ISSN: 2473-4901
v10 n6162

A Diffusion of Innovation-Driven Approach for Strategic Integration of Large Language Models in Education

Mohammad Imran Hossain
Mihst742@mail.rmu.edu
School of Data Intelligence and Technology
Robert Morris University, Pittsburgh
Moon Township, PA 15108

Abdur Rahman Bin Shahid
shahid@cs.siu.edu

Ahmed Imteaj
imteaj@cs.siu.edu

School of Computing
Southern Illinois University
Carbondale, Illinois 62901

Abstract

This paper synthesizes existing research findings and current concerns regarding the use and attitudes towards Large Language Models (LLMs), such as ChatGPT, Google Gemini, Facebook LLaMA, and Anthropic Claude, in academic settings. Using a Diffusion of Innovation (DOI) perspective, it develops a framework and provides actionable recommendations for the ethical integration of these tools into education. The study assesses both the educational benefits and potential risks of LLMs, highlighting how they can enhance access to information and support personalized learning while addressing issues like plagiarism and the reduction of critical thinking skills. By proposing a conceptual adoption model based on five crucial factors—relative advantage, compatibility, complexity, trialability, and observability—the paper aims to influence educational stakeholders' decisions regarding LLM adoption. Additionally, it underscores the need for ethical guidelines, regular bias assessments, and policy alignment to ensure responsible usage. This strategic approach not only facilitates the responsible integration of LLMs but also equips educators and policymakers with a systematic framework for incorporating AI tools into Information Systems curricula.

Keywords: ChatGPT, Large Language Models, Diffusion of Innovation, Ethics, Education.

1. INTRODUCTION

The meteoric rise of artificial intelligence (AI) is poised to profoundly revolutionize industries through its growing capacity to expand and transform human life, work, connectivity, and communication. Like the majority of fields, the education sector is on the verge of a massive AI-centric transformation. AI-driven educational innovations for instruction and learning are currently undergoing trials across diverse environments. One of the most groundbreaking AI-based innovations in recent years is ChatGPT (OpenAI, 2022). Other LLMs, such as Google

Gemini, Facebook LLaMA, and Anthropic Claude, have also made significant inroads, necessitating a comprehensive approach to their integration in education.

Within a few months after its launch, it had amassed over 100 million users (Guardian, 2023). This AI-operated bot uses Large Language Models (LLMs), to function and converse with the user in a human-like manner (Iqbal et al., 2022). Harnessing ChatGPT's educational potential presents a multifaceted challenge that extends beyond its technical capabilities. The central dilemma lies in how to leverage ChatGPT ethically and effectively within the classroom environment, ensuring that it not only augments learning but also upholds the integrity of education. Unlike traditional forms of plagiarism, LLMs like ChatGPT can generate human-like content effortlessly, making it harder for educators to distinguish between AI-generated and student-created work. Key issues that need to be tackled include educational content accuracy, ethical use of ChatGPT, personalized learning and adaptivity, and teacher involvement and support.

Concerns about academic integrity are heightened as students might use ChatGPT and similar LLMs to effortlessly create essays, posing risks of plagiarism and undermining the value of academic credentials by potentially bypassing intellectual development and honesty in education (Willems, 2023; Cotton et al., 2023; Zhai, 2022). Students using AI for assignments could gain an unfair advantage, leading to grading biases due to difficulties in distinguishing AI-generated content from student work. This challenges educators to develop new assessment methods to accurately gauge student comprehension (Rudolph et al., 2023; Cotton et al., 2023). The reliance on ChatGPT may also impact critical thinking and creativity. As students turn to AI for answers, there's a risk that their ability to think independently and innovate could diminish (Iqbal et al., 2022; Rahman & Watanobe, 2023). Ethically, the use of ChatGPT and other LLMs raises concerns about biases and the potential for misuse in generating misleading or harmful content. The technology's dependence on vast amounts of data without explicit consent poses significant privacy risks, necessitating strict safeguards to protect personal information and prevent data leaks (Zhou et al., 2023; Najafali et al., 2023; Wu et al., 2023; Rahman & Watanobe, 2023).

This paper synthesizes contemporary concerns and existing literature on the use and attitudes toward LLMs in educational settings. Building on this synthesis, it presents a comprehensive theoretical framework and offers actionable recommendations for the ethical adoption of LLMs in academia. The highlights of this paper are as follows:

1. **Overview of LLM Pros and Cons in Education:** Provides an overview of the prospective advantages as well as potential disadvantages and challenges associated with the application of ChatGPT and similar LLMs in educational settings. It highlights key issues like plagiarism, unfair advantage, and impacts on critical thinking.
2. **Diffusion of Innovation Theory (DOI Framework):** Applies Rogers' Diffusion of Innovation theory to understand the elements that influence the uptake of LLMs like ChatGPT within the educational sector.
3. **Adoption Model:** Proposes a conceptual model with five factors from DOI theory: relative advantage, compatibility, complexity, trialability, and observability. Suggests these will influence educators' and institutions' adoption decisions.
4. **Assessment Methods:** Offers a comprehensive set of assessment methods grounded in DOI theory to evaluate the 5 factors regarding LLM adoption. Provides specific techniques like surveys, interviews, and case studies.
5. **Ethics Strategies:** Discusses ethical considerations and strategies to promote responsible LLM use, like developing guidelines, assessing biases, and aligning with educational policies.

It is worthwhile to mention that, while we use ChatGPT as the primary example throughout the rest of the paper, the discussions and findings are similarly applicable to other Large Language Models (LLMs), such as Google Gemini, Facebook LLaMA, and Anthropic Claude. We focus on ChatGPT due to its popularity and the extensive amount of research conducted on this particular model in education settings.

2. LITERATURE REVIEW

The use of Large Language Models (LLMs) in academia has sparked debate over how to effectively adopt these tools or whether they should be banned entirely. The potential benefits, such as enhancing personalized learning and access to information, are countered by concerns related to academic integrity, privacy, and ethics. This section explores the balance between positive applications and the challenges LLMs pose within educational settings.

