Issues in Information Systems
Volume 24, Issue 3, pp. 245-260, 2023

DOI: https://doi.org/10.48009/3_iis_2023_121

A four-stage model of ChatGPT adoption: application in tourism, healthcare, and education industry

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Abstract

The advance of artificial intelligence (AI) chatbots, in particular Open AI's ChatGPT, has led to reactions worldwide, from academics to practitioners. While many have expressed support for integrating ChatGPT in business processes as it can increase effectiveness, efficiency, and profit, others have sounded alarms about its advancement dominance due to likely job losses and dehumanization of everyday interactions. However, whether ChatGPT will be widely adopted or settle into a niche market like recent technological innovations (e.g., cryptocurrencies) remains unanswered. To answer this question, this study develops a four-stage model of ChatGPT adoption, suggesting that for ChatGPT to be adopted on a broad scale, it must pass four stages of applicability, availability, acceptability, and adaptability. The study first discusses the process of model development. Subsequently, the model is applied in 3 industries where the adoption of ChatGPT has generated great supporters and opponents: tourism, healthcare, and education. Among the three, the education and healthcare industry has progressed the least (currently at the acceptability stage), and tourism has progressed the most and has found limited acceptability in the model. Implications are further discussed in the paper.

Keywords: ChatGPT, AI chatbot, technology adoption, healthcare, tourism, education

Introduction

ChatGPT (Generative Pretrained Transformer) is the latest and most controversial artificial intelligence (AI) chatbot innovation developed by Open AI. At its core, it can utilize patterns from existing data to create new data in the forms of text, images, and music (Ray, 2023). Currently, this AI chatbot can perform many tasks, including responding to inquiries, troubleshooting, translating various languages, and producing original content (Javaid et al., 2023; Jiao et al., 2023; Ram & Pratima Verma, 2023).

ChatGPT has taken the world by storm with reactions from excitement (George & George, 2023; Grünebaum et al., 2023; Tlili et al., 2023) to anxiousness (Shen et al., 2023; Taecharungroj, 2023; Zarifhonarvar, 2023). In this spectrum of reactions, the former group touts the advancement as one of the most significant technological breakthroughs in the 21st century, while the latter worry that ChatGPT and other forms of AI chatbots will impact the labor market negatively (Zarifhonarvar, 2023), change industry processes (Mathew, 2023) and ultimately cause many people to lose their jobs (Aljanabi, 2023).

Since its prototype's launch on November 30, 2022, ChatGPT has slowly been applied in various industries for small tasks. In Tourism, for example, ChatGPT can potentially do almost all tasks currently completed

by travel agents (Carvalho & Ivanov, 2023). The website "Roamaround.to" currently provides a detailed itinerary with suggestions based on travel destinations. In healthcare, case studies have suggested that many rudimentary service tasks or more specialized tasks can be performed by ChatGPT (Biswas, 2023; Cascella et al., 2023). In education, reactions have ranged from eagerness to incorporate ChatGPT in classroom learning (Baidoo-Anu & Owusu Ansah, 2023; Tlili et al., 2023) to concerns about cheating and demise of the current educational system (Ali, 2023; Cotton et al., 2023). Outside business usage, there is also a rise in the number of mobile apps available at the app store, which users can use to respond to inquiries (Economic Times, 2023).

ChatGPT, currently available in the 3.5 version, is still in its infancy and contains several significant limitations. One of which is the lack of reliability and the possibility of spreading misinformation. If the data that is fed to the algorithm is misleading, there are no mechanisms currently in place to conduct a truth check (Carvalho & Ivanov, 2023; Zhuo et al., 2023). Despite this status quo, many reactions deviate from discussing what is actually happening to either catastrophizing or idolizing the discussion of the replacement of humans by AI. This is unsurprising as the idea of human replacement by AI has haunted many ever since it was displayed on the big screen with Stanley Kubrick's Space Odyssey.

However, we argue that before any world-ending reaction, one must ask **whether ChatGPT can effectively replace human jobs and change industries, as discussed by many, and if yes, how the adoption process will look**. This is the most pressing conflict that must be addressed. Due to its novelty, many studies have focused on conceptual, technological capabilities, and use case studies. If we were to rely upon the literature, the most well-known model for technology adoption — the technology acceptance model (Davis, 1989), while useful, would not be able to address the multifacetedness of the issue. The discussions around ChatGPT have evolved beyond simple adoption in the workplace, as ChatGPT could lead to many social and economic ramifications in addition to its technological innovations.

Furthermore, addressing this issue is more critical than ever. Over the last decade, there have many new technological innovations such as cryptocurrencies, NFTs, and virtual reality (VR), which were also touted as revolutionary in their industries, but none has been able to grow out of their niche audience and find adoption in the general public. NFT trading is down by 97% from its peak (Shukla, 2022). Investors have almost two trillion in the crypto market, and outside Bitcoin and Ethereum, there are almost no widely used or accepted cryptocurrencies (Levi & MacKenzie, 2022). Virtual reality, which was thought to change the gaming industry, currently has a market capitalization of 6.5 billion, roughly 3%, compared to overall gaming (Fortune Business Insight, 2021; Modern Intelligence, 2022). The reality has even set in for Meta, who controls the majority of the VR market, that VR will not grow out of its niche market for general public use. That's why companies like Apple and Microsoft never set foot in the industry and rather have focused on augmented reality. An action which Meta is following (Kolakowski, 2018; Seitz, 2022).

Relevant to the motivation of this study, we identify a trend with modern technological innovations: new technology emerges, people in the tech industry will overhype the innovation, many respond emotionally to the technology without it actually having an impact, and technology will only continue to function in a niche market for a small audience. Is ChatGPT the newest technology to be added to this lineup, or will it change the world, as many assume? To address this issue, we propose a four-stage framework, labeled as the ChatGPT 4A adoption model, which attempts to explain the adoption process of ChatGPT and similar AI chatbots. The motivation behind this framework is to provide a comprehensive framework that goes beyond technological innovation and examine the adoption of ChatGPT from a business, social, legal, and economic standpoint. Although the model is proposed in the context of ChatGPT and similar AI chatbots, we see its potential application for other disruptive technologies as well. In addition to offering a conceptual

model, we wish to use it in action by applying it to three industries that appear to be most affected by ChatGPT: healthcare, tourism, and education. Thus, our research questions are as the following:

RQ1. *How can a framework assist with understanding the successful adoption and utilization of ChatGPT?*
RQ2. *How do the healthcare, education, and tourism industries apply the four-staged ChatGPT adoption model?*

Background and Literature Review

ChatGPT in Tourism

The existing tourism literature has investigated the role of AI chatbots in the industry on multiple levels, from tourism education (Ali, 2023) to application in the sector (Mich & Garigliano, 2023). Carvalho & Ivanov (2023) discuss the potential benefits and risks of ChatGPT conceptually. On paper, ChatGPT is expected to impact HR and cause job losses negatively. On the other hand, ChatGPT can potentially enhance the number of operational processes, including reducing memos for inner communication and streamlining customer service by performing crucial tasks such as answering inquiries and booking procedures. In their book, Ivanov & Soliman (2023) advise before any wide adoption, the tourism industry must consider both financial and non-financial costs and benefits and shouldn't merely follow the trend in other industries.

