

Alducate: Your Smart Tutor–A Survey

Vinod Desai¹, Tejashwini N.¹, Shanta Kumar B. Patil², Anupam Saha³,
Sagar Pathak^{3,*}, Ravindra Kumar Yadav³

Abstract

The ongoing “datafication” of our social reality has led directly to the emergence of new data-driven business models across various sectors, including education. As a result, the market for educational services is rapidly expanding. Educational technology (EdTech) companies are at the forefront, offering data-driven pedagogical solutions that are reshaping the landscape of learning. Despite the market's growth, few companies are harnessing the full potential of artificial intelligence (AI) and machine learning to create customized learning experiences. Our project aims to address this gap with a recommendation system designed for educational purposes. This system responds to queries entered from uploaded PDF documents and suggests relevant multimedia content, such as pictures and videos. By enhancing the answer generation process, these multimedia recommendations aim to enrich learning experiences and improve comprehension. The discourse surrounding AI-based learning systems is increasingly focused on the demand for personalized and adaptable educational tools. These systems leverage AI to tailor learning pathways according to individual needs, preferences, and learning styles, thereby optimizing educational outcomes. As the education sector continues to evolve, integrating advanced technologies like AI promises to revolutionize how knowledge is imparted and acquired in a more dynamic and responsive manner.

Keywords: Educational technology (EdTech), artificial intelligence (AI), large language models (LLMs), recommendation system, ChatGPT

INTRODUCTION

Large language models (LLMs), like ChatGPT, or generative artificial intelligence (GAI) are seen as a disruptive force that will fundamentally alter the education industry. The capacity of ChatGPT and, more recently, GPT4 to produce coherent and contextually relevant answers to challenging questions is seen as a major advancement in the field of conversational AI. It is already starting to change education

in both positive and negative ways [1]. The fact that big “tech lords” are heavily investing in the development of pedagogical solutions based on AI raises the question of whether schools and universities are ready to integrate technologies laden with massive amounts of data into the pedagogical processes in the classroom. It is challenging to provide solutions for these and related challenges because of a dearth of information, the complexity of the problems, and the chaotic market. In addition, the dynamics of the digital transformation are propelling the educational technology (EdTech) industry to rise significantly. Still, despite forecasts indicating that the global EdTech market would reach \$8 trillion by 2020,

*Author for Correspondence

Sagar Pathak

E-mail: sagarpathak.20cs@saividyaa.ac.in

¹Associate Professor, Department of Computer Science, Sai Vidya Institute of Technology, Bengaluru, Karnataka, India

²Professor, Department of Computer Science, Sai Vidya Institute of Technology, Bengaluru, Karnataka, India

³Student, Department of Computer Science, Sai Vidya Institute of Technology, Bengaluru, Karnataka, India

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EdTech growth remains comparatively moderate to other industries. There are several advantages for LLMs in the field of education. LLMs may generally improve the quality of the educational process and provide students with a wealth of extra knowledge. For example, LLMs can assist students in honing and strengthening their language proficiency. Two LLMs can produce chatbots that mimic conversations with natural speakers or interactive dialogues. They can also assist with producing transcripts or subtitles for videos, which can help make instructional information more accessible to students with impairments or those who speak other languages. From an EdTech standpoint, relatively little study has been done in this area. We make an effort to close this gap in this paper. For this reason, the article describes how EdTech companies are using digital, data-driven business models in the higher education industry. We employ AI and machine learning in the same empirical context to examine the motivators and challenges.

EDUCATION AND Large Language Models

Exploring the transformative potential of LLMs in modern education.

Background of Education

Education is a deliberate process that aids in and directs personal growth [2]. It entails teaching knowledge, developing skills, and molding attitudes and values to support students' holistic development and self-realization. To enable people to contribute positively to society, education aims to develop in them the intellectual, emotional, moral, creative, and social flexibility they need. There are several ways to educate people, including but not restricted to the following:

Education in Schools

The most popular and well-recognized type of education is traditional schooling, in which pupils learn from teachers through structured instruction.

Online Education

As digital technologies progress, new educational opportunities are made possible by the internet and online platforms. Through distance learning, online courses, and other digital channels, students can participate in the learning process. Community education pertains to educational endeavors carried out inside a community, offering tailored training and educational opportunities to fulfill the educational requirements of the community's members.

Self-Directed Learning

Education is mostly dependent on learning. Through self-motivation and self-management, students can explore and study on their own, gaining information and skills through self-directed learning.

Teachers

An essential part of education is teaching. They are in charge of planning, transferring knowledge, and supervising the growth and learning of students.

Students

The people who receive education are the students. With the goal of personal development and progress, they learn and practice to acquire knowledge and abilities.

Parents

They play a crucial guardianship and supportive role in their children's education. They provide the surroundings and resources that their kids need to learn and grow.

Educational Institutions

In addition to planning and supervising educational activities, schools, colleges, training centers, and other educational institutions offer instructional environments and resources.

Government and Society

They contribute to the formulation of educational policies, the distribution of resources, and the provision of social support, all of which serve to support and protect education.