LLM Potential vs. Academic Integrity

Lund et al. (2023) discuss various educational benefits of LLMs with a focus on ChatGPT, including its ability to search and summarize literature, generate text based on a provided context in different languages, and translate text from one language to another. The authors also list various ethical aspects that demand awareness, such as privacy, bias, and security issues around its capacity to produce sensitive personal data. Similarly, the research conducted by Bonsu and Baffour-Koduah (2023) revealed no significant connection existed between individuals' emotions and their inclination to employ ChatGPT. Despite this absence of correlation, the study indicated that students exhibited positive attitudes toward ChatGPT, expressed an interest in its use, and endorsed its implementation in educational settings. Research conducted by Rahman & Watanobe (2023) explores both the benefits and challenges associated with integrating ChatGPT in educational contexts, highlighting its utility in coding tasks as well as its limitations, such as a lack of common sense and a tendency to make errors in mathematical computations (Borji, 2023). The research also raises concerns about biases, underscoring the importance of cautious application (Mhlanga et al., 2023). For example, it is relatively straightforward to mislead ChatGPT into producing incorrect mathematical results (Borji, 2023). Additionally, the study points out ChatGPT's inability to process visual information and its inherent biases, emphasizing that ChatGPT should complement rather than substitute for comprehensive investigative efforts; users should be aware of these limitations.

It is of utmost importance to consider the multifaceted ethical issues, such as data confidentiality, discrimination, and lack of transparency, surrounding ChatGPT. These challenges involve not only technical aspect of how the models operates but also broader implications for privacy, fairness, and the integrity of educational processes. Mhlanga et al. (2023) examine how using ChatGPT in education necessitates privacy protection, impartiality, non-discrimination, and openness. Iqbal et al. (2022) indicate that university faculty need more education on ChatGPT, noting teacher concerns about its potential to promote student cheating, its limited educational value, and the need for increased support for its use in classrooms. Halaweh et al. (2023) offer a set of protocols and guidelines for its moral and efficient use in the classroom or laboratory. They designed experiments with fifty ChatGPT-generated essays to assess the effectiveness of plagiarism detection tools in identifying essays composed using ChatGPT. The tools raised around 20% similarity scores for the ChatGPT-generated essays, raising a dilemma between ChatGPT's capability to generate highly original content and existing plagiarism tools' inability to detect AI-generated content.

Furthermore, Atlas et al. (2023) illustrates how ChatGPT can streamline the writing process in higher education by generating texts, summarizing information, and outlining content, thereby helping save time to focus on other important work. Additionally, ChatGPT appears to be great in dealing with grammatical mistakes and dramatically improving the overall readability of writing materials (Kung et al., 2023), causing a major problem to established online grammar checkers such as Grammarly (Rudolph et al., 2023).

In a separate study, Al Afnan et al. (2023) analyzes the benefits and drawbacks of ChatGPT in writing and communication education, noting its ability to surpass traditional search engines in precision and reliability, and its utility as a resource for students and educators to explore ideas and evaluate responses. However, they also highlight challenges such as unethical student use leading to intellectual laziness and difficulties for instructors in assessing true learning outcomes. Meanwhile, Malinka et al. (2023) express concerns that ChatGPT could facilitate academic dishonesty, potentially allowing unqualified students to fulfill university degree requirements, thus undermining academic integrity. These studies underscore the need for further research into the impacts of LLMs like ChatGPT and strategies to mitigate their misuse.

The Theoretical Perspective

The current body of literature deals with the theoretical framework for the adoption of IT-based tools in academia. In their research, Rahman et al. (2023) investigated the various aspects that shape the educational adoption of ChatGPT and grouped the critical factors into five categories, including its advantage over existing technologies, its compatibility with educational materials and platforms, user-friendliness, transparency in understanding its benefits and challenges, and trialability. It was revealed that the majority of students perceive ChatGPT as cutting-edge, universally applicable, and user-friendly, viewing it as a sophisticated tool that promotes self-directed learning. Consequently, students are motivated to embrace ChatGPT primarily due to its perceived benefits in the

ISSN: 2473-4901
v10 n6162

classroom setting. Furthermore, it is observed that both male and female students placed higher importance on factors related to ChatGPT's compatibility with existing technologies and usability. However, while the male students stressed its observability features, female students showed greater interest in its trialability attributes.

The diffusion of innovation theory (DOI), which we will discuss in greater detail in subsequent sections, provides a robust theoretical framework for comprehending the adoption of technology. To explore whether ChatGPT should find its place in academia, we can draw parallels with the adoption challenges faced by social media platforms. For instance, Kocak et al. (2013) employ DOI to investigate the dynamics of social media adoption. Their research reveals that, like other technological applications, the widespread embrace of social media adheres to a distinct decision-making process. This process can be effectively analyzed through the perspective of DOI theory, encompassing stages such as knowledge acquisition, persuasion, decision-making, implementation, and confirmation. The study establishes a connection between the evolution and popularity of social media platforms and specific attributes and processes within the context of innovation dissemination. Moreover, according to research conducted by Alrahmi et al. (2015), the acceptance and utilization of e-learning systems in university settings were influenced by factors such as their relative advantage, compatibility, complexity, trialability, and observability. Similarly, in an investigation involving Portuguese college students, Pinho et al. (2021) corroborated Rogers' (2014) theory by demonstrating that the perceived benefits of Moodle LMS were instrumental in driving its adoption. Employing structural equation modeling, Pinho et al.'s (2021) study underscores the substantial impact of features inherent to Moodle LMS as suggested by the innovation diffusion theory (Tornatzky & Klein, 1982) on the actual usage of this tool.

3. An Information System Theory Perspective of the Problem

This section leverages acceptance theories rooted in the realm of information systems research and innovation diffusion. These theories, which focus on individuals' attitudes toward technology, have been widely employed to analyze the acceptance and dissemination of innovations across various domains (Kelly, 2014; DeLone & McLean, 2003; Venkatesh & Davis, 2000; Attuquayefio & Addo, 2014). Among these theoretical frameworks are the Theory of Reasoned Action (TRA) (Al-Suqri, 2015) and extensions of the Technology Acceptance Model (TAM2, TAM3) (Menzli et al., 2022). These extensions have evolved to accommodate the intricate array of factors that influence the acceptance of technology, providing a more comprehensive perspective on the dynamics of technology adoption.