However, the most significant focus appears to be on travelers' chatbot use intentions (i.e., if AI chatbots were to be adopted, which factors would influence travelers' usage intentions). Cai et al. (2022) discovered that chatbots displaying human emotions would increase customers' use intentions. Furthermore, to increase the usage of chatbot AI, behavioral factors such as trustworthiness, intelligence, and enjoyment can influence travelers' usage of AI chatbots. Based on survey results, Melián-González et al. (2021) showed that individuals' intention to interact with AI chatbots is directly associated with the habit of using chatbots, hedonic aspects of using, prior chatbot/service technologies usage, social influence, and level of anthropomorphizing of the chatbot. Furthermore, factors such as perceived ease of use, perceived usefulness, perceived trust, perceived intelligence, and anthropomorphism are all associated with usage intentions (Pillai & Sivathanu, 2020). Finally, there has been exponential growth in online travel assistant tools. The proliferation of travel apps based on ChatGPT and AI models include Roamaround, Vacay Chatbot, iPlan.AI, and Curiosio. Each app platform is rapidly changing, and new versions are released as they gather data through user interaction. AI is expected to play a significant role in all aspects of the travel industry - from booking to planning. In addition, occupancy prediction and similar use cases are emerging and exciting areas related to the use of AI for travel.

ChatGPT in Healthcare

Increasingly, ChatGPT is being evaluated and applied in healthcare in various settings, as it is touted to have the ability to transform healthcare fundamentally (Editorial of Nature Medicine, 2023). In a systematic review of academic literature, Sallam (2023) states that ChatGPT has already been shown to help healthcare practitioners in healthcare practice, research, and education. It can be used to improve efficiencies in operations, such as in medical diagnostics, clinical decision support, and medical research (Sallam, 2023). Further, on the patient side, ChatGPT can be used to improve efficiencies in patient management, such as in recruiting patients for clinical studies, and in patient engagement by facilitating better communication and interaction with healthcare practitioners (Javan et al., 2023; Xue et al., 2023). We provide some illustrative examples of research findings from ChatGPT evaluation in healthcare settings below.

Clinical Decision Support (CDS) Systems: Clinical decision support (CDS) systems are key systems used by healthcare practitioners that provide prompts and information about a particular condition of the patient, facilitating appropriate decisions on treatments. In CDS systems, ChatGPT has already been shown to conduct effective diagnoses and recommend treatment options. For example, Liu et al. (2023) conducted a study comparing ChatGPT-generated suggestions with human suggestions based on the prompts from the CDS system. This study concluded that ChatGPT-generated suggestions had a high degree of relevance, understandability, and a low degree of bias and other negative factors. It also seemed to offer "unique perspectives" to the CDS prompts (Liu et al., 2023).

***Medical research and writing*:** The use of ChatGPT in medical research and writing is an evolving field with application in various activities such as conducting literature reviews, summarizing findings, and evaluating the writing (Biswas, 2023; Stokel-Walker & Van Noorden, 2023). In trying to evaluate the real-world applications of ChatGPT, Cascella et al. (2023) evaluated the feasibility of ChatGPT in various clinical scenarios in healthcare. In one such test, they asked ChatGPT to summarize five articles with the prompt that *"Based on the Background, Methods, and Results provided below, write the Conclusions of an abstract for the NEJM. The conclusions cannot be longer than 40 words"* (p. 33). They found that ChatGPT had an impressive ability to summarize medical research and present findings succinctly as prompted. Further, when asked to express the definition of "seniority," ChatGPT first was able to correctly categorize the definition as being elderly with different age subgroups. On further prompts regarding post-operative contexts, ChatGPT also suggested that age-related complications can occur in the post-operative context.

***Patient Engagement and Management**:* Patient engagement, education and management are important aspects of the clinical lifecycle which can be enhanced with the use of ChatGPT. As ChatGPT helps in reducing monotonous tasks, scheduling, and internal communications of doctors and nurses, they are able to better engage and communicate with patients (Siwicki, 2023; Xue et al., 2023). For instance, Cascella et al. (2023) found that ChatGPT worked extremely well in composing medical notes for patients after they were admitted to ICU. They document that ChatGPT classified the parameters into the correct sections in the notes most of the time. Palal et al. (2023) state that ChatGPT can complete the discharge summaries accurately for patients "within seconds," making it extremely efficient and effective. Yeo et al. (2023) show that ChatGPT has the potential to offer patient-friendly support. In a test of 164 questions regarding cirrhosis and hepatocellular carcinoma (HCC), ChatGPT answered 76.9% of the questions correctly. Although it exhibited some limitations in terms of offering in-depth advice, such as regarding decision-making cutoffs, it was able to offer "practical" and "multi-faceted advice" to patients and caregivers, which can be extremely beneficial.

ChatGPT in Education

In education, there has been an increase in interest by scholars who favor and oppose the integration of technology. Tlili et al. (2023) used a qualitative case study to examine the perception of ChatGPT in education. The study discovered that despite the perception of potentially high impact, there are a number of concerns, including challenges with cheating and responsibility. An empirical study of the use of ChatGPT as an educational tool for composition, business writing, and communication found both opportunities (e.g., integrating technology with class teaching, conducting workshops) and challenges (i.e., unlearning and cheating) is presented by AlAfnan et al. (2023). Malinka et al. (2023) have studied the impact of ChatGPT on subjects related to computer programming and show how ChatGPT can be used as a tool aiding the learning process and as a means for cheating. Thurzo et al. (2023) present the applications of AI and its effects on dental education curricula. The use of ChatGPT in engineering education to provide feedback and offer personalized learning is discussed by Qadir (2023).

