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From Early Adoption to Ethical Adoption: A Diffusion of Innovation Perspective on ChatGPT and Large Language Models in the Classroom

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Abstract—This paper presents a comprehensive framework and actionable recommendations for the ethical integration of ChatGPT and other Large Language Models (LLMs) into the academic environment from a Diffusion of Innovation Theory perspective. It provides a critical analysis of the technology’s potential benefits and risks in education and proposes a conceptual adoption model using critical DOI factors including the comparative benefits it offers, its compatibility with existing systems, its level of complexity, the ability to trial it, and its observability. Through guidelines on different assessment methods like surveys, interviews, and case studies are recommended to evaluate these factors regarding ChatGPT uptake. Additionally, strategies are discussed to promote responsible use, such as developing guidelines, assessing biases, and aligning with education policies. We call for interdisciplinary research between stakeholders, including educators, policymakers, and AI experts, to address LLM’s multifaceted impacts on education.

Index Terms—ChatGPT, Large Language Models, Diffusion of Innovation, Ethics, Education.

I. 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. Similar to the majority of the 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[1]. One of the most groundbreaking AI-based innovations in recent years is ChatGPT[2]. Within a few months after its launch, it had amassed over 100 million users [3]. This AI-operated bot uses AI to function and converse with the user in a human-like manner. Thanks for its massive training data, it gives the illusion of conversing with a real human being instead of a machine[4]. The Generative Pretrained Transformer (GPT) language model that OpenAI created serves as the foundation for the cutting-edge ChatGPT language model, which seeks to create indistinguishable information from human-written content. This advanced technology opens up a world of possibilities for education. Using ChatGPT ethically and responsibly in the classroom is a complex and multifaceted topic that requires a sophisticated and interdisciplinary approach. Recent studies have highlighted the need for AI’s ethical and responsible implementation in the classroom [5], [6]. Increased student engagement, cooperation, and accessibility are just a few of the many benefits offered by ChatGPT, an AI application. With its interactive and dynamic nature, ChatGPT can keep students engaged in course materials that can assist students in retaining their inspiration and enthusiasm, ultimately enhancing their understanding of the subject matter [7]. Through collaborative learning facilitation, support for different languages, and virtual real-time assistance, ChatGPT and LLMs promise a great deal of cooperation and accessibility[8]. However, questions about academic integrity and plagiarism are also raised [9]. Addressing ethical questions about AI in education (AIED) is far from frivolous because, as of today, there has been no established framework, no universally accepted guidelines, no formulated policies, and no enacted regulations to comprehensively address the ethical concerns specifically arising from the integration of LLMs within the field of education [10]. Consequently, the exploration of future research directions in this domain becomes imperative, seeking to establish ethical norms and standards for the responsible integration of LLM-based tools in academia. This paper explores prospective research guidelines concerning the ethical utilization of LLMs in academia from an information system perspective, aiming to provide a roadmap for ethical and responsible AI adoption in educational settings.

A. Problem Statement

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. Key issues that need to be tackled include educational content accuracy; ethical Use of chatGPT; personalized learning and adaptivity; and teacher involvement and support. To overcome these obstacles, it will be necessary for educators, AI researchers, legislators, and educational technology professionals to work together. It is of utmost importance to establish a comprehensive framework that systematically enhances learning outcomes, fosters student engagement,
and nurtures critical thinking skills within educational settings while giving top priority to ethical considerations, ensuring content accuracy, and providing ample support to educators, all while integrating ChatGPT and other LLMs.

B. Importance of the Problem

The multifaceted issues stemming from the integration of ChatGPT in educational settings have attracted significant attention due to their potential implications. These concerns underscore the importance of addressing these challenges:

1) Academic Integrity and Plagiarism: The ease with which students can use ChatGPT to generate essays raises concerns about academic honesty [11]. Plagiarism is a serious issue when incorporating GPTs for assessing university-level assignments. Automatic essay generators, powered by AI, are designed to generate essays based on given criteria. Consequently, students might exploit these tools to submit plagiarized essays as their original compositions, potentially avoiding detection. Such a practice could eventually devalue academic degrees and conflict with the fundamental goals of higher education, such as intellectually developing students, driving innovation, and promoting academic honesty.[9], [12].