Background of Large Language Models

What is an LLM? What qualities does it possess? What connections exist between big models and data science, AI, and other interdisciplinary fields? Which cutting-edge technology is used in large models? An LLM has strong language generation and comprehension ability [3]. Its goals are to generate correct and coherent writing, comprehend and reply to human queries, and train on vast volumes of linguistic data to discover statistical patterns and semantic linkages within the language.

Here are several characteristics of LLMs:

1. *Natural language generation*: Natural language writing of excellent quality and coherence may be produced using LLMs. Based on queries or input prompts, they may comprehend the context and provide relevant answers, stories, articles, and more.
2. *Semantic understanding*: LLMs can understand the vocabulary, grammar, and context of human language as well as its semantic links. They possess the ability to decipher intricate phrase patterns, extract crucial information, and produce pertinent answers.
3. *Context awareness*: LLMs are capable of performing context-based language creation and comprehension. They can comprehend the previous exchanges in a discussion and produce well-reasoned, contextually relevant answers.
4. *Broad variety of applications*: Among other areas, LLMs find widespread use in natural language processing, virtual assistants, intelligent writing, and intelligent customer service.

MACHINE LEARNING IN THE CLASSROOM AND DEFINITION OF ARTIFICIAL INTELLIGENCE FOR ACADEMIC PURPOSES

There is disagreement about a single, accepted definition of AI education (AIEd) because of the variations across AI, machine learning (ML), educational data mining (EDM), and learning analytics (LA). Telling LA is generated from AIEd in particular might be difficult. A portion of the issue stems from the paucity of data about the frequency and quality of the term's classroom usage [4, 5]. However, there are still a lot of barriers standing in the way of the effective and practical adoption of EdTech solutions, which emphasizes the need for meaningful implementation [6]. The underlying premise of research is that all aspects of intelligence or learning can be precisely described to the point that a computer can be trained to mimic them. The definition of AI has changed throughout the past several decades depending on the situation. Researchers originally began looking at the significant intersections between education and AI in fields including information presentation, reasoning, and learning in the early 1970s [7]. This is when studies in AIEd began. Since then, interest in it among academics has grown dramatically worldwide. The complex network of AIEd concerns is the subject of a broad range of conferences, committees, social gatherings, and political initiatives nowadays. When we discuss AIEd, we are talking about computers that can learn, adapt, synthesize, self-correct, and use data for complex processing tasks like that of a human. Because AIEd encompasses many levels of interdisciplinarity, it may be considered an interdisciplinary topic of study. AIEd aspires to develop effective, integrative, adaptive, personally personalized, and additional learning and training environments, both standalone and in conjunction with traditional education. Recent research publications on AIEd have focused on issues such as what to expect from its utilization and its current application restrictions.

Wiki success is directly responsible for the evolution of wikis into massive open online courses (MOOCs) in 2012 and the emergence of huge platforms like edX in subsequent years. Photographs, movies, and music are just a few of the digital tools and resources that may now be included in creative teaching approaches. The three primary categories of AIEd software solutions now in use are intelligent collaborative learning tools, intelligent virtual reality, and intelligent personal instructors [8]. By establishing a virtual classroom, serving as the instructor's spokesperson, dividing students into groups,

and developing a personal relationship with each student, AIEd can support cooperative learning. Additionally, each session may be customized by the apps to fit the interests and desired study speed of each student. Smart virtual reality (VR) might be utilized to create immersive online environments and interactive classrooms, as well as to place students in the hands of virtual instructors [9].

METHODOLOGY

There are two primary sections to the study. First, we used a qualitative technique to perform a content study of eighteen educational technology companies. Understanding digital pedagogical practices' economic models and the extent to which AI and LA are included in their value propositions is essential for their advancement. In both academics and industry, the concept of a business model is becoming more and more popular [10]. We purposefully shift the focus from EdTech users to EdTech suppliers, who have received little to no attention in the past. Although it is still a relatively young area of study, interest in the economic strategies of EdTech companies is growing among academics. This can be mostly attributed to the industry's increasing digitization. With the use of instructional software and internet resources, new methods of teaching are emerging. In conjunction with digital tools, they facilitate the creation of novel business models through data analysis. After cause-and-effect knowledge, information is the second most valuable resource in the field of education. The foundation of the evaluation of EdTech business models is the architecture or design of the system for producing, delivering, and collecting value. Apart from developing feasible commercial plans, we also look into the variables influencing India's AI- and LA-based educational frameworks.