Lo (2023) uses a rapid review approach to study the literature on ChatGPT. The review suggests that ChatGPT can be used to solve technical and non-technical problems. The findings of this review suggested that ChatGPT can serve as an assistant for both instructors and students. For example, ChatGPT can help instructors generate exercises, quizzes, and scenarios for student assessment, concept checking, and exam preparation. ChatGPT can be a professional tutor for developing skills in the areas of programming and report writing. ChatGPT can support learning by assisting in answering questions, summarizing information, and facilitating collaboration and group discussions. According to Thunstrom (2022), students can be assisted in learning by ChatGPT to solve complex problems and write essays. Cotton et al. (2023) present opportunities and challenges of using ChatGPT in higher education. ChatGPT can enable remote learning as well as provide a platform for asynchronous communication. Rahman & Watanobe (2023) explored the potential opportunities and threats of ChatGPT to education from the perspective of students and educators. In the area of research in education, ChatGPT can be used effectively to support the writing process. It can assist in providing vocabulary assistance as well as correcting typographical errors and grammatical inconsistencies. It also has the ability to provide summaries of published work, which can be helpful for researchers to understand the topic of interest better.

Framework Development

Over the years, models such as the technology acceptance model (Davis, 1989; Marangunić & Granić, 2015) have attempted to explain how new technologies will get adopted. However, the ramification of advancements in AI chatbot and their potential capabilities goes beyond increasing effectiveness and efficiency in the workplace. It can potentially upend industries, eliminate various job categories, and completely change how society and the economy function. This calls for a new framework that can address various facets of AI chatbot adoptions. In particular, in order for ChatGPT and other AI chatbots to be successfully utilized, what must happen? Who must be on board? What may the utilization process look like? The majority of prior studies in the domain of ChatGPT have focused on its potential impact or examination of current capabilities in specific industries (Aljanabi, 2023; Baidoo-Anu & Owusu Ansah, 2023; Cascella et al., 2023; George & George, 2023; Javaid et al., 2023; Ram & Pratima Verma, 2023; Ray, 2023). However, to our knowledge, no framework has been developed to offer an explanation of the adoption process of ChatGPT in general. Accordingly, in this section, we introduce our conceptual framework, explicate its components, and discuss the adoption process offered through this framework.

Illustrated in Figure 1, we propose that in order for ChatGPT and similar AI chatbot technologies to be fully utilized, they must go through four reiterative stages: applicability, availability, acceptability, and adaptability. Our framework suggests that ChatGPT must pass all four stages to be fully adopted and utilized in a sector. The framework includes a number of assumptions: first, even though the model was developed for ChatGPT and AI chatbot adoption, we believe it can be applicable to almost all disruptive new technologies. Second, the failure to pass each stage will stop the adoption process completely or causes technology to become a niche product. Third, each stage will include a number of facets. Although we offer our list, these facets may differ among different industries. Finally, the model is also reiterative. Meaning that anytime ChatGPT changes, it must go through all four stages again, albeit the adoption process may be faster.

Stage 1 - Applicability: The first stage, labeled as applicability, examines whether ChatGPT is applicable in the commerce of industries. Commerce across all industries consists of 3 facets: product, process, and delivery. This concept is derived from the e-commerce literature. Researchers and practitioners used this definition to examine the various forms of e-commerce and categorize them (Bryant et al., 2008). For example, Audible offers a full e-commerce model where the product (i.e., audiobook), process (i.e., search,

selection, payment), and delivery (i.e., sending the e-book to the customer) are all digitized. On the other hand, Amazon follows a partial e-commerce model where delivery and product are still physical, but the process has been digitized. This allows experts to analyze e-commerce markets (Ekeledo & Sivakumar, 2004).

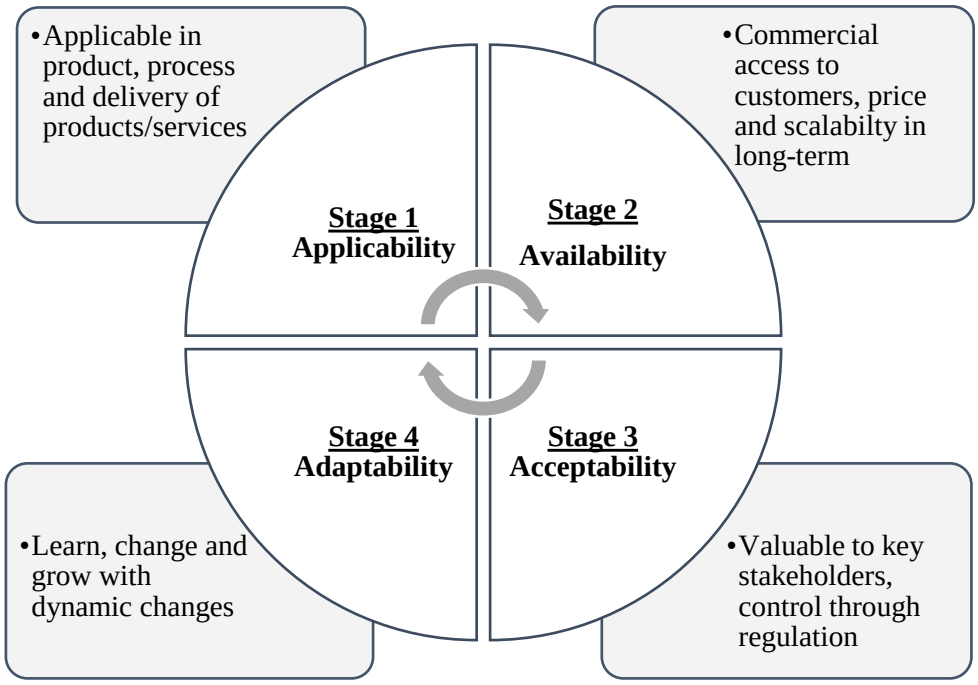

Figure 1: The 4A Model of ChatGPT Adoption Model

We posit that the concept can also be applied in ChatGPT's applicability. We note that if ChatGPT is able to be used in at least one of these three facets of a business's commerce (i.e., product, process, or delivery), then it successfully passes the first stage. In other words, applicability in that industry exists if ChatGPT can be utilized and replace or complement the existing practices in the commerce of the business. If there's no applicability in the final product, business processes, or delivery of the product, adoption will stop at this stage.

Stage 2 - Availability: If ChatGPT is applicable, it is time to examine whether it is available for industries to use the technology. Availability is used as an umbrella term, covering a multitude of factors. This will include many economic factors such as commercial access by customers (e.g., companies), price, and scalability in the long term (Jogalekar & Woodside, 2000; Moffett & Sloman, 1988). The availability will also be dependent on the availability of developers and distributors of AI chatbot technologies (Bhagwan et al., 2003; Gray & Siewiorek, 1991). Currently, Google with Bard and Open AI with ChatGPT are the most well-known developers of the technology (Hurst, 2023). However, several open-source projects are developing simultaneously and could challenge the current availability of ChatGPT and Bard (Milmo, 2023). The idea behind this stage is simple: absence of a sensible economic offering, companies won't adopt ChatGPT regardless of its applicability. Consequently, ChatGPT must be available for commercial use.

