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Harnessing AI and NLP to Transform Pharma Education Personalization, Learning, and Skill Development

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Abstract

Particularly with NLP technologies, it is revolutionizing pharmaceutical education, enhancing human creativity, personalizing learning, and improving student outcomes. AI models like those from Open AI's Chat GPT are increasingly integrated into educational practices that offer a solution to issues, such as teacher shortages, resource limitations, and the inefficient use of traditional teaching methods. This paper explores the diverse ways through which AI and NLP technologies are transforming pharma education within the fields of research, patient counseling, and skill development. Such prime applications of virtual labs and simulations offer affordable and scalable alternatives to the physical laboratory while many students could not access physical laboratories due to the COVID-19 pandemic. Such AI-driven interactive learning platforms for pharmacy students, such as those using ChatGPT-4, are more empowered to simulate real-life patient counseling scenarios. Predictive learning analytics, dependent on historical student information, enables student performance to be monitored and improved and can predict at-risk students through interventions. AI in facilitating content development and summarization helps make any academic resources and other learning materials available faster. From GPT-1 to GPT-4 and beyond, the evolution of the AI models discusses how they have become more sophisticated as they are currently capable of performing more complex tasks. This includes producing human-like responses to analyzing emotional sentiments. All these contributions are leaning toward a more dynamic, personalized educational experience. This paper concludes that AI and NLP are necessary tools to modernize pharmaceutical education, offering innovative solutions to long-standing challenges while paving the way for more effective, engaging, and accessible learning environments.

Keyword: Artificial intelligence, neural language processing, (chat generative pre trained transformer) chat GPT, pharma, open AI.

INTRODUCTION

"Artificial intelligence is a tool to amplify human creativity and integrity. Neural Language Processing: The Heart of AI, NLP focuses on how computers and human beings relate. It uses machine learning and enables computers to understand and communicate with humans [1]. NLP is already used in our daily life in the form of chat bots for consumer service. In GPS systems, it works as an assistant in questioning and answering on smartphones. Such assistants are Siri, Google, and Microsoft Crotona [1, 2]. NLP models are rapidly becoming relevant to pharma education as they help in transforming teaching and learning by personalized learning. That every student can learn and understand in multiple ways [3]. Assist educators to analyze student performance to help the student with their difficult area, their assignment, and assessment. By this, it can maintain a record of every student by analyzing

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and gathering data on what area a particular student faces difficulty. It will help the educator to access every student's learning achievement, their ups and downs. AI and NLP can help students in skill development in research and academics by providing them with proper feedback and guidance [1]. As the old method of teaching faces many problems of not having qualified teachers, it is resolved with the help of AI and NLP. Chat bots can give every student a precise and detailed answer in a fraction of a second with a deep explanation [1]. Chat GPT by Open AI and Bard (Google's response to Chat GPT) are the famous AI tools used to transform pharma education in research. Chat GPT and Google Bard are being widely used in research writing, language learning, general academic inquiry, etc. [3].

Open AI's Journey with Chat GPT

According to the definition, artificial intelligence is a tool that can be used to enhance human creativity and integrity. One such tool is called Chat GPT (chat generative pre trained transformer) [4]. Chat GPT is an artificial intelligence built as a chat bot that uses a deep neural network to generate results from given context in real time without any delay, just like chatting with someone. Open AI is a demo version of Chat GPT that was released on November 30, 2022. Open AI was founded in December 2015 by Sam Altman, Greg Brockman, Elon Musk, Ilya Sutskever, Wojciech Zaremba, and John Schulman [5, 6], where Sam Altman was the CEO of the company (Figure 1).

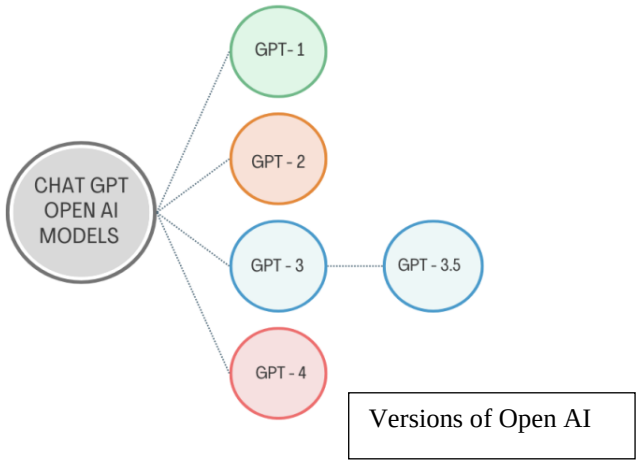

Figure 1. Open AI models.