Everett M. Rogers' theory of Diffusion of Innovations (DOI), as shown as in Figure 1, provides a robust conceptual framework for understanding the intricate dynamics behind adopting and disseminating new ideas, technologies, products, or concepts within various societal contexts (Rogers et al., 2014). This theory primarily delves into the post-adoption determinants of innovation. Its extensive application spans over a thousand studies, predominantly concentrated on IT innovations both at the individual and institutional levels across developed and developing nations (Nazari et al., 2013; Wang & Wang, 2016; Okour et al., 2021; Raman et al., 2023). DOI theory offers insights into how individuals decide to adopt or resist innovations, particularly in IT and educational contexts. According to Raman et al. (2023), applying DOI to ChatGPT helps understand the adoption of open educational

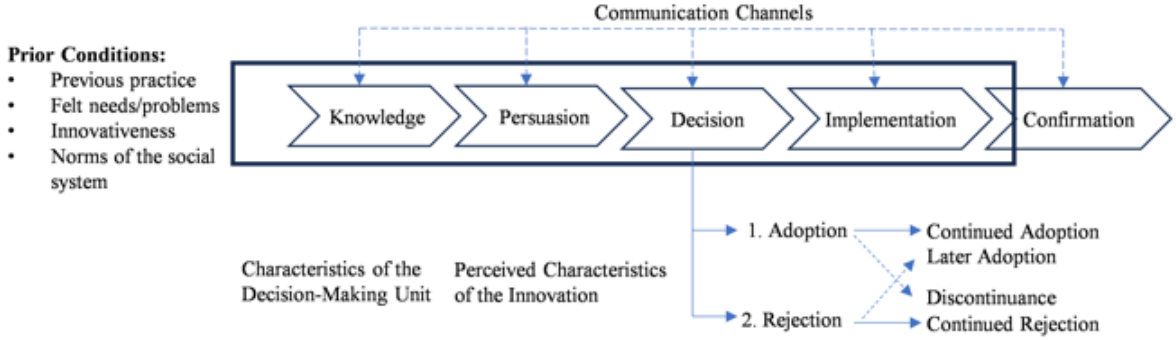

Figure 1: The decision-making process of innovation (Rogers et al., 2014).

resources in academia. Rogers et al. (2014) note that innovations with positive attributes such as clear advantages, compatibility with existing norms, simplicity, trialability, and observability tend to be more readily accepted. Al-Rahmi et al. (2019) also found that these factors significantly influence university students' intentions toward e-learning systems. People are generally more receptive to innovations perceived as novel, as outlined by the five adopter categories ranging from innovators to laggards (LaMorte, 2022).

ChatGPT's adoption mirrors other technologies, following a "decision-making process" described by Kocak et al. (2013), which includes stages of knowledge acquisition, persuasion, decision-making, implementation, and confirmation. This process, aligned with Rogers' diffusion of innovation framework, requires understanding, forming attitudes, and confirming beliefs about the innovation. Decisions may be reconsidered during the implementation phase, where adopters gauge the innovation's full integration or rejection based on its perceived benefits and drawbacks (Rogers et al., 2014). Unlike TRA or TAM, which primarily focus on individual attitudes and intentions, DOI considers a broader range of factors including a broader social context, communication channels, innovative characteristics, and time, making it well-suited for capturing the multifaceted nature of adopting complex technologies like ChatGPT.

4. CONCEPTUAL MODEL

The pace of innovation acceptance is underpinned by five key criteria: relative advantage, compatibility, trialability, observability, and complexity. Generally, the first four aspects tend to be positively linked to increased adoption rates, while the fifth factor, complexity, typically demonstrates a negative association with adoption rates (Rogers et al., 2014). Building upon Rogers' framework, this paper presents a conceptual model that incorporates these five factors affecting innovation adoption in the context of ChatGPT.

1. **Relative Advantage:** How much people think a new idea, program, or product is better than the one it substitutes (LaMorte, 2022). Perceived as an improvement over its predecessors, ChatGPT reached one million downloads in just five days, establishing itself as the fastest-growing consumer application in history (Tooltester, 2023). Since its launch, ChatGPT has attracted considerable attention primarily due to its capacity to generate responses that closely emulate natural human conversation (Haque et al., 2022). A substantial portion of OpenAI's user base, approximately 62.52%, falls within the young adult demographic (aged 18-34), with 65.68% being male and 34.32% female. The instant success of ChatGPT can be attributed to its perceived relative advantage over existing educational resources and methods, particularly in its capacity to deliver personalized and immediate responses to queries, thereby enhancing the efficiency and effectiveness of assessments.

   Utilizing DOI theory, researchers can delve into how ChatGPT's perceived relative advantage influences its adoption among educators and institutions. To effectively integrate ChatGPT into academic settings, crucial questions need addressing:
   - How do educators and students perceive its advantages compared to traditional methods, such as conventional educational resources and practices like textbooks and lectures?
   - Which specific features of ChatGPT enhance educational processes?

2. **Compatibility:** How well the new idea fits the beliefs, experiences, and needs of those who might use it (LaMorte, 2022). As per the data, about 100 million people use the ChatGPT website regularly out of an estimated 1 billion monthly visits. In January 2023, the site attracted an average of 13 million unique users per day, an increase of almost 3.4% daily (Tooltester, 2023). A Study.com survey (2023) gathered views from over 100 teachers and 1000 students on ChatGPT's role in education. It found high school students more aware of ChatGPT than elementary teachers. Notably, 89% of students have used ChatGPT for academic help: 48% for test preparation, 53% for essay writing, and 22% for planning academic papers, showcasing its diverse educational applications.

   DOI theory helps identify potential compatibility issues with ChatGPT in educational settings, prompting necessary curriculum and instructional adjustments. Key questions to ensure its effective integration include:
   - To what extent does ChatGPT align with the educational goals and objectives of institutions and educators?
   - Are there any compatibility issues that might hinder its long-term adoption in different educational contexts?