Stage 3 - Acceptability: By now, ChatGPT has gone through two stages: applicability and availability. If successful, it means that: first, it has been determined to be applicable to one or more facets of the commerce in the industry (i.e., product, process, delivery). Second, it has been determined that the technology is

available with economic justification. The third stage will focus on the acceptability of the ChatGPT. This stage is the biggest hurdle to overcome. In any business activity, there are many key stakeholders—management, shareholders, customers, consumers, and lawmakers (Cadle et al., 2014). Under the value proposition model, any key stakeholder is after values that are either financial, time-based, or quality-based. Consequently, this interest, combined with their power and interest over and in business, will determine the outcome of many strategic proposals that are set forth. Lawmakers (i.e., state and federal) follow additional values to protect their supporters and residents (Jackson, 2018; Osterwalder et al., 2015).

This is where logic and emotions intertwine. To drive adoption, key stakeholders, particularly those holding power (e.g., managers, shareholders, lawmakers), will determine the outcome of this stage. Unless key stakeholders find value in the form of money, time, and quality or support by lawmakers, ChatGPT will not be accepted, regardless of all its benefits. A great example is the shutdown of Beaxy, a crypto exchange platform, by the Securities and Exchange Commission (U.S. Securities and Exchange Commission, 2023).

Stage 4 - Adaptability: Market, customer expectations, and industry dynamics are always changing. The final stage of the model is concerned with the growth and sustainability of ChatGPT. Unless technology can learn, change, and grow as time passes, there will be no sustainability of the technology in the future. At the time of writing this paper, ChatGPT still faces severe limitations, particularly regarding truth checking and spreading misinformation (Carvalho & Ivanov, 2023). Furthermore, the technology has yet to fully grow to the functionality it promises (Aljanabi, 2023). With constant changes in market demands, the profit-seeking mentality of corporations, and unstable political systems, ChatGPT must be able to adapt. This adaptivity must come not only in the form of growth in functionality and ease of use but also in customization ability required by companies' needs and control and monitoring mechanisms which laws may require (Dolata, 2009; Tuominen et al., 2004).

Use Case Application: VR in Gaming

Table 1 - Application of the 4A Model in VR in the Gaming Industry

Stage	Analysis Description
Applicability	VR is applicable in the product facet of the gaming industry. Games would not require the traditional controller. Rather players use headsets and VR controllers to immerse themselves in the world. Thus, the technology passes the first step of it being applicable in the gaming industry.
Availability	Over the years, technology has become wildly available. PlayStation, Valve, HTC, and Meta all sell VR headsets at various price points.
Acceptability	This is where VR faced its major issues: consumers (i.e., gamers) didn't accept the technology over traditional gaming practices (i.e., mouse and keyboard/controllers). High price, excess wiring (Barker, 2021), inability to play for long hours (due to heat and weight of the headsets (Kourtesis et al., 2019), low number of VR games, low-quality graphics compared to other forms of gaming, VR motion sickness (Hale & Stanney, 2014; LaMotte, 2017) were all factors among general consumers not accepting the technology at a wide level.
Adaptability	VR has advanced. Both Meta and Sony have introduced their new headsets recently. However, now in the gaming sphere, it is accepted that VR is for a niche audience (Kolakowski, 2018; Seitz, 2022). A statement that can be backed by sales of PlayStation VR 2.

Before applying the model to the three target industries (i.e., healthcare, education, and tourism), we illustrate its application in a used case study of a highly innovative industry: VR in the gaming industry. As noted in our assumption, we believe the model can be applicable to any disruptive and innovative

technology. Understanding the history behind VR and witnessing what happened in reality, is a good starting point for applying the model, as we won't be speculating on the future but rather retroactively applying the model to existing facts. This helps to assess the sensibility of the model and its application.

Virtual reality was once touted as the "next big thing" (The Verge, 2014). In the gaming world, it was suggested by various industry experts that it would change gaming as most would know it, and playing on the keyboard or traditional controllers would be outdated (Jenkins, 2019; Pallavicini et al., 2019). Years later, VR only occupies roughly 3% of the gaming world (Fortune Business Insight, 2021; Modern Intelligence, 2022). More recently, the launch of the new PS VR saw Sony only hitting 8% of their projected sales, 270,0000 units instead of 2 million (Tassi, 2023). The application of the 4A adoption framework is presented in Table 1.

Framework Application

Application in Tourism Industry

Applicability: Among the three facets of the tourism industry: product, delivery, and process, two will always be physical and cannot be replaced by AI: the product (i.e., visiting actual locations) and delivery (e.g., room supplies, attractions, souvenirs). However, many elements within the industry process are in danger of replacement. While the current applications are quite limited, several companies have started building interfaces on top of the ChatGPT platform to offer travel itineraries, suggestions, and connections with tour guides. It was recently announced that Kayak and Expedia have integrated ChatGPT plug-ins into their services (Biesiada, 2023). Accordingly, ChatGPT passes the stage of applicability.

Availability: With its digital nature, ChatGPT can be readily available to users 24/7, providing uninterrupted support and information. Whether accessed through dedicated applications, websites, or messaging platforms, users can access the tool from anywhere with an internet connection, ensuring round-the-clock availability and convenience. The simple web interface has made it easily available to travelers and their ability to prompt the tool for ideas. It is not yet clear if travel agents have started using the product, though online services have started integrating at different levels.

Acceptability: ChatGPT's language model is designed to interact in a natural and human-like manner, making it more acceptable to users seeking assistance. By understanding and responding to users' queries in a conversational manner, it helps create a positive user experience and fosters a sense of trust and reliability. Moreover, as technology advances and users become more accustomed to AI-driven interactions, the acceptance of ChatGPT as a reliable tool in the travel and hospitality industry is likely to increase. The tool is unable to customize results for travelers without multiple interactions and prompts. Personalized recommendations are the holy grail of travel itineraries. Many of the platforms using ChatGPT for travel-related activity are focusing their efforts on building personalization. For example, in a statement written by ChatGPT and edited by staff by Kayak, the company noted that "by leveraging AI technology to provide more personalized and intuitive search experiences, we're making it easier than ever for travelers to plan their dream vacations (Kayak, 2023)." While this is a massive step forward for travel tech, the value of the response from the integrated system remains to be seen. This will have a direct impact on the acceptability of the travel community. However, since these value propositions provide what the decision maker (authorities) or the market (i.e., customer) demands more optimally, those key stakeholders will move toward using AI, and those jobs will be lost in the near future, and ChatGPT passes the acceptability stage.