GPT-1

The journey began with the chat GPT-1 model in June 2018, the first GPT [7]. GPT-1 learned to predict the new word in a sentence having 117 million parameters.

GPT-2

Released in Feb 2019, upgrade of 1.5 billion parameters. It has a big upgrade and has improved in multi-paragraph text generation [5, 6, 8]. But it was not released in public due to its potential misuse.

GPT-3

Released in 2020, it contains 175 billion parameters and has a natural language understanding famous for the generation of human-like responses [9, 10].

GPT-3.5

An upgraded version of GPT-3 optimized for its performance in chat bots. It increases user interaction [10].

GPT-4

Released in 2023, more advanced, which helps to solve complex problems. It helps to remember the conversation, respond accordingly, and give a detailed answer and conclusion [11].

GPT-4 Turbo

It is just like ChatGPT-4, but it is the lighter version of GPT Turbo that shows advancement in overall neural sentiments and positive and negative sentiment analysis and emotion detection [12].

TRANSFORMING PHARMA EDUCATION

- Virtual labs and simulation.
- Interactive learning platform.
- Predative learning analytics.
- Content development and summarization.

Virtual Labs and Simulation

Amongst virtual labs and simulations, the best example is that before the covid-19 pandemic, the universities faced a lot of issues providing the resources in the laboratory, such as the process of building new laboratory equipment, as the number of students grows in the university [13]. This process is costly and time-consuming, and at a time, a small group of students can only perform or see [14]. During the pandemic, when everywhere was in lockdown, then with the use of technology and good and realistic courses, lab courses, the traditional system of teaching was changed into virtual labs, which more students can access at a particular real-time and get real-time experience. It also helped to reduce cost and time [15]. In pharmacy students receive training in pharmaceutics and dosage form design, as a part of curriculum. A basic concept of rheology and surface tension experiments in the lab requires expensive equipment to perform; after performing it, it must be stored for the next batch to perform, and the equipment must be maintained and stored until the following year. As the COVID-19 pandemic suspended face-to-face learning due to lockdown, some universities moved toward online learning and online virtual laboratories [16, 17].

Interactive Learning Platform

In the field of pharmacy there is a tool that is designed as an innovative tool especially for pharmacy students to sharpen their patient counseling skills. With the help of Open AI's ChatGPT-4 API, it constructs an AI patent for each patient who has a unique health condition, background, medication, and more. With this, the student can empower real-world patients. With this tool, they can be more confident and well-prepared, and can step into the real world [18]. There is a term, GBL (Game-Based Learning) [19] which helps the student to improve knowledge innovatively by adding the game element to non-game activities and encouraging students. This active learning technique uses games that help to improve student learning [20].

Predictive Learning Analytics

Predictive learning analytics is a learning technique based on historical data of a student or something. With that data, one can predict the future outcome of that student and help provide the best assessment of what will happen in the future [21]. Predictive models used in student learning and education monitor student performance and work as preventive intervention measures for students at risk [22].

Content Development and Summarization

The main objective is that it saves time, as the user does not need to read the entire document automatically with the help of ATS (Automatic text summarization. The user gets the automatically generated summary in a fraction of the time [23]. Chat GPT and other AIs are involved in creating images, music, and digital content. The AIGC (Artificial Intelligence Generated Content) provides information according to human context. In recent years, AIGC has provided better results, and the results are closer to reality [24].

THE DARK SIDE OF AI AND NLP IN PHARMACY

While talking about challenges, first there are some limitations of Chat GPT, as it is emotionless, as is advanced technology. Still, there is an obstacle in the relationship between doctor and patient [25].

The main drawbacks that are being noticed in using AI in the pharmacy sector are bias, clinical implementation, data privacy and security, data integration, ethical concerns, patient safety, and social concerns [26]. To understand more about the opportunities and challenges, they have been listed below in Table 1 [27].

Table 1. Opportunities and challenges.