2) Unfair Advantage: Students who use AI chatbots to complete assignments may have an unfair advantage over those who do not, as they can produce high-quality work more quickly. This disparity in access to chatbot assistance can potentially introduce grading biases[13]. The problem is further exacerbated by the fact that it is problematic to distinguish chatbot-generated work from human-written work with high accuracy as of today. This is causing an extra burden on the instructors to develop new techniques to assess a student’s understanding of the subject matter as chatbot-generated responses are highly unlikely to reflect a student’s actual level of comprehension[9].

3) Critical Thinking and Creativity: One major aspect driving ChatGPT’s popularity is its remarkable ability to generate incredibly human-like answers to user prompts. We are even seeing grown obsession with developing the “prompt engineering” field - which involves identifying efficient and effective strategies to query chatbots to stimulate the most useful answers. Unfortunately, it comes with a great cost, as it lacks the capability to teach critical thinking skills or come up with new innovative concepts independently. There is a genuine concern that the quality of educational outcomes may decline if students become excessively dependent on the chatbot and resort to it for solving problems instead of nurturing their own independent thinking[4], [14]. It is important to recognize that ChatGPT and other LLMs are only as capable as they are due to human innovation so far. Overreliance on chatbots without critical thinking and fundamental innovation could pose major problems for the advancement of humankind against unknown adversaries.

4) Ethical Implications and Biases: Another aspect that must be taken into account involves the ethical consequences and potential biases linked to the incorporation of ChatGPT in educational and research settings[15]. Large language models (LLMs) pose the risk of producing inaccurate predictions when trained on biased or anomalous data. For instance, the presence of bias in the training data towards a specific demographic or cultural group is highly likely to cause the model to exhibit unfairness or discrimination. That is why using diverse and evenly distributed data for training is crucial for LLMs.

5) Misinformation and Abuse: ChatGPT and LLMs can be manipulated through easy-to-use prompt engineering to generate false information, bigotry, and other forms of online abuse. This can cause disruption in the community, harm to one’s reputation, and even violence [16].

6) Model Transparency and Responsibility: In addition, more information regarding internal systems and processes is needed to be readily available to users. It is also crucial to ensure that users can easily understand how these algorithms arrive at their conclusions [17]. ChatGPT’s automated response generation makes it hard to pin responsibility on a single person or group. Because of this, addressing any prejudices or ethical problems may be more challenging.

7) Data Privacy and Security: Most of the LLMs are trained on massive amounts of personal data without obtaining explicit approval from their original producers and rightful owners. This raises issues around privacy and the safe use of confidential personal information. It is essential to take the necessary precautions to prevent unwanted leakage of personal information from these models[14].

It is vital that we address these complex, multidimensional challenges to leverage the imaginable benefits of LLMs in education. At the same time, we must safeguard the integrity of the educational process and ensure ethical, equitable, and effective implementation. This study explores the possible advantages and drawbacks of introducing ChatGPT to the education sector and evaluates its effectiveness in improving student learning outcomes.

C. Contributions

This paper presents a comprehensive theoretical framework and offers actionable recommendations aimed at facilitating the ethical adoption of ChatGPT in academic settings. It synthesizes contemporary concerns and existing literature related to this subject, ultimately serving as a valuable resource for shaping evidence-based policies. The highlights of our approach is as follows.

- **Overview of ChatGPT 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 in educational settings. It highlights key issues like plagiarism, unfair advantage, and impacts on critical thinking.
- **Diffusion of Innovation theory (DOI Framework):** Incorporates the implementation of ChatGPT within the framework of an information systems theory - Rogers’ Diffusion of Innovation theory. This theory is employed to achieve great insight into the elements that influence the uptake of ChatGPT.
- **Adoption Model:** Proposes a conceptual model with five factors from DOI theory: relative advantage, compatibility, complexity, trialability, and observability. Suggests
of its capacity to generate responses that can be used to harm others, its lack of transparency of explaining the generating results, and societal impact. Mhlanga et al. [5] examine how using ChatGPT in education necessitates privacy protection, impartiality, non-discrimination, and openness. Iqbal et al. [4] suggest that university faculty need more information and education about ChatGPT to make informed decisions about its use. This research shows that teachers generally have a negative attitude toward ChatGPT. Most participants claimed they believed students would use ChatGPT to cheat and become lazy. They also felt that ChatGPT does not add any value to the learning process and could be intrusive in the classroom. Furthermore, teachers expressed concern about the need for more teacher support for using ChatGPT as an educational tool. Halaweh et al. [21] examine ChatGPT’s educational applications in great detail and 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.’s research [22] 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 is appears to be great in dealing with grammatical mistakes and dramatically improve the overall readability of writing materials [23], causing a major problem to established online grammar checkers, such as Grammarly [13].