3. **Triability:** The feasibility of trying out the idea before implementing it fully (LaMorte,

2022). The Study.com survey (2023) reveals significant awareness and concern disparities between educational levels regarding ChatGPT: 82% of college professors are aware of it, compared to 55% of grade school teachers. Concerns about cheating are higher among college professors (72%) than grade school teachers (58%). Opinions are split on its use, with 34% of teachers favoring a ban and 66% supporting student freedom to use ChatGPT. Notably, 72% of college students oppose ChatGPT on their school networks. A crucial aspect of DOI-based research is exploring how educator experimentation with ChatGPT affects adoption decisions. Two essential questions that must addressed in this regard are:

- How does triability impact educators' decisions on adopting ChatGPT in education?
- What is the influence of educators' awareness and concerns on ChatGPT's triability in educational settings?

4. **Observability:** The degree to which other people may see the outcomes of innovations is referred to as their observability. Compared to other innovations, the consequences of specific ideas are simple to observe and convey to others, while the outcomes of other innovations are more challenging in both these respects. According to Kocak et al. (2013), a positive correlation exists between innovation's observability to members of a social system and how quickly it spreads. Students are more inclined to accept technology if their peers show interest in and use it (Raman et al., 2023). Suppose the survey research is conducted among teachers and students in the U.S. on how they pursued the use of ChatGPT. In that case, it will clarify how observability became a factor in adopting new technology. DOI theory encourages researchers to explore how the observability of the benefits can influence the wider acceptance and adoption of ChatGPT within educational institutions. Considering the observability factor, two significant questions arise regarding ChatGPT's long-term integration into education:

    - How does the observability of ChatGPT's benefits impact the willingness of teachers and students to adopt and use this technology in educational settings?
    - What strategies can educational institutions employ to enhance the observability of ChatGPT's positive outcomes among teachers and students, thereby promoting its wider acceptance and adoption?

5. **Complexity:** The perceived usability of innovation is generally categorized immediately as either easy or hard (Rogers et al., 2014). According to Davis, perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Adoption rates tend to be lower for complex inventions due to the learning curve involved in using them. Numerous studies (Rahman & Watanobe, 2023; Foundation, 2023) show that school and college students will find ChatGPT to be a helpful and time-saving tool for their studies. How simple ChatGPT is to use will affect their interest in using it. The complexity here is that if an AI-based sophisticated plagiarism detection model is implemented, how will the student adopt ChatGPT? DOI theory guides researchers in examining how educators perceive the complexity of adopting ChatGPT and its impact on their willingness to embrace the technology. In the context of ChatGPT's integration into the classroom, two crucial questions emerge:

    - How does the perceived complexity of adopting ChatGPT influence the willingness of teachers and students to incorporate it into their educational practices?
    - What strategies can be employed to simplify the user experience of ChatGPT, particularly in scenarios involving complex functionalities such as AI-based plagiarism detection, to facilitate its widespread adoption in educational settings?

Embracing novel concepts or technologies often adheres to a predictable trajectory, which can be explained through the lens of the innovation diffusion curve. This theoretical framework asserts that the process of innovation adoption unfolds in five distinct phases. In the context of ChatGPT's integration into the academic setting, this theory suggests a parallel progression. Initially, a select group of early adopters will become acquainted with ChatGPT and manifest interest in its utilization. As awareness of this technology spreads, individuals will commence an evaluative process and experiment with its limited application. Should ChatGPT demonstrate effectiveness, a broader audience will gradually embrace it, eventually establishing it as a standard tool within educational settings.

ISSN: 2473-4901
v10 n6162

5. ASSESSMENT METHOD

Figure 2: Proposed Assessment Methods

One theoretical implication of this process is that the success of ChatGPT adoption in academia will depend on the technology's effectiveness in meeting early adopters' needs. If the early adopters find the technology useful and practical, they will be more likely to spread the word and encourage others to try it out. However, if the technology does not meet their needs or expectations, it may fail to gain traction and never reach the critical mass necessary for widespread adoption. As the DOI theory suggests, the complexity of the technology, its compatibility with current academic practices, and the relative advantage of using ChatGPT over other available tools all influence the short-term and long-term adoption of ChatGPT in academia. For example, if ChatGPT is seen as too complex or challenging, it may not be widely adopted. Similarly, if the technology is incompatible with existing academic practices or the advantages of using ChatGPT are insignificant, it may not gain widespread acceptance. It is important to develop a comprehensive framework to evaluate these factors. Based on the proposed conceptual model, we recommend utilizing different assessment methods, as shown in Figure 2, to assess its five factors.

1. **Identify Adopter Categories:** Determine the proportion of each of the five user groups (pioneers, early users, early mainstream, and laggers) described in the DOI theory among educators and schools (Xu et al., 2023a; Adarkwah et al., 2023; Elbanna & Armstrong, 2023). A university focused on research might have a greater share of pioneering and eager early adopters on its staff. A school district chosen to implement ChatGPT may similarly have more moderate early and late mainstream teachers (Zhai, 2023).
2. **Tailor Educational Activities:** Design and create domain- or subject-specific educational activities tailored to the appropriate educational level, incorporating the use of ChatGPT (Murgia et al., 2023a; Küchemann et al., 2023), as shown in figure 3. For example, analyzing educational materials such as lesson plans and curricula can help identify instances of ChatGPT integration (Xuan-Quy et al., 2023a). ChatGPT and other LLMs can be utilized in different steps of solving programming problems, including explaining a concept, debugging errors, and suggesting code optimizations (Jacques, 2023; Daun & Brings, 2023). Educators can create interactive quizzes with the assistance of ChatGPT. In the case of group projects, ChatGPT can be utilized as a coach for project planning, template and guideline creation, and training students to explore best practices for project execution (Keiper, 2023). In a high school science class, an AI chatbot could aid in proposing hypotheses before conducting experiments, structuring and articulating lab report findings, and explaining complex research in more straightforward terms.
3. **Assess Perceptions:** Design surveys or questionnaires to assess an educator's and student's perceptions of ChatGPT's complexity (Shoufan, 2023) and relative advantage over traditional teaching methods (Skjuve et al., 2023). To assess educators' perspectives effectively, the surveys and questionnaires should include various aspects, including their level of comfort with ChatGPT, their assessment of ChatGPT's relative advantages over traditional teaching methods in terms of enhancing student engagement, their perception of ChatGPT's role in enhancing the quality of educational materials and resources, and more. To better understand students' opinions on utilizing ChatGPT, anonymous questionnaires could be conducted to gather their perspectives. Potential survey questions could include how easy or difficult they find using ChatGPT, if they feel it aids in explaining and simplifying complex academic concepts, whether they think it helps them finish assignments more efficiently, how engaging they consider it compared to traditional teaching, and what impacts they believe it has on their overall learning process (M Alshater, 2022).