Adaptability: One of the strengths of ChatGPT is its adaptability to different scenarios and user preferences. It can be tailored to meet specific business requirements and branding guidelines, ensuring a consistent and personalized experience for customers. For example, it can be trained to understand and provide recommendations based on individual travel preferences, dietary restrictions, or accessibility needs. Additionally, as the model learns from user interactions, it can continuously adapt and improve its responses over time, providing increasingly accurate and relevant information. These are the early stages of this travel tech, and it is clear it will grow and adapt to user needs.

It is our assessment that ChatGPT has progressed past the first two stages of our framework, i.e., applicability and availability. But it is currently stuck at the acceptability stage since travel itineraries can be highly tricky with a heavy requirement for personalization. With time, more usage and data from users ChatGPT will start to become more relevant in the Tourism industry. Multiple travel and hospitality services are adopting ChatGPT plug-ins. Starting with Expedia and Kayak, the number of players has been expanding rapidly since March of 2023. Thus, it seems technology is able to adapt, and the industry is ready to embrace ChatGPT in its operations.

Application in Healthcare

Applicability: Despite healthcare's nature as a human-centric industry, a number of commerce applications exist for ChatGPT. Among the three facets of the healthcare industry: product, delivery, and process, all can be delivered in a hybrid format. Patients can visit online or in person (delivery), and the service may include examination, prescription drugs, or remote care (delivery). The process of checking in and other healthcare facts can be done both in person and online (process). Prior research has outlined a number of possible useful application areas, including supporting clinical practice, research assistance, and public health reasoning, as discussed in the literature review. Although the veracity of the information generated by ChatGPT remains an open area of concern, there exists a substantial benefit to the healthcare industry in pursuing the use of ChatGPT. The healthcare industry is already moving to incorporate this technology, with electronic health record (EHR) vendors Epic and eClincalWorks demoing new GPT-powered applications in March of 2023 (Fox, 2023). Thus, ChatGPT for the healthcare sector passes the applicability stage in the 4A model.

Availability: ChatGPT is widely available to the public, and there currently seem to be few barriers to accessing the technology for medical use. As noted above, major EHR vendors are making strides in integrating GPT into existing tools. From the perspective of individual users, ChatGPT is widely available for healthcare workers to assist in information dissemination (e.g., writing research papers and public health documents). Based on these factors, we believe ChatGPT passes the availability stage in the healthcare sector for the 4A model.

Acceptability: ChatGPT satisfies some of the stakeholder expectations with regard to sufficient reliability and lower cost. For example, healthcare assistants may see some of their tasks replaced by AI, as many of their tasks are quite automated and can be reliably performed by AI. This scenario satisfies the patient's needs at a lower cost which is desirable to management stakeholders. Other tasks, such as scheduling and accreditation documentation, can potentially be streamlined by AI, with similar outcomes. However, a negative consequence of ChatGPT for these purposes may be the loss of stakeholder jobs, among roles such as healthcare assistants and accreditation staff. Further, any application which requires patients to interface with AI may meet resistance. It has been shown that patients are hesitant to engage in sensitive healthcare interactions with chatbots (Müller et al., 2020). Any possible gains in terms of lower cost with sufficient quality would need to be balanced with increased patient resistance to interfacing with AI, as well as the ethical aspects of reducing stakeholder jobs.

Other applications of ChatGPT in healthcare focus on information dissemination, including assistance in medical research papers (Lecler et al. 2023) to reasoning about public health topics (Marco Cascella et al. 2023). In all of these cases, ChatGPT may be seen as a tool to streamline the creation of quality content; however, based on its current capabilities, there must be a knowledgeable medical professional to ensure the veracity of what is generated. This is acceptable in some cases (e.g., using ChatGPT to transform notes into a formal writeup), but in other cases renders it fairly useless (e.g., using ChatGPT to perform a literature review). Thus, we believe that in the healthcare sector, there are some limited use cases where ChatGPT is on the cusp of passing the acceptability test in the 4A model. However, overall major obstacles must be overcome first.

Adaptability: A major concern about using ChatGPT in the healthcare domain is the veracity and reliability of the information generated. As of the writing of this paper, ChatGPT is still suffering from "hallucinations" where it creates information that it reports as fact and has no reliable fact-checking mechanism. This is a concern across many industries but is especially sensitive when dealing with human health. Further, given that AI cannot be the responsible party should a patient suffer injury due to misinformation, its wide deployment in healthcare raises many ethical and legal challenges. For those reasons, we believe that ChatGPT generally does not pass the Adaptability stage of the 4A model. However, limited uses with knowledgeable healthcare professionals in the loop (e.g., recording information into EHRs) may be on the horizon.

Application in Education

Applicability: ChatGPT has been successful in generating value for customers in the education sector (Curry, 2023). In addition, the process of producing and delivering value is completely digitized. Based on the classification of e-commerce model types (Bryant et al., 2008), ChatGPT can be considered a full e-commerce model. Hence, in our view, ChatGPT for the education sector passes the applicability stage in the 4A model.

Availability: Currently, ChatGPT is available free to end customers/consumers in the education sector. Since its release on 30 November 2022, ChatGPT has become the fastest-growing user application in history, reaching 100 million active users as of January 2023, just two months after its launch. The number of developers has grown rapidly. ChatGPT can handle the rapid increase in demand/workload, which has surpassed 1.8 billion visitors per month (Hu, 2023). Based on the price structure, credible developers such as Google and Microsoft, and scalability performance (Curry, 2023), we believe ChatGPT passes the availability stage in the 4A model.

Acceptability: ChatGPT provides adequate financial benefits for most stakeholders (e.g., lowering costs) and reduces the time required for many activities (e.g., problem-solving assistance for students or simulation development for instructors). As far as the quality dimension is concerned, there are serious concerns for different stakeholders. The use of ChatGPT in education poses challenges related to its accuracy and reliability (Sallam, 2023). In domains of education like Mathematics, ChatGPT's performance is unsatisfactory (Lo, 2023). There are concerns such as plagiarism as well as difficulties in detecting and preventing dishonesty (Cotton et al., 2023; Thurzo et al., 2023). Cotton et al. (2023) points out that such technologies could provide an unfair advantage to some students over others. Qadir (2023) raises concerns about ensuring equitable access to such technologies for marginalized communities. Using generative AI in education also raises ethical concerns, such as the potential unemployment of humans who are made redundant by technology. Social Network Analysis of tweets by Tlili (2023) about using ChatGPT for education purposes report that there were twice as many positive comments as negative comments.

