DeepSeek Hits Hard: Helping to Revolutionize Higher Education in the Era of Artificial Intelligence

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Received: February 15, 2025 Accepted: March 26, 2025 Online Published: March 27, 2025

doi:10.5430/ijhe.v14n2p26 URL: https://doi.org/10.5430/ijhe.v14n2p26

Abstract

DeepSeek is reshaping the higher education model in all aspects by assisting differentiated teaching and personalized learning, promoting flat teaching management processes, creating interactive learning modes with deep participation, creating intelligent paths for boundaryless learning, providing accurate and comprehensive data-driven feedback, and enhancing global education equity and inclusiveness. For better applying artificial intelligence to promote the development of higher education, this study summarizes the main scenarios in which DeepSeek R1 contributes to the sustainable development of higher education. The development strategy of higher education in the era of intelligence is obtained, which includes improving teacher literacy we should continue to promote the healthy and innovative development of education models, actively deepen artificial intelligence to assist in the construction of teacher teams, enhance the interpretability of education models, improve the precision support of personalized learning, real-time detect and regulate student emotions, construct a scientific evaluation system for large models, bridge the global education digital divide, establish an ethical and moral framework for artificial intelligence, strengthen the cross-cultural adaptability of intelligent collaboration, and help lifelong learning and sustainable social development.

Keywords: higher education, artificial intelligence, teachers, challenges, sustainable development

1. Introduction

Artificial intelligence is increasingly permeating into our daily lives, and one of its most profound impact areas is higher education. Artificial intelligence tools like ChatGPT have begun to fundamentally change the way students learn and teachers teach. With the rapid development of artificial intelligence technology, a new participant has emerged - DeepSeek, which is highly likely to become the next number one disruptor in the development of higher education.

On January 20, 2025, DeepSeek released the open-source large-scale language model DeepSeek R1. It has core capabilities such as natural language understanding and generation, multi round dialogue management, cross domain knowledge integration, and code processing. It supports language interaction between Chinese and English, and can assist in scenarios such as information retrieval, learning and research, and creative generation. It is comparable to top artificial intelligence models such as ChatGPT. According to British media reports, DeepSeek R1 has approximately 670 billion parameters, making it the largest open-source LLM to date. DeepSeek, a powerful and cost-effective open-source language model, has sparked great discussion among scholars and industry researchers worldwide. Forbes reports that DeepSeek's success on the R1 model is based on several key innovations, including using reinforcement learning for post training, utilizing an "expert hybrid" architecture to reduce costs and improve efficiency, combining multi head latent attention to simultaneously process multiple input instructions, and using distillation techniques to transform complex and high-performance model knowledge into compact and efficient models.

The emergence of DeepSeek R1 challenges many key assumptions in artificial intelligence development (Woods, 2025): 1. In response to the huge assumption cost of building competitive artificial intelligence models, DeepSeek R1 demonstrates that high-quality models can be built faster and cheaper than previously imagined; 2. In response to the inevitable environmental impact of the emerging artificial intelligence industry, DeepSeek's success can alleviate the environmental and energy issues surrounding artificial intelligence by using fewer resources and utilizing more efficient programming methods; 3. In response to the traditional view that larger models and datasets have inherent advantages, DeepSeek R1 suggests that if trained properly, relatively smaller models can match or outperform the

performance of larger models; 4. DeepSeek's achievements demonstrate that startups and small companies have the ability to compete with Silicon Valley giants, as artificial intelligence models can only be developed by large tech companies; 5. A significant advantage of DeepSeek's strategy in response to the importance of proprietary intellectual property is its embrace of open source, which promotes global collaboration and the convergence of professional knowledge. In 2025, The Stanford University Human-Centered Artificial Intelligence (HAI) pointed out that DeepSeek's high inference speed, low computational power consumption, strong task adaptability, and open-source nature would enable educational institutions, especially those with resource shortages, to quickly enhance their competitiveness.