Generative AI Applications in Digital Forensics

A large multinational corporation, Globex Inc., recently faced a significant data breach. Preliminary investigations suggest that the breach was an insider job. To address this, Globex Inc. decided to use a sophisticated generative AI system, "ForenTech AI," to assist in the investigation. ForenTech AI is designed to analyze vast amounts of data, including employee emails, chat logs, and file access histories, to identify potential suspects. While the AI system significantly speeds up the investigation process, its use raises several ethical concerns, including AI Bias and AI Transparency. In this context, this assignment involves two main tasks: discussing AI biases and transparency in the context of a data breach at Globex Inc. and designing a concept for an AI-assisted forensic tool that addresses these issues. You will be using ChatGPT, a generative AI chatbot, to assist you in completing these tasks.

Task 1: AI Biases and Transparency Discussion

- **Initial Research:** Ask ChatGPT about AI biases and transparency. For example: "Explain AI biases in digital forensics.". "Why is transparency important in AI systems?"
- **Deep Dive into the Globex Inc. Scenario:** Use ChatGPT to explore specific aspects of the scenario. Questions might include: "How can AI biases affect investigations like the Globex Inc. data breach?". "What are the challenges in maintaining transparency in AI-driven investigations?"
- **Gather Diverse Perspectives:** Encourage ChatGPT to provide different viewpoints or case studies related to AI ethics in digital forensics in the context of Globex Inc data breach. Provide more information about data breach based on the knowledge you gathered through the course.
- **Note-Taking:** Keep notes of the insights and information provided by ChatGPT for your discussion.

Task 2: AI-Assisted Forensic Tool Development

- **Brainstorming with ChatGPT:** Use ChatGPT to brainstorm features that address AI biases and transparency. Ask questions like: "What features can reduce AI biases in forensic tools?". "How can an AI forensic tool be designed to be transparent?"
- **Design Feedback:** Once you have a basic tool concept, present it to ChatGPT and ask for feedback or suggestions for improvement.
- **Ethical Guidelines Discussion:** Discuss with ChatGPT what ethical guidelines should be considered in your tool design. For example: "What ethical guidelines are important for AI forensic tools?"
- **Refinement:** Use the feedback to refine your tool concept.

Task 3: Presentation

Present your tool concept, emphasizing how it innovatively tackles AI biases and transparency issues.

Figure 3: A tailored activity incorporating ChatGPT introduced in a Digital Forensics course

4. **Evaluate Compatibility:** Analyze whether educators find ChatGPT and related technologies compatible with their teaching methods and institutional goals (Xuan-Quy et al., 2023b). Before jumping onto the implementation, an institution must decide the extent to which ChatGPT and LLMs align with existing educational practices and beliefs. For example, project-based learning centers on students solving real-world problems. Assessments could explore whether ChatGPT might complement this method by assisting learners with research and project creation rather than undermining the critical thinking and problem-solving project-based learning aims to develop (Dai et al., 2023). Additionally, a crucial aspect to explore is the alignment of ChatGPT with an institution's preferred pedagogical approaches (Smith et al., 2023). Furthermore, it is imperative to evaluate how seamlessly ChatGPT can integrate with existing educational resources such as learning management systems (LMS) (Alabool, 2023; Firat, 2023; Sankey & Marshall, 2023).
5. **Assess Complexity:** Explore the perceived complexity associated with adopting ChatGPT. Determine if educators view the technology as user-friendly or challenging to implement. Collect data on the technical requirements and training needed for successful integration (Murgia et al., 2023b). Some areas to examine regarding perceived complexity include evaluating the user interface (Xu et al., 2023b), identifying compatibility concerns with the institution's hardware, software, or network, and assessing the quality of technical support available. Getting educator feedback on these aspects can identify potential hurdles or facilitators when integrating ChatGPT so they can be addressed proactively.
6. **Evaluate Trialability:** Investigate whether educators have opportunities to trial ChatGPT before committing to full-scale adoption. Assess the impact of pilot programs or trial periods on educators' perceptions and intentions to adopt (Bitzenbauer, 2023). This may include running a limited trial program across one subject area or grade level at the institution and letting individual educators volunteer to incorporate ChatGPT on a trial basis in a few of their class sections and gather their feedback on the pros and cons they observed (Halaweh, 2023).

7. **Measure Benefits:** Examine how the benefits and outcomes of ChatGPT use are visible to educators, students, and other stakeholders (Tlili et al., 2023). Determine whether educators can readily observe the positive effects on teaching and learning. Develop data-driven metrics to analyze student performance data, engagement levels, and other relevant metrics to determine the impact on teaching and learning outcomes (Rudolph et al., 2023; Chang et al., 2023). Use predictive modeling to forecast potential benefits or harms.
8. **Identify Ethical Concerns:** Define the specific ethical concerns related to ChatGPT adoption in the classroom, including academic integrity, confidentiality of user data, prejudiced output, and consequences for students' critical analysis abilities (Kooli, 2023). Several specific ethical concerns related to academic integrity arise when considering ChatGPT. These include the potential for students to employ ChatGPT for plagiarism or cheating on assignments (Qadir, 2023), as well as the challenge of verifying whether a student authored the work independently (Khalil & Er, 2023). Throughout the research process, safeguarding and ensuring the privacy of students' data and usage information is of utmost importance. Additionally, it is crucial to investigate any gender, racial, political, or other biases present in ChatGPT's content output (Motoki et al., 2023), assess the fairness of its responses to diverse users and requests (Zhang et al., 2023), scrutinize the risk of excessive reliance on ChatGPT (Liaw et al., 2023), and examine its potential impact on students' cognitive sharpness and analytical abilities.
9. **Ethical Case Studies:** Implement case studies based on the education contents to simulate ethical issues related to ChatGPT in the classroom (Gordon et al., 2021). Consider different modes of evaluating this content, including in-person open-book exams and online. Create assessment tools to gather data on ethical concerns. Utilize data mining and machine learning methodologies to analyze the content generated by ChatGPT during classroom activities to identify potential biases, inaccuracies, or ethical concerns in the output. For instance, Mujahid et al. (2023) adopt various transformer-based models to study users' opinions and sentiments about ChatGPT from tweets.
10. **Align with Guidelines:** Compare the usage of ChatGPT in the classroom with established ethical guidelines or policies for technology adoption in education (Chiu, 2023), such as the European Commission's Ethics Guidelines for Trustworthy Artificial Intelligence (Smuha, 2019) and The National Educational Technology Standards (NETS) for Students (Technology in Education, 2023).