In a separate study, AL Afnan et al. [24] highlight the pros and cons of ChatGPT by examining its impact on subject areas related to writing, composition, and communication; and proposes a recommendation on its potential utilization in education. The study suggested that ChatGPT has the capacity to replace conventional search engines with its superior ability to provide information with high precision and reliability. It has the incredible potential to provide a venue for students and educators alike to find answers to a variety of questions and to generate ideas. Furthermore, it proposes a new way of utilizing technology for educators to discuss and evaluate student responses. However, the study identified certain challenges, notably students’ unethical use of ChatGPT, which can lead to intellectual complacency and hinder learning. This also poses a dilemma for instructors, as it complicates their ability to distinguish between diligent students and those overly reliant on automation, making it challenging to assess learning outcomes accurately. In a separate study, Malinka et al. [25] show that ChatGPT has the potential to be exploited to complete university degree requirements, raising concerns about academic integrity. Without adjustments to the educational model, the proliferation of plagiarism and academic dishonesty could lead students who lack adequate skills and knowledge to graduate.

The above literature indicates that more study is needed to
properly comprehend the effects of LLMs like ChatGPT and methods to counteract their misuse.

B. The Ethical Issue of AI-Based Tools

The existing body of literature sheds light on the ethical concerns associated with AI-based tools. In a study by Holmes et al. [6], sixty prominent artificial intelligence researchers in education (AIED) were surveyed. Participants were tasked with assessing whether they believed AIED researchers were adequately addressing ethical concerns in their work and providing reasons for their stance. All the participants unanimously agreed on the different ethical considerations within AIED research and development. This unanimity underscores the pressing need for AIED researchers to recognize the existing ethical challenges and prepare to address emerging ethical dilemmas proactively. As suggested by Yu et al. [26], the initial stage of developing AI systems that operate ethically is a comprehensive investigation of the ethical dilemmas within the specific application contexts. These dilemmas encompass multifaceted areas such as safeguarding intellectual property, ensuring the confidentiality of sensitive information, navigating complex negotiations between entrepreneurs and investors, employing strategic fundraising techniques including marketing and initial public offerings, and effectively managing information while mitigating the potential for insider trading [27].

C. 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. [14] 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 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 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. [29], 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. corroborated Rogers’ [30] theory by demonstrating that the perceived benefits of Moodle LMS were instrumental in driving its adoption. Employing structural equation modeling, Pinho et al.’s [31] study underscores the substantial impact of features inherent to Moodle LMS, as suggested by the innovation diffusion theory [32], on the actual usage of this tool.

III. An INFORMATION SYSTEM Theory Perspective of the Problem

This paper’s primary objective revolves around whether LLMs should find adoption within academic settings, taking into account both ethical concerns and academic integrity. To thoroughly explore this multifaceted issue, 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 [33], [34], [35], [36]. Among these theoretical frameworks are the Theory of Reasoned Action (TRA) [29] and extensions of the Technology Acceptance Model (TAM2, TAM3) [37]. 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.

A. Diffusion of Innovation (DOI) Theory

Everett M. Rogers’ theory of Diffusion of Innovations (DOI) provides a robust conceptual framework for understanding the intricate dynamics behind adopting and disseminating new ideas, technologies, products, or concepts within various societal contexts [30]. 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 [38], [39], [40], [41].

DOI theory holds significant promise in shedding light on the factors that drive individuals’ decisions to embrace or resist innovations within the realm of information technology. When applied to ChatGPT, it can offer valuable insights into the factors influencing adopters’ perceptions of open educational resources within academic settings [41]. According to this theory, innovations characterized by positive attributes tend to garner higher acceptance rates [30]. Innovations that offer clear advantages, align with existing practices and beliefs, exhibit
low complexity, are amenable to trial and observation, and facilitate rapid diffusion are more likely to find acceptance [42].