Opportunities	Challenges
The Relationship Between Diagnostic Evaluation and Evidence – Based Medicine	
Integrating advanced diagnostic tools, AI, and evidence – based practices along with real-time access to medical knowledge improves diagnostic accuracy, enhances treatment plans, and optimizes patient outcome in modern healthcare	Those are some risks that AI creates within healthcare – hallucination and over-reliance, which leads to misdiagnosis and neglect of clinical expertise. Therefore, a good balance should be maintained between AI usage and clinical judgment and oversight for patient safety.
Patient-Centered Approach in Treatment Planning	
With evidence from on-going research and real-time patient monitoring, personalized plans for treatment use available patient data to enable specific therapies that will optimize their effectiveness and minimize side effects while allowing patients to participate in their health care	AI faces challenges in healthcare that include points like lack of accountability, ethical dilemmas with treatment, and refusal from professionals. Thus, solid framework, ethical guidelines, and training are necessary for trust and collaboration
The Role of Technology in Student Evaluation	
Assessment methodologies that are powered by artificial intelligence deliver evaluation standardization, objective, and continuous monitoring of student performance. These deliver instant feedback for quick corrective actions and offer students personalized learning paths.	AI assessment has raised concerns about data security and will engage FERPA issues. They fail to cover comprehensively all the skills that leave out areas, such as creativity and emotional intelligence, which can emphasize the requirement for a joint with human assessment to be part of the complete assessment.
The Role of AI in Admission Processes	
By utilizing data analysis, admission process can evaluate student concerning academics, extracurricular activities, and personal growth to mitigate bias and promote fairness, thus enabling institutions to recruit highly qualified diverse students who are in alignment with their merit – based vision.	As it is risk-prone, artificial intelligence introduces inequities, and exclusion in their admission process applied to limited data sets. However, ethical underwriting complemented with diversified data and strict supervision would make it possible to avoid this in a risk-free manner to ensure fairness and equity in higher stakes decision making process.

The AI algorithm works on the datasheet to work and predict according to the context sent by the user [28]. Thus, AI can make the correct diagnosis for the wrong reason. But for accountability. it must be understood that the models in ML work on large amounts of data and learn patterns only to predict future and related things. The neural network is added to the AI to minimize the error. But in terms of patient safety, this term is "INSENSITIVE". This assumption is incorrect in healthcare [29]. The AI system is not equipped as humans to recall the changes in any data or context. Or the AI cannot make assumptions as per the current scenario, which results in an error [30]. AI is a way to amplify human abilities instead of replacing them. It optimally handles all repetitive tasks, allowing one to invest energy in producing great relationships and deeper interaction with humans, which is their unique area to shine instead of machines [31].

CONCLUSIONS AND DISCUSSION

In brief, artificial intelligence, and especially through natural language processing technologies like Open AI models-Chat GPT is revolutionizing the practice of learning in the pharma education space. Creativity is fostered while offering personal learning experiences with real-time feedback support that fills the gap of traditional methods of education. The development of AI-driven tools has helped both educators and students in improving their learning outcomes. This marked a change toward more efficient, interactive, and accessible education. With virtual labs and simulations, AI has enabled overcoming various logistical challenges in teaching practical skills-particularly in the face of

constraints like those that occurred during the COVID-19 pandemic. With virtual environments, students can now be given hands-on learning without the expensive physical infrastructure that would have been required otherwise and therefore, achieve a cost-effective and more accessible education. Interactive learning platforms with AI, including those that utilize Chat GPT, can engage pharmacy students in meaningful practices of real-world patient counseling and realizing critical professional skills in a controlled dynamic environment. Furthermore, predictive learning analytics, based on data gathered from students' performance, can help identify areas for improvement and allow for more tailored interventions to support struggling learners. In addition, the use of AI in content development and summarization ensures that students and educators can quickly access relevant, high-quality information, saving valuable time and improving overall academic efficiency. AI-generated content, including text, images, and even music, could contribute to this impact by providing more engaging and personalized resources for students.

In conclusion, AI and NLP are going to transform pharma education, unlocking a comprehensive set of innovative solutions tailored to the diverse needs of learners, while making an invaluable contribution to learning and administrative outcomes. As the respective technologies continue to evolve, their potential for further transforming the educational experience is immense, making sure that both students and educators are more prepared for the challenges that are faced by those working in modern academic and professional environments. Yet, the deployment of AI and NLP, which has transformed the pharmacy level, has its own side of the coin. Non-emotional intelligence in human care, data privacy issues with whom to share, ethical issues, potential biases, and an innate inability to adjust to small and nuanced real-world contexts have already established the case of need for painstaking implementation of AI. AI in pharmacy requires Chat GPT-like tools to aid research, education, and patient counseling and brings noticeable risks that can indeed result in patient safety hazards in healthcare delivery. Resources will augment human beings more than they will replace human beings. In other words, the focus is on using trimming technology sufficiently and effectively to overcome the challenges to realize the pharmacy for what the pharmacy sector can become in the future – to ensure efficacious, efficient, and inclusive education, research, and patient care.

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