6. DISCUSION AND CONCLUSION

The impact of ChatGPT on the education sector has become a debatable issue. The current research highlighted how ChatGPT facilitated academic activities like writing essays, generating ideas, solving problems, and evaluating students. It simultaneously displays concern for data bias, personal privacy, and academic honesty. It is still a researchable issue to determine the long-term impacts of ChatGPT on students. Should the question of academic integrity become increasingly precarious in relation to ChatGPT, it prompts contemplation regarding its prospects for widespread integration within academia. In response, an array of scholarly investigations has proposed a reconfiguration of the student evaluation framework and the potential introduction of an advanced AI-based plagiarism detection mechanism. Numerous studies suggest that the student evaluation system should be reorganized. Aside from that, a sophisticated AI-based plagiarism tracker could be introduced. With that said, the study offers several implications in academia. First, academic institutions need to delineate a defined stance regarding the incorporation of ChatGPT into educational practices, yet the ultimate verdict on its acceptance or rejection remains pending future deliberation. Second, faculty and staff should receive comprehensive professional training, equipping them with the requisite knowledge to judiciously employ ChatGPT and similar AI tools while guiding students toward their ethical utilization. Third, the AI-based company also adheres to ethical standards when developing new concepts or tools. Last, the government's main priority should be establishing uniform laws and considerations for ChatGPT adoption in academics. This entails a proactive role for governments in crafting regulations that navigate the evolving intersection of education and AI, thereby safeguarding the interests of both educators and learners. In short, the paper's main contribution is providing a theoretical framework, ethical considerations, and practical recommendations for the strategic and responsible integration of LLMs like ChatGPT into educational systems. It addresses the advantages and challenges of using AI tools in academic settings. Future empirical research should focus on using evidence-based guidelines

and policies in academia.

7. REFERENCES

AlAfnan, M. A., Dishari, S., Jovic, M., & Lomidze, K. (2023). ChatGPT as an educational tool: Opportunities, challenges, and recommendations for communication, business writing, and composition courses. *Journal of Artificial Intelligence and Technology*, *3*(2), 60–68. https://doi.org/10.37965/jait.2023.0184

Alptekin, G., Yıldırım, Y., Altinpulluk , H., & Yumurtacı, O. (2023). Awareness and acceptance of chatgpt as a generative conversational AI for transforming education by ghanaian academics: A two-phase study. *Journal of Applied Learning and Teaching*, *6*(2). https://doi.org/10.37074/jalt.2023.6.2.26

Atlas, S. (2023). ChatGPT for higher education and professional development: A guide to conversational AI. *College of Business Faculty Publications*. https://digitalcommons.uri.edu/cba_facpubs/548

Attuquayefio, S. N., & Addo, H. (2014). Using the UTAUT Model to analyze students' ICT Adoption. *International Journal of Education and Development Using Information and Communication Technology*, *10*(3), 75–86. https://eric.ed.gov/?id=EJ1059042

Bitzenbauer, P. (2023). ChatGPT in physics education: A pilot study on easy-to-implement activities. *Contemporary Educational Technology*, *15*(3), ep430. https://doi.org/10.30935/cedtech/13176

Bonsu, E., & Baffour-Koduah, D. (2023, March 7). *From the consumers' side: Determining students' perception and intention to use chatgptin Ghanaian higher education*. Papers.ssrn.com. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4387107

Borji, A. (2023). A categorical archive of Chatgpt failures. *ArXiv:2302.03494 [Cs]*. https://arxiv.org/abs/2302.03494

Brandl, R. (2023, February 15). *ChatGPT Statistics and User Numbers 2023 - OpenAI Chatbot*. Tooltester. https://www.tooltester.com/en/blog/chatgpt-statistics/

Chiu, T. (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. https://doi.org/10.1080/10494820.2023.2253861

Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, *61*(2), 228–239. https://doi.org/10.1080/14703297.2023.2190148

Dai, Y., Liu, A., & Cher Ping Lim. (2023). Reconceptualizing ChatGPT and generative AI as a student-driven innovation in higher education. *Procedia CIRP*, *119*, 84–90. https://doi.org/10.35542/osf.io/nwqju

Dao, X. Q., Le, N. B., Phan, X. D., Ngo, B. B., & Vo, T. D. (2023). Evaluation of ChatGPT and Microsoft Bing AI Chat Performances on Physics Exams of Vietnamese National High School Graduation Examination. *arXiv Prepr. arXiv2306*, *4538*

Dao Xuan-Quy, Ngoc-Bich, L., Vo The-Duy, Ngo Bac-Bien, & Phan Xuan-Dung. (2023). *LLMs' capabilities at the high school level in chemistry: Cases of chatgpt and microsoft bing chat*. https://doi.org/10.26434/chemrxiv-2023-kxxpd

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9–30. https://doi.org/10.1080/07421222.2003.11045748

Dillon, A., & Morris, M. (1996). User acceptance of new information technology: Theories and models item type book chapter. *Annual Review of Information Science and Technology Publisher Medford, N.J.: Information Today Journal Annual Review of Information Science and Technology*, *14*(4), 3–32. https://repository.arizona.edu/bitstream/handle/10150/105584/AdArist96.pdf

Elbanna, S., & Armstrong, L. (2023). Exploring the integration of ChatGPT in education: Adapting for the future. *Emerald Insight*,