A study conducted by [43] emphasized that factors such as relative advantage, compatibility, complexity, trialability, and observability significantly impact students’ intentions to engage with e-learning systems in university contexts. The theory posits that individuals are more inclined to adopt innovations they perceive as novel or cutting-edge, thereby enabling diffusion. However, it is important to note that most people fall within the continuum of the five defined adopter categories, including innovators, early adopters, early majority, late majority, and laggards [44].

Similar to other technological advancements, ChatGPT’s success can be attributed to a "decision-making process." This process, characterized by "knowledge, persuasion, decision, implementation, and confirmation," aligns with the principles of the diffusion of innovation approach [28]. Figure 1 provides a visual representation of these stages in accordance with Rogers’ framework [30].

Understanding the process of innovation adoption is the initial phase in the decision-making process, which continues until an attitude is formed toward or confirmation is received about the invention [28]. Each successive stage in Figure 1 is required for the subsequent stage. For instance, persuasion naturally follows knowledge as individuals shape their attitudes toward innovation based on the information they acquire. The knowledge phase is grounded in acquiring information, whereas the persuasion phase is driven by emotional factors. Subsequently, individuals then decide whether or not to implement the innovation during the decision phase. The implementation phase follows the decision phase, during which individuals implement their innovations. While the initial decision to adopt the innovation has been made, individuals often seek validation of their choice in the confirmation stage [28]. Nevertheless, it is worth noting that decisions regarding acceptance or rejection may undergo revisions during the implementation phase. In the context of innovation, adopters must initially learn how much of the innovation to acquire, how to employ it effectively, and other essential details during the knowledge stage.

As they advance to the persuasion stage, individuals frequently contemplate queries on aspects such as potential outcomes of the innovation and how its advantages and disadvantages might manifest in their specific context, which compels an individual to be invested in the innovation. Following the knowledge and persuasion stages, individuals are tasked with the pivotal decision of whether to embrace or reject the innovation. Adoption implies a commitment to fully integrate the innovation as the optimal course of action, while rejection signifies a conscious choice not to incorporate the innovation [30].

B. 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 [30]. 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 [44]. 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 [45]. The early adopters of this innovative technology predominantly consisted of students. Since its launch, ChatGPT has attracted considerable attention, primarily due to its capacity to generate responses that closely emulate natural human conversation [46] (Figure 2). It can provide answers and engage in conversations based on an extensive dataset comprising 300 billion words and 175 billion features. 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. It is necessary to answer several crucial questions to adopt ChatGPT’s early relative advantage to the long-term academic integration, such as:

- How do educators and students perceive ChatGPT’s relative advantage compared to traditional teaching and learning methods?
- What specific features or capabilities of ChatGPT contribute to its perceived advantage in enhancing educational processes?

2) Compatibility: How well the new idea fits the beliefs, experiences, and needs of those who might use it [44]. 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 [45]. Study.com conducted a survey to gather insights into educators’ and students’ perspectives on the integration of ChatGPT in educational settings [47]. The survey included responses from over 100 teachers and more than 1,000 students. It was observed that a higher proportion of high school students were aware of ChatGPT compared to elementary school teachers. Furthermore, the survey revealed that a significant percentage of students, exceeding 89%, have utilized ChatGPT as a resource for academic assistance. Specifically, 48% of the students reported using ChatGPT for test or quiz preparation at home, while 53% employed it to assist in essay writing tasks. Additionally, 22% of students acknowledged using ChatGPT for the purpose of planning their academic papers, demonstrating the versatility of its applications within
Prior Conditions:
- Previous practice
- Felt needs/problems
- Innovativeness
- Norms of the social system

Fig. 1: The decision-making process of innovation [30].

Communication Channels

Characteristics of the Decision-Making Unit
1. Adoption
2. Rejection
Perceived Characteristics of the Innovation
- Continued Adoption
- Later Adoption
- Discontinuance
- Continued Rejection

Fig. 2: The advantages of ChatGPT and similar LLM chatbots in conversations compared to “traditional” technology (e.g., Google search) become evident in specific cases.

Fig. 3: Ethical concerns surrounding content generated by ChatGPT and other LLMs, including issues related to authorship, are central topics in societal and legal debates, presenting significant challenges to their compatibility in educational settings.