2. The Main Challenges Currently Facing Global Higher Education

Higher education systems around the world are facing numerous challenges, ranging from overcrowded classrooms to limited resources, to the growing demand for personalized learning (Wang, 2024). Teachers are often overwhelmed by administrative tasks in teaching management, leaving little time for one-on-one interaction and communication with students. At the same time, students' learning engagement has encountered various difficulties, especially in remote or blended learning environments. The main problems faced by higher education are mainly reflected in the uneven distribution of educational resources, regional and social class differences, lack of high-quality teachers, the impact of the COVID-19, changes in employment patterns, and the need for lifelong learning transformation. The specific challenges are as follows:

2.1 Imbalance of Educational Resources Undermines Educational Equity

Over the past decade, global higher education spending has been on the rise. However, especially in many low-income countries, even if the education expenditure ratio has reached the recommended level of gross domestic product, the absolute funding level is too low to ensure that students have equal learning opportunities, and the learning crisis still exists (Williams & Usher, 2022). At the same time, further attention needs to be paid to the effectiveness and equity of higher education, allocating resources to the most cost-effective educational projects, quickly meeting local educational needs, improving school management, optimizing teacher performance, and making the most of available educational resources.

2.2 Regional and Social Class Differences Affect the Growth of Enrollment Rates

From 2000 to 2022, the global higher education enrollment rate has more than doubled, with the number of students receiving higher education increasing from 100 million in 2000 to 254 million. Although the average number of people in each region has indeed increased, there are significant regional differences in this growth worldwide. The enrollment rate of undergraduate students in middle-income countries in Asia has experienced explosive growth, followed by Latin America and the Caribbean. The average gross enrollment rate of higher education in sub Saharan Africa, Central Asia, and South Asia has not reached the world average level. Despite the overall upward trend in global enrollment rates, not all social classes can benefit equally from higher education, and low-income groups are still at a disadvantage in accessing educational resources (UNESCO IESALC, 2020).

2.3 Insufficient Supply of High-quality Teachers Hinders the Improvement of Educational Quality

Low quality teaching is a huge traditional education problem that is becoming increasingly severe in many low - and middle-income countries. Many countries do not have minimum pre service training standards for teachers, and there is a call for a review of teacher training content that includes digital skills, addressing students' new social emotional and academic needs. At the same time, the shortage of teachers in science, technology, engineering, and mathematics (STEM) subjects has become the largest worldwide, and the shortage of high-quality teachers is also widespread in developed regions such as Europe and North America. Despite the abundant resources in the education system, these regions still struggle to recruit and retain qualified educators, posing significant challenges to the quality and fairness of education (UNESCO, 2021).

2.4 The COVID-19 has Catalyzed the Reform of the Traditional Education Model

The impact of the COVID-19 on higher education is complex, extensive and long-term, including teaching, research, management, evaluation, internationalization and mobility (European Commissions, 2021). COVID-19 has changed the interaction between students and faculty into an online mode, which has brought huge opportunities for virtual mobile and collaborative innovation. However, due to inadequate infrastructure and a lack of teaching and learning experience for teachers and students in virtual environments, higher quality educational practices cannot be carried out. According to the report of the National Commission for UNESCO, countries' response to the challenges posed by the COVID-19 to higher education needs to focus on strengthening online and distance learning, including through teacher training, improving the availability of digital infrastructure and digital equipment.

2.5 Changes in Employment Forms Test the Sustainable Development of Education

The "2024 World Employment Trends" released by the International Labor Organization points out that economic recovery has slowed down, and the overall growth of labor productivity has fallen back to the low level of the past decade. Some developed and emerging economies still have concerns about labor shortages, with industries such as smart technology facing severe labor shortages. The strong arrival of a wave of digital innovation involving the generation of artificial intelligence has exacerbated regional development inequality. Large digital monopolies have created technological barriers to entry for low productivity industries and developing countries, hindering the use of artificial intelligence technology to implement leapfrog strategies in developing countries. The development of digital skills is uneven between countries and regions, and many adults lack a high level of artificial intelligence literacy, which is closely related to their level of education. Artificial intelligence technology has triggered a disruptive change in global employment patterns, prompting universities to adjust their disciplinary and professional structures and innovate (Dong & Chen, 2024).

2.6 Intelligent Technology Leads the Transformation of Higher Education towards Lifelong Learning

Faced with the challenges of the 21st century, including technological progress, climate change, demographic changes, globalization, and a constantly changing world of work, higher education institutions must expand their learning opportunities and participation to better meet social needs. Given the unique ability of higher education institutions to develop learners' skills, promote knowledge and innovation, and the potential to mobilize educational resources and provide learning opportunities (Osborne et al., 2015), higher education institutions urgently need to transform into "lifelong learning institutions". Lifelong learning has become the overall concept and vision of education, as explicitly required by United Nations Sustainable Development Goal 4. Countries should ensure inclusive and equitable quality education, and promote lifelong learning opportunities for all (UNESCO, 2016).