3(1). https://doi.org/10.1108/msar-03-2023-0016

Firat, M. (2023). Integrating AI applications into learning management systems to enhance e-Learning. *Öğretim Teknolojisi ve Hayat Boyu Öğrenme Dergisi - Instructional Technology and Lifelong Learning*, *4*(1), 1–14. https://doi.org/10.52911/itall.1244453

Gordon, D., Collins, M., & O'Sullivan, D. (2021). The development of teaching case studies to explore ethical issues associated with computer programming. *United Kingdom and Ireland Computing Education Research Conference.*, 1–7. https://doi.org/10.1145/3481282.3481293

Halaweh, M. (2023). ChatGPT in education: Strategies for responsible implementation. *Contemporary Educational Technology*, *15*(2), ep421. https://doi.org/10.30935/cedtech/13036

Haque, M. U., Dharmadasa, I., Zarrin Tasnim Sworna, Rajapakse, R. N., & Ahmad, H. (2022). "I think this is the most disruptive technology": Exploring sentiments of ChatGPT early adopters using Twitter data. *ArXiv (Cornell University)*. https://doi.org/10.48550/arxiv.2212.05856

Héctor Terán. (2023). La implementación de la inteligencia artificial en la enseñanza de la programación. un estudio sobre el uso ético de ChatGPT en el aula. *Encuentro Internacional de Educación En Ingeniería*. https://doi.org/10.26507/paper.2768

Holmes, W., Iniesto, F., Sharples, M., & Scanlon, E. (2019). *ETHICS in AIED: Who cares?* 25–29. https://oro.open.ac.uk/60361/

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2021). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, *32*(1), 504–526. https://doi.org/10.1007/s40593-021-00239-1

Iqbal, N., Ahmed, H., & Azhar, K. A. (2022). Exploring teachers' attitudes towards using chatgpt. *Global Journal for Management and Administrative Sciences*, *3*(4), 97–111. https://doi.org/10.46568/gjmas.v3i4.163

Jacques, L. (2023). Teaching CS-101 at the dawn of ChatGPT. *ACM Inroad*, *14*(2), 40–46. https://doi.org/10.1145/3595634

Keiper, M. C. (2023). ChatGPT in practice: Increasing event planning efficiency through artificial intelligence. *Journal of Hospitality, Leisure, Sport & Tourism Education*, *33*, 100454. https://doi.org/10.1016/j.jhlste.2023.100454

Kelly, H. (2014). A path analysis of educator perceptions of open educational resources using the technology acceptance model. *The International Review of Research in Open and Distributed Learning*, *15*(2). https://doi.org/10.19173/irrodl.v15i2.1715

Khalil, M., & Er, E. (2023). Will ChatGPT get you caught? Rethinking of plagiarism detection. *ArXiv:2302.04335 [Cs]*. https://arxiv.org/abs/2302.04335

Küchemann, S., Steinert, S., Revenga, N., Matthias Schweinberger, Yavuz Dinc, Avila, K. E., & Jochen Kühn. (2023). Can ChatGPT support prospective teachers in physics task development? *Physical Review*, *19*(2). https://doi.org/10.1103/physrevphyseducres.19.020128

Kung, T. H., Cheatham, M., Medenilla, A., Sillos, C., De Leon, L., Elepaño, C., Madriaga, M., Aggabao, R., Diaz-Candido, G., Maningo, J., & Tseng, V. (2023). Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digital Health*, *2*(2), e0000198. https://doi.org/10.1371/journal.pdig.0000198

LaMorte, W. (2022, November 3). *Diffusion of innovation theory*. Boston University School of Public Health. https://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories4.html

Liaw, W., Chavez, S., Pham, C., Tehami, S., & Govender, R. (2023). The hazards of using chatgpt: A call to action for medical education researchers. *PRiMER*, *7*. https://doi.org/10.22454/PRiMER.2023.295710

Lund, B. D., & Wang, T. (2023). Chatting about chatgpt: How may AI and GPT impact academia and libraries? *Library Hi Tech News*, *40*(3), 26–29. https://doi.org/10.1108/lhtn-01-2023-0009

Malinka, K., Peresíni, M., Firc, A., Ondrej Hujnák, & Janus, F. (2023). On the educational impact of ChatGPT: Is artificial intelligence ready to obtain a university degree? *On the*

Educational Impact of ChatGPT: Is Artificial Intelligence Ready to Obtain a University Degree?, *1*. https://doi.org/10.1145/3587102.3588827

Menzli, L. J., Smirani, L. K., Boulahia, J. A., & Hadjouni, M. (2022). Investigation of open educational resources adoption in higher education using rogers' diffusion of innovation theory. *Heliyon*, *8*(7), e09885. https://doi.org/10.1016/j.heliyon.2022.e09885

Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4354422

Milmo, D. (2023, February 2). ChatGPT reaches 100 million users two months after launch. *The Guardian*. https://www.theguardian.com/technology/2023/feb/02/chatgpt-100-million-users-open-ai-fastest-growing-app

Motoki, F., Neto, V., & Rodrigues, V. (2023). More human than human: Measuring ChatGPT political bias. *Public Choice*. https://doi.org/10.1007/s11127-023-01097-2

Mujahid, M., Kanwal, K., Rustam, F., Wajdi Aljadani, W., & Ashraf, I. (2023, June 30). *Arabic ChatGPT Tweets Classification using RoBERTa and BERT Ensemble Model*. ACM Transactions on Asian and Low-Resource Language Information Processing,. https://doi.org/10.1145/3605889

Murgia, E., Landoni, M., Landoni, M., & Huibers, T. (2023, June 16). *Children on ChatGPT readability in an educational context: Myth or opportunity?* Adjunct Proceedings of the 31st ACM Conference on User Modeling, Adaptation and Personalization . https://doi.org/10.1145/3563359.3596996

Murgia, E., Zahra Abbasiantaeb, Aliannejadi, M., Huibers, T., Landoni, M., & Maria Soledad Pera. (2023, June 16). *ChatGPT in the Classroom: A Preliminary Exploration on the Feasibility of Adapting ChatGPT to Support Children's Information Discovery*. Adjunct Proceedings of the 31st ACM Conference on User Modeling, Adaptation and Personalization (pp. 22-27). https://doi.org/10.1145/3563359.3597399

Najafali, D., Camacho, J. M., Reiche, E., Galbraith, L., Morrison, S. D., & Dorafshar, A. H. (2023). Truth or lies? The pitfalls and limitations of ChatGpt in systematic review creation. *Aesthetic Surgery Journal*. https://doi.org/10.1093/asj/sjad093

Nazari, F., Khosravi, F., & Babalhavaeji, F. (2013). Applying rogers' diffusion of innovation theory to the acceptance of online databases at university zone of Iran . *Malaysian Journal of Library & Information Science*, *18*(3), 25–38.