Businesses are concerned with legal issues related to ChatGPT. As of now, there are no government regulations on ChatGPT. However, given the recent history of legal issues related to the use of social faced by companies such as Facebook and TikTok, there is concern about possible government regulations in the US as well as worldwide (McDade & Jackson, 2023). Several countries have already banned ChatGPT (Martindale, 2023). Hence, we believe that ChatGPT in the education sector has severe concerns in passing the acceptability test in the 4A model.

Adaptability: ChatGPT has many limitations, such as a lack of common sense, potential bias, difficulty with complex reasoning, and inability to process visual information (Rahman and Watanobe, 2023). ChatGPT and other AI language models may make mistakes or provide incorrect information. The generation of incorrect or fake information can pose threats to academic integrity (Cotton et al., 2023; Lo, 2023). ChatGPT also faces severe limitations with respect to truth checking and spreading misinformation. Lastly, it is expected there will be many legal challenges from businesses and governments against ChatGPT. Hence, ChatGPT has a long way to go as far as passing the Adaptability stage of the 4A model.

Discussion

Table 2 – 4A ChatGPT Adoption Analyses Summary

	Tourism	Healthcare	Education
Applicability	✓	✓	✓
Availability	✓	✓	✓
Acceptability	✓ **(Limited)**	×	×
Adaptability	×	×	×

This study aimed to understand the various applications of ChatGPT and propose a four-stage framework that attempts to explain the adoption process of ChatGPT and similar AI chatbots. Through a focused literature review, the 4A four-stage framework, and illustrative examples, we have demonstrated the application of ChatGPT across three industries: healthcare, tourism, and education. Table 2 presents the summary of this application. The central contribution of this study is the 4A four-stage framework of applicability, availability, acceptability, and adaptability of ChatGPT, as it offers a novel approach to studying ChatGPT and other AI applications in these contexts. By applying the framework in the use case of VR gaming and various contexts, this study provided an in-depth view of how ChatGPT's maturity level can be understood across healthcare, education, and tourism. While ChatGPT is comfortably poised at the "availability" stage in healthcare and education (and some limited acceptability cases in healthcare), it still has some ways to go before it reaches the acceptability and adaptability stages in these contexts. In tourism, there has been more progress, with limited acceptability. However, complex processes such as insurance have hindered its full acceptance.

This study further makes an important contribution by assessing the utility of ChatGPT in various contexts. Through illustrative examples and the framework, this study establishes the viewpoint that the future is increasingly poised to allow ChatGPT and other such AI-enabled tools to become embedded in our lives and offer several important assistant services in these various contexts. In healthcare, ChatGPT has the potential to improve efficiencies for healthcare practitioners and patients alike by providing medical diagnosis, research, and decision-support services. In tourism, future research can explore the development of ChatGPT plug-ins that specialize in personalized recommendations for travelers. These plug-ins could take into account factors such as individual preferences, past travel history, budget constraints, and travel goals to offer tailored suggestions for destinations, accommodations, activities, and attractions. By

leveraging machine learning algorithms and user feedback, these plug-ins can continuously refine their recommendations and improve the overall travel experience. Multilingual support, safety and crisis management, sustainability, and eco-friendly travel can all be addressed by developments using ChatGPT. In education, ChatGPT is and will remain controversial the most. While the technology is highly applicable, almost all studies, including our analysis, point to the issue of cheating and unlearning. Accordingly, with education, it is not the issue of "whether ChatGPT will cause job loss" but also "whether ChatGPT will cause unlearning in students and reduction in education quality," which must be further studied. Thus, future research can explore the framework to induce responsible use and limitation to its adoption.

As ChatGPT responses become increasingly inseparable from human-like interactions, several researchers have called for regulatory reforms to control or manage such AI tools. In this regard, although a majority of papers argue for the benefits of ChatGPT, it is important to point out cautionary notes on ChatGPT and associated AI tools (Baumgartner, 2023) and also the question of whether these tools are, in fact, double-edged swords (Palal et al., 2023). In the healthcare context, for instance, DiGiorgio & Ehrenfeldm (2023) argue that the use of AI should be in such a way that it unburdens the doctors and nurses without compromising on the quality of the work and that more regulatory norms are needed for such tool use in medical practice and research. In tourism, issues of accuracy, reliability, data privacy, data security, and lack of human touch are all real issues and will have a direct impact on adoption. The ethical use of AI also has some bearing on this merging travel tech. In education, plagiarism, and unlearning issues will be the main barrier to entry into the technology (Rahman & Watanobe, 2023; Tlili et al., 2023).

These cautionary limitations aside, ChatGPT has immense potential to be a game-changer in several contexts by completely revolutionizing and reimagining the foundational relationships: the patient-provider relationship in healthcare, the customer-agent relationship in tourism, and the learner-teacher relationship in education. Future research can expand on the four-stage framework by testing the framework in other contexts. Surveys and case studies of the application of ChatGPT and other AI tools in these contexts can be used to verify the veracity of our framework. As technological barriers are broken and regulatory and societal norms are in place for managing AI, these tools have the power to not only transform relationships but also transform lives.

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.

Ali, F. (2023). Let the devil speak for itself: Should ChatGPT be allowed or banned in hospitality and tourism schools? *Journal of Global Hospitality and Tourism*, *2*(1), 1–6.

Aljanabi, M. (2023). ChatGPT: Future directions and open possibilities. *Mesopotamian Journal of CyberSecurity*, *2023*, 16–17.

Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Available at SSRN 4337484*.

Barker, S. (2021). *Soapbox: PSVR's Crap Load of Cables Has Put Me Off*. https://www.pushsquare.com/news/2021/03/soapbox_psvrs_crap_load_of_cables_has_put_me_off

Baumgartner, C. (2023). The potential impact of ChatGPT in clinical and translational medicine. *Clinical and Translational Medicine*, *13*(3).

Bhagwan, R., Savage, S., & Voelker, G. M. (2003). *Understanding availability*. 256–267.

Biesiada, J. (2023, March 27). *Kayak launches a ChatGPT plug-in*. https://www.travelweekly.com/Travel-News/Travel-Technology/Kayak-launches-a-ChatGPT-plug-in

Biswas, S. (2023). ChatGPT and the future of medical writing. *Radiology*, *307*(2), e223312.

Bryant, R., Katz, R. H., & Lazowska, E. D. (2008). *Big-data computing: Creating revolutionary breakthroughs in commerce, science and society*.

