance, the utilization of AI tools from the instructors' perspective, the formulation of specific strategies, and ethical discussions regarding the integration of ChatGPT in writing instruction, as well as the precise impact of ChatGPT on the cultivation of students' critical thinking skills. The authors intend to extend their research into these areas and anticipate sharing more detailed findings in future publications.

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