Okour, M. K., Chong, C. W., & Abdel Fattah, F. A. M. (2021). Knowledge management systems usage: Application of diffusion of innovation theory. *Global Knowledge, Memory and Communication*, *70*(8/9), 756–776. https://doi.org/10.1108/gkmc-08-2020-0117

OpenAI. (2022). *ChatGPT*. Chat.openai.com; OpenAI. https://chat.openai.com/

Passin, Y. (Ed.). (2000). Innovation and ethics ethical considerations in the innovation business. *Journal of Business Ethics*, *27*, 193–203.

Pedró, F., Subosa , M., Rivas, A., & Valverde, P. (2019). *Working papers on education policy 07 artificial intelligence in education: Challenges and opportunities for sustainable development education sector united nations educational, scientific and cultural organization*. https://repositorio.minedu.gob.pe/bitstream/handle/20.500.12799/6533/Artificial%20intelligence%20in%20education%20challenges%20and%20opportunities%20for%20sustainable%20development.pdf

Pinho, C., Franco, M., & Mendes, L. (2020). Application of innovation diffusion theory to the E-learning process: Higher education context. *Education and Information Technologies*, *26*(1), 421–440. https://doi.org/10.1007/s10639-020-10269-2

Qadir, J. (2023). Engineering education in the era of ChatGPT: Promise and pitfalls of generative AI for education. *2023 IEEE Global Engineering Education Conference (EDUCON)*, 1–9. https://doi.org/10.1109/educon54358.2023.10125121

Rahman, Md. M., & Watanobe, Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. *Applied Sciences*, *13*(9), 5783. https://doi.org/10.3390/app13095783

Raman, R., Mandal, S., Das, P., Kaur, T., JP, S., & Nedungadi, P. (2023). *University students as early adopters of ChatGPT: Innovation diffusion study*. https://doi.org/10.21203/rs.3.rs-2734142/v1

Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of innovations. In *An integrated approach to communication theory and research* (pp. 432-448). Routledge.

Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning & Teaching*, *6*(1), 342–363. https://doi.org/10.37074/jalt.2023.6.1.9

Sankey, M. D., & Marshall, S. J. (2023, February 17). *Perspective chapter: The learning management system of 2028 and how we start planning for this Now*. Www.intechopen.com; IntechOpen. https://www.intechopen.com/chapters/86104

Shoufan, A. (2023). Exploring students' perceptions of ChatGPT: Thematic analysis and follow-up survey. *IEEE Access*, *11*, 1–1. https://doi.org/10.1109/access.2023.3268224

Skjuve, M., Asbjørn Følstad, & Petter Bae Brandtzæg. (2023, July 19). *The user experience of chatgpt: Findings from a questionnaire study of early users*. Proceedings of the 5th International Conference on Conversational User Interfaces (pp. 1-10). https://doi.org/10.1145/3571884.3597144

Smith, A., Hachen, S., Schleifer, R., Dinesh Bhugra, Buadze, A., & Liebrenz, M. (2023). Old dog, new tricks? Exploring the potential functionalities of ChatGPT in supporting educational methods in social psychiatry. *International Journal of Social Psychiatry.* https://doi.org/10.1177/00207640231178451

Smuha, N. A. (2019). The EU approach to ethics guidelines for trustworthy artificial intelligence. *Computer Law Review International*, *20*(4), 97–106. https://doi.org/10.9785/cri-2019-200402

Study.com. (2023, January). *Productive teaching tool or innovative cheating?* Study.com. https://study.com/resources/perceptions-of-chatgpt-in-schools

Teachers and students embrace ChatGPT for education. (2023, March 1). Walton Family Foundation. https://www.waltonfamilyfoundation.org/learning/teachers-and-students-embrace-chatgpt-for-education

Technology in Education. (2023). ISTE Standards.

Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*, *10*(1). https://doi.org/10.1186/s40561-023-00237-x

Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, *EM-29*(1), 28–45. https://doi.org/10.1109/tem.1982.6447463

Venkatesh, V., & Davis, F. D. (2020). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Wang, Y.-M., & Wang, Y.-C. (2016). Determinants of firms' knowledge management system implementation: An empirical study. *Computers in Human Behavior*, *64*, 829–842. https://doi.org/10.1016/j.chb.2016.07.055

Willems, J. (2023). ChatGPT at Universities – the least of our concerns. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4334162

Wu, Y., Henriksson, A., Duneld, M., & Nouri, J. (2023). Towards improving the reliability and transparency of Chatgpt for educational question answering. *Lecture Notes in Computer Science*, 475–488. https://doi.org/10.1007/978-3-031-42682-7_32

Xu, S., Kee, K. F., Li, W., Yamamoto, M., & Riggs, R. E. (2023). Examining the diffusion of innovations from a dynamic, differential-effects perspective: A longitudinal study on AI adoption among employees. *Communication Research*. https://doi.org/10.1177/00936502231191832

Yu, H., Shen, Z., Miao, C., Leung, C., Lesser, V., & Yang, Q. (2018). *Building ethics into*

ISSN: 2473-4901
v10 n6162

artificial intelligence. https://arxiv.org/pdf/1812.02953

Zhai, X. (2022). ChatGPT user experience: Implications for education. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4312418

Zhang, J., Bao, K., Zhang, Y., Wang, W., Feng, F., & He, X. (2023). *Is ChatGPT fair for recommendation? Evaluating fairness in large language model recommendation*. https://doi.org/10.1145/3604915.3608860

Zhou, J., Müller, H., Holzinger, A., & Chen, F. (2023). *Ethical ChatGPT: Concerns, challenges, and commandments*. https://doi.org/10.48550/arxiv.2305.10646