Cadle, J., Paul, D., & Turner, P. (2014). *Business analysis techniques*. Chartered Institute for IT.

Cai, D., Li, H., & Law, R. (2022). Anthropomorphism and OTA chatbot adoption: A mixed methods study. *Journal of Travel & Tourism Marketing*, *39*(2), 228–255.

Carvalho, I., & Ivanov, S. (2023). ChatGPT for tourism: Applications, benefits and risks. *Tourism Review*.

Cascella, M., Montomoli, J., Bellini, V., & Bignami, E. (2023). Evaluating the feasibility of ChatGPT in healthcare: An analysis of multiple clinical and research scenarios. *Journal of Medical Systems*, *47*(1), 1–5.

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1–12.

Curry, D. (2023). *ChatGPT Revenue and Usage Statistics*. https://www.businessofapps.com/data/chatgpt-statistics/

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–340.

DiGiorgio, A. M., & Ehrenfeld, J. M. (2023). Artificial intelligence in medicine & ChatGPT: de-tether the physician. *Journal of Medical Systems*, *47*(1), 32.

Dolata, U. (2009). Technological innovations and sectoral change: Transformative capacity, adaptability, patterns of change: An analytical framework. *Research Policy*, *38*(6), 1066–1076.

Economic Times. (2023). *Keep missing WhatsApp messages? Here's how you can have ChatGPT respond to texts on your behalf!* https://economictimes.indiatimes.com/magazines/panache/keep-missing-whatsapp-messages-heres-how-you-can-have-chatgpt-respond-to-texts-on-your-behalf/articleshow/98154063.cms?from=mdr

Ekeledo, I., & Sivakumar, K. (2004). The impact of e-commerce on entry-mode strategies of service firms: A conceptual framework and research propositions. *Journal of International Marketing*, *12*(4), 46–70.

Fortune Business Insight. (2021). *Market Research Report, Virtual Reality in Gaming Market Size*. The global virtual reality in gaming market is projected to grow from $7.92 billion in 2021 to $53.44 billion in 2028 at a CAGR of 31.4% in forecast period... Read More at:- https://www.fortunebusinessinsights.com/industry-reports/virtual-reality-gaming-market-100271

Fox, A. (2023). *EHR vendors demo new GPT features at HIMSS23*. https://www.healthcareitnews.com/news/ehr-vendors-demo-gpt-himss23

George, A. S., & George, A. H. (2023). A review of ChatGPT AI's impact on several business sectors. *Partners Universal International Innovation Journal*, *1*(1), 9–23.

Gray, J., & Siewiorek, D. P. (1991). High-availability computer systems. *Computer*, *24*(9), 39–48.

Grünebaum, A., Chervenak, J., Pollet, S. L., Katz, A., & Chervenak, F. A. (2023). The exciting potential for ChatGPT in obstetrics and gynecology. *American Journal of Obstetrics and Gynecology*.

Hale, K. S., & Stanney, K. M. (2014). *Handbook of virtual environments: Design, implementation, and applications*. CRC Press.

Hu, K. (2023). *ChatGPT sets record for fastest-growing user base—Analyst note*. https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/

Hurst, L. (2023). *Google's Bard vs OpenAI's ChatGPT: Which of the rival AI chatbots is better?* https://www.euronews.com/next/2023/03/22/googles-bard-vs-openais-chatgpt-which-of-the-rival-ai-chatbots-is-better

iPlan: Your Smart Travel Planner. Published 2023. Accessed June 27, 2023. Iplan.ai

Ivanov, S., & Soliman, M. (2023). Game of algorithms: ChatGPT implications for the future of tourism education and research. *Journal of Tourism Futures*.

Jackson, B. W. (2018). Artificial intelligence and the fog of innovation: A deep-dive on governance and the liability of autonomous systems. *Santa Clara High Tech. LJ*, *35*, 35.

Javaid, M., Haleem, A., & Singh, R. P. (2023). ChatGPT for healthcare services: An emerging stage for an innovative perspective. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 100105.

Javan, R., Kim, T., Mostaghni, N., & Sarin, S. (2023). ChatGPT's Potential Role in Interventional Radiology. *CardioVascular and Interventional Radiology*, 1–2.

Jenkins, A. (2019). *The fall and rise of VR: The struggle to make virtual reality get real*. https://fortune.com/longform/virtual-reality-struggle-hope-vr/

Jiao, W., Wang, W., Huang, J., Wang, X., & Tu, Z. (2023). Is ChatGPT a good translator? A preliminary study. *ArXiv Preprint ArXiv:2301.08745*.

Jogalekar, P., & Woodside, M. (2000). Evaluating the scalability of distributed systems. *IEEE Transactions on Parallel and Distributed Systems*, *11*(6), 589–603.

Kayak. (2023). *Welcome, robots: KAYAK is now integrated on ChatGPT*. https://www.kayak.com/news/kayak-chatgpt/

Kolakowski, N. (2018). *Virtual Reality is Transforming into a Niche Sub-Industry*. https://www.dice.com/career-advice/virtual-reality-transforming-niche-sub-industry

Kourtesis, P., Collina, S., Doumas, L. A., & MacPherson, S. E. (2019). Validation of the virtual reality neuroscience questionnaire: Maximum duration of immersive virtual reality sessions without the presence of pertinent adverse symptomatology. *Frontiers in Human Neuroscience*, *13*, 417.

LaMotte, S. (2017). *The Very Real Health Dangers of Virtual Reality*. https://www.cnn.com/2017/12/13/health/virtual-reality-vr-dangers-safety/index.html

Levi, A., & MacKenzie, S. (2022). *Crypto peaked a year ago—Investors have lost more than $2 trillion since*. https://www.cnbc.com/2022/11/11/crypto-peaked-in-nov-2021-investors-lost-more-than-2-trillion-since.html

Liu, S., Wright, A. P., Patterson, B. L., Wanderer, J. P., Turer, R. W., Nelson, S. D., McCoy, A. B., Sittig, D. F., & Wright, A. (2023). Using AI-generated suggestions from ChatGPT to optimize clinical decision support. *Journal of the American Medical Informatics Association*, ocad072.

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences*, *13*(4), 410.

Malinka, K., Perešíni, M., Firc, A., Hujňák, O., & Januš, F. (2023). On the educational impact of ChatGPT: Is Artificial Intelligence ready to obtain a university degree? *ArXiv Preprint ArXiv:2303.11146*.