 DOI theory can be instrumental in identifying areas where compatibility issues might arise, enabling institutions to make necessary adjustments in their curriculum and instructional strategies (figure 3). To ensure the sustained and effective integration of ChatGPT into academic settings, it is critical to address several pivotal questions related to its compatibility, including:

- 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[44]. Investigating the extent to which educators are given the chance to experiment with ChatGPT and its influence on their adoption decisions is a key aspect of DOI-based research. Two essential questions 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?

The study.com poll found that 82% of college professors know about ChatGPT, while only 55% of grade school teachers...
Fig. 4: Do educators and students require extensive training to craft precise prompts for specific chatbots? In the top example, a prompt without any real coding errors causes Google BARD to make an incorrect decision (middle), whereas ChatGPT correctly makes the decision (bottom). For google BARD, it was required to rewrite the prompt in a different way by excluding teacher’s involvement!

Fig. 5: Observability: While Google BARD (top) is unable to generate BibTeX for a web link, the question arises: does witnessing a similar ChatBot’s failure in a task negatively impact the adoption of another chatbot, even if it successfully accomplishes the task, as seen with ChatGPT?

do. Regarding cheating, 72% of college professors who know about ChatGPT are worried about it, while only 58% of grade school teachers are. Opinions on ChatGPT usage are divided: 34% of teachers advocate for a ban in both schools and universities, while 66% believe students should have the liberty to use it. Strikingly, 72% of college students are against ChatGPT’s presence on their school’s network[47]. Investigating the extent to which educators are given the chance to experiment with ChatGPT and its influence on their adoption decisions is a key aspect of DOI-based research.

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 Koçak et al.[28], 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 [41]. 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. In light of 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[30]. 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”[48]. Adoption rates tend to be lower for complex inventions due to the learning curve involved in using them. Numerous studies[14], [49] 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.

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 to assess its five factors (figure 7).

1) **Identify Adopter Categories:** Determine the proportion of each of the five user groups (pioneers, early users, early mainstream, and laggards) described in the DOI theory among educators and schools [50], [51], [52]. 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[53].

2) **Tailor Educational Activities:** Design and create domain or subject-specific educational activities tailored to the appropriate educational level, incorporating the use of ChatGPT [54], [55] (figure 8 shows an example tailored classroom activity incorporating chatGPT in a digital forensics course). In order to do that, analyze educational materials, such as lesson plans and curricula, to identify instances of ChatGPT integration [56]. ChatGPT and other LLMs can be utilized in different steps of solving programming problems, including explaining a concept, debugging errors, and suggesting code optimizations [57], [58]. 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 train students to explore best practices for project execution [59]. 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 survey or questionnaire [60] to assess an educator’s and student’s perceptions of ChatGPT’s complexity [61] and relative advantage over traditional teaching methods[62]. 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 [63].

4) **Evaluate Compatibility:** Analyze whether educators find ChatGPT and related technologies compatible with their teaching methods and institutional goals[64]. 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[65]. Additionally, a crucial aspect to explore is the alignment of ChatGPT with an institution’s preferred pedagogical approaches[66]. Furthermore, it is imperative to evaluate how seamlessly ChatGPT can integrate with existing educational resources, such as learning management systems (LMS)[67], [68], [69].

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[70]. Some areas to examine regarding perceived complexity include evaluating the user interface[71], 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 [72]. 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 [21].
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.

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7) **Measure Benefits**: Examine how the benefits and outcomes of ChatGPT use are visible to educators, students, and other stakeholders[73]. 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 of teaching and learning outcomes[13], [74]. 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 outcomes, and consequences for students’ critical analysis abilities [75]. 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 [76], as well as the challenge of verifying whether a student-authored the work independently[77]. 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[78], assess the fairness of its responses to diverse users and requests [79], scrutinize the risk of excessive reliance on ChatGPT [80], 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[81]. 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. [82] adopts various transformer-based models to study users’ opinion and sentiment 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[83], such as the European Commission’s Ethics Guidelines for Trustworthy Artificial Intelligence [84] and The National Educational Technology Standards (NETS) for Students [85].

V. DISCUSSION 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. Future empirical research should focus on using evidence-based guidelines and policies in academia.

REFERENCES

[32] L. G. Tornatzky and K. J. Klein, “Innovation characteristics and in-...