The interviews were randomly transcribed, just as in the first part of the study, which mostly relied on websites, news releases, social networking platforms, and free software downloads. A single dataset was created by compiling the desk research on the EdTech sector conducted by each firm. At a later stage, discursive analysis was added to the interviews to bring the discourse up to the level of science. According to Foucault's theoretical framework, granting someone the right to speak elevates the topic of the study. Speech can serve as a means of temporarily institutionalizing the mutually bound knowledge order of a social ensemble by stabilizing meaning attributions and ordering of meaning. Conversely, discourse analysis is an attitude to inquiry rather than a method [4]. Because both qualitative interviews and discourse are based on a conversational-analytical perspective and, as such, complement each other's data sets, the methodology employed was acceptable for this study. Due to the multidisciplinary character of the study, a combined analysis was required because an empirical analysis alone would seldom have revealed all of the motivating factors and barriers to the adoption of LA and AI in higher education. Our chosen strategy forced us to compile as much data as we could on LA and AI in academic contexts. We studied the foundations of AI systems based on algorithms and the operations of the EdTech industry using the discursive method. Data coding was then followed by quantitative content analysis.

We called a meeting after the coding process to go over and double-check the decisions taken based on the empirical data, literature research, and discourse analysis. Because of their distinct academic backgrounds, investigators A and B were able to examine the theories and findings in greater detail. Then, experts in the domains of informatics and education discussed and refined the revised results. The dataset was “triangulated” using a variety of academics and data sources to increase the study's credibility and interdisciplinarity [5].

RECOMMENDED EDUCATIONAL STRATEGIES IN THE AGE OF GENERATIVE ARTIFICIAL INTELLIGENCE

Mainly as a result of the quick adoption of AI by businesses, the students of today will likely work in fields unrelated to human resources. Educating students about the labor market of the future is one of academic institutions' main duties. Working well with LLMs or GAI programs will be necessary in the future for success in many jobs. Students who are unable to apply these models will have a significant disadvantage when they go into the workforce. Students need to learn how to utilize LLMs

successfully to stay competitive in the workforce, even if it means only encouraging them to do great work and evaluating the originality, correctness, and quality of their output [6].

Academic institutions must instruct students on the moral use of these kinds of instruments. Additionally, students must comprehend the constraints of these models and how they operate. For academic institutions to be relevant and successful in the AI era, they must change. Various steps may be taken by academic institutions that are worried about academic integrity to ensure that assignments are impossible to cheat on. Policies requiring students to provide an appendix explaining the specifics of AI use in papers and other take-home assignments are being implemented by several colleges. Some often forbid the use of AI tools in exams, quizzes, or assignments that are completed in class if there is no alternative technology. Teachers may also require students to deliver their written work aloud in order to gauge their level of understanding. Before distributing the assignments to the students, teachers can use ChatGPT to reduce cheating and uphold academic standards. Ultimately, ChatGPT's training data continues to increase till 2021. It is therefore unable to get real-time news updates. After that, teachers might center the assignments around current events in the news. Furthermore, employing ChatGPT can give rise to moral questions about accountability and transparency, particularly in academic environments where students might submit false assignments. Future studies aimed at identifying LLMs' flaws and enhancing their effectiveness could produce better educational results. Currently, there are still a lot of obstacles to be solved before ChatGPT can be completely included in the educational system.

REVIEW GENERATION

The aforementioned simulation may be modified to do the review-generating task in addition to explanation creation. This might facilitate and expedite users' ability to post a review following a purchase, movie viewing, ride, etc. The generated data would therefore make it easier to perform research on recommendations, including conversational and explainable suggestions. As is customary, we may populate a prompt with the user and the item they interacted with, for example, "create a review for user 1234 regarding item 5678." The LLM could then write a review paragraph after that. For instance, "the hotel is situated in..." Nevertheless, we are not aware of any LLM-based recommendation study on this issue, most likely due to the formulation's close resemblance to the explanation.

REVIEW SUMMARIZATION

It might take some time to read a lengthy review, which users might not always have the means. A succinct review summary can aid readers in rapidly comprehending the advantages and disadvantages of a product. The primary goal of current LLM-based review summarizing techniques is to summarize a user's review (R) for an item, using the review title or tip as the summary. A user's review may not need to be summarized, though, if the user is already aware of the reviewed item. It may be more beneficial to summarize the review for a different consumer who has not used the product. Additionally, it seems sensible to do a multi-review summarization that compiles the thoughts of several consumers on the same item. Within several rounds of discussion, conversational recommendation seeks to suggest certain objects to the user. In contrast to traditional recommendation systems (RS), which mostly rely on past user interactions, conversational environments allow users to openly express their preferences in natural language and even offer negative feedback, such as rejecting recommendations. Still, the research community is trying to agree on how to define this endeavor. Despite ChatGPT's undeniably great conversation capabilities, its performance on current measures is subpar because it places too much emphasis on the matching between produced answers and annotations or utterances.

CONCLUSION

There are several opportunities for applying to LLMs in the sector of education. The present study offers a methodical synthesis and evaluation of the theoretical framework, driving forces, and practical applications of large-scale educational models. It begins by outlining the purpose and research history of LLMs and by outlining the fundamentals of large models. After that, it addresses the connection

between educational LLMs and intelligent education and provides an overview of the state of educational LLM research at the moment. We have found that several barriers still stand in the way of the development and application of AI- and LA-based solutions in the educational domain. These barriers may be overcome by changing our focus from the student to the educator. Because of this, the usual level of discussion is theoretical, and the available data no longer supports the effective and efficient application of AI in education.

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