Martindale, J. (2023). *These are the countries where ChatGPT is currently banned*. https://www.digitaltrends.com/computing/these-countries-chatgpt-banned/

Mathew, A. (2023). Is Artificial Intelligence a World Changer? A Case Study of OpenAI's Chat GPT. *Recent Progress in Science and Technology Vol. 5*, 35–42.

McDade, A., & Jackson, S. (2023). *Here's every country that has banned TikTok as the US threatens a nationwide ban. Montana is the first state to pass a total ban*. https://www.businessinsider.com/every-country-that-banned-tiktok-us-threatens-nationwide-ban-2023-3#united-kingdom-7

Melián-González, S., Gutiérrez-Taño, D., & Bulchand-Gidumal, J. (2021). Predicting the intentions to use chatbots for travel and tourism. *Current Issues in Tourism*, *24*(2), 192–210.

Mich, L., & Garigliano, R. (2023). ChatGPT for e-Tourism: A technological perspective. *Information Technology & Tourism*, 1–12.

Milmo, D. (2023). *Google engineer warns it could lose out to open-source technology in AI race*. https://www.theguardian.com/technology/2023/may/05/google-engineer-open-source-technology-ai-openai-chatgpt

Modern Intelligence. (2022). *Global Gaming Market Size and Share Analysis*. https://www.mordorintelligence.com/industry-reports/global-gaming-market#:~:text=Gaming%20Market%20Analysis,6.96%25%20during%20the%20forecast%20period.

Moffett, J. D., & Sloman, M. S. (1988). The source of authority for commercial access control. *Computer*, *21*(2), 59–69.

Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2015). *Value proposition design: How to create products and services customers want*. John Wiley & Sons.

Palal, D., Ghonge, S., Jadav, V., & Rathod, H. (2023). ChatGPT: A Double-Edged Sword? *Health Services Insights*, *16*, 11786329231174338.

Pallavicini, F., Pepe, A., & Minissi, M. E. (2019). Gaming in virtual reality: What changes in terms of usability, emotional response and sense of presence compared to non-immersive video games? *Simulation & Gaming*, *50*(2), 136–159.

Pillai, R., & Sivathanu, B. (2020). Adoption of AI-based chatbots for hospitality and tourism. *International Journal of Contemporary Hospitality Management*, *32*(10), 3199–3226.

Qadir, J. (2023). *Engineering education in the era of ChatGPT: Promise and pitfalls of generative AI for education*. 1–9.

Rahman, M. M., & Watanobe, Y. (2023). Chatgpt for education and research: Opportunities, threats, and strategies. *Applied Sciences*, *13*(9), 5783.

Ram, B., & Pratima Verma, P. V. (2023). Artificial intelligence AI-based Chatbot study of ChatGPT, Google AI Bard and Baidu AI. *World Journal of Advanced Engineering Technology and Sciences*, *8*(01), 258–261.

Ray, P. P. (2023). ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. *Internet of Things and Cyber-Physical Systems*.

Road Trip Planner. Published 2023. Accessed June 27, 2023. Curiosio.com

Roam Around: Your personal AI travel planner. Published 2023. Accessed June 27, 2023. Roamaround.io

Sallam, M. (2023). *ChatGPT utility in healthcare education, research, and practice: Systematic review on the promising perspectives and valid concerns*. *11*(6), 887.

Seitz, P. (2022). *Facebook Parent Stands Tall In Small Market For Virtual Reality*. https://www.investors.com/news/technology/virtual-reality-meta-dominates-a-small-market/

Shen, Y., Heacock, L., Elias, J., Hentel, K. D., Reig, B., Shih, G., & Moy, L. (2023). ChatGPT and other large language models are double-edged swords. *Radiology*, *307*(2), e230163.

Shukla, S. (2022). *NFT Trading Volumes Collapse 97% From January Peak*. https://www.bloomberg.com/news/articles/2022-09-28/nft-volumes-tumble-97-from-2022-highs-as-frenzy-fades-chart#xj4y7vzkg

Siwicki, B. (2023). How ChatGPT can boost patient engagement and communication, Healthcare IT News. *Healthcare IT News*. https://www.healthcareitnews.com/news/how-chatgpt-can-boost-patient-engagement-and-communication

Stokel-Walker, C., & Van Noorden, R. (2023). What ChatGPT and generative AI mean for science. *Nature*, *614*(7947), 214–216.

Taecharungroj, V. (2023). "What Can ChatGPT Do?" Analyzing Early Reactions to the Innovative AI Chatbot on Twitter. *Big Data and Cognitive Computing*, *7*(1), 35.

The Verge. (2014). *The Rise and Fall and Rise of Virtual Reality*. https://www.theverge.com/a/virtual-reality/

Thunstrom, A. O. (2022). We asked GPT-3 to write an academic paper about itself: Then we tried to get it published. *Scientific American*, *30*.

Thurzo, A., Strunga, M., Urban, R., Surovková, J., & Afrashtehfar, K. I. (2023). Impact of artificial intelligence on dental education: A review and guide for curriculum update. *Education Sciences*, *13*(2), 150.

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), 15.

Tuominen, M., Rajala, A., & Möller, K. (2004). How does adaptability drive firm innovativeness? *Journal of Business Research*, *57*(5), 495–506.

U.S. Securities and Exchange Commission. (2023). *SEC Charges Crypto Trading Platform Beaxy and its Executives for Operating an Unregistered Exchange, Broker, and Clearing Agency*. https://www.sec.gov/news/press-release/2023-64

Vacay AI Chatbot. Published 2023. Accessed June 27, 2023. Smartstash.ai/product/vacay-ai-chatbot

Will ChatGPT transform healthcare? (2023). *Nature Medicine*, *29*(3), 505–506. https://doi.org/10.1038/s41591-023-02289-5

Xue, V. W., Lei, P., & Cho, W. C. (2023). The potential impact of ChatGPT in clinical and translational medicine. *Clinical and Translational Medicine*, *13*(3).

Yeo, Y. H., Samaan, J. S., Ng, W. H., Ting, P.-S., Trivedi, H., Vipani, A., Ayoub, W., Yang, J. D., Liran, O., & Spiegel, B. (2023). Assessing the performance of ChatGPT in answering questions regarding cirrhosis and hepatocellular carcinoma. *MedRxiv*, 2023–02.

Zarifhonarvar, A. (2023). Economics of chatgpt: A labor market view on the occupational impact of artificial intelligence. *Available at SSRN 4350925*.

Zhuo, T. Y., Huang, Y., Chen, C., & Xing, Z. (2023). Exploring ai ethics of chatgpt: A diagnostic analysis. *ArXiv Preprint ArXiv:2301.12867*.