DeepSeek's affordability and scalability make it a viable solution for addressing global higher education challenges. Unlike other AI models such as OpenAI, Google, and Microsoft, DeepSeek R1 has been released as open-source software. This means that the model can be used for free by anyone, enabling scientists around the world to validate its functionality. As stated in a recent report by the World Economic Forum, "Anyone can download, copy, and build DeepSeek. Its code and comprehensive technical explanations are freely shared, allowing developers and organizations worldwide to access, modify, and implement it." Advanced artificial intelligence technology is not only a luxury for a few people, but also a learning tool that many dream of. DeepSeek's affordability, accessibility, and open-source nature will fundamentally change the way higher education is taught globally, making high-quality education more equitable and inclusive.

3. DeepSeek R1 Empowers the Main Scenarios of Sustainable Development in Higher Education

The application of DeepSeek R1 is reshaping the higher education model in many scenarios, forming a virtuous deep interaction between teachers, students, and technology, promoting the development of higher education towards a smarter, more efficient, and more scientific direction. As a comprehensive platform that meets the unique needs of educational institutions, DeepSeek R1 has features such as specialization, integration, and powerful analytical capabilities: (1) DeepSeek R1 is specifically designed for education, with its functions tailored to the needs of students, teachers, and educational institutions; (2) Regarding integration, unlike ChatGPT, DeepSeek can integrate with existing educational platforms to provide a seamless user experience; (3) DeepSeek's data-driven insights give it an advantage over large models such as ChatGPT, which lack strong analytical capabilities. Compared to other existing large models, DeepSeek R1 has overcome many long-standing challenges in the field of higher education, and its specific advantages are as follows:

3.1 Assist in Differentiated Teaching and Personalized Learning

One of the biggest challenges facing higher education is meeting the diverse individual learning needs of students (Yang, 2024). DeepSeek R1 uses advanced algorithms to analyze individual learning patterns and adjust learning content accordingly, providing tailored exercises and knowledge point coaching to help them master relevant concepts. This level of personalization goes beyond the scope currently provided by ChatGPT, making DeepSeek a powerful tool for differentiated teaching and driving teachers to achieve personalized instruction. Teachers can use DeepSeek R1 to match students' needs and learning styles, achieving differentiated teaching processes.

3.2 Promote a Flat Teaching Management Process

Teachers spend a lot of time on teaching management tasks such as grading, attendance tracking, and course planning. DeepSeek R1 automates these tasks, simplifies management tasks and safe time, allowing teachers to focus more on creative and critical areas of teaching, and provides real-time feedback on student performance; Although ChatGPT can help generate course plans, DeepSeek R1 can further simplify workflows by integrating with school management systems. A university in India is using DeepSeek R1 to automate administrative tasks such as grading and attendance tracking, reducing the pressure on faculty and staff. As a result, faculty members can save up to 10 hours of time per week, allowing for more in-depth academic research and personalized student counseling.

3.3 Create an Interactive Learning Mode with Deep Participation

Participation is the key to effective learning, and DeepSeek's interactive features make it excel in this regard. Through gamified learning modules and real-time feedback, DeepSeek R1 promotes students to maintain sustained learning motivation and engagement. Unlike ChatGPT, which primarily relies on text-based interaction, DeepSeek R1 combines multimedia elements to create a more immersive learning experience.

3.4 Creating an Intelligent Path for Boundaryless Learning

The COVID-19 pandemic has increased the demand for powerful online learning tools. DeepSeek R1 aims to promote the development of online learning by providing support for virtual classrooms, collaborative projects, and more. Although ChatGPT has been used for remote learning, DeepSeek's ensemble approach makes it a more comprehensive educational solution. A rural school in Africa utilizes DeepSeek R1 to support online learning, ensuring that students participate in learning anytime, anywhere through its interactive features. DeepSeek R1 can break the time and space limitations of traditional classrooms, create immersive learning experiences for students, increase the fun of learning, and create borderless classrooms.

3.5 Provide Precise and Comprehensive Data-driven Feedback

DeepSeek R1 analyzes students' learning performance data, identifies their learning needs and weaknesses, and compares them with a vast database of knowledge points to determine the learning areas that students need to improve. It achieves precise push of exercises and examples, and proposes targeted intervention measures. DeepSeek R1 provides students with a data-driven exclusive learning path by accurately grasping their learning progress, gaining profound insights into knowledge blind spots, and meticulously depicting their thinking trajectories, helping them efficiently grasp knowledge. This data-driven approach supplements the lack of relevant features in ChatGPT and provides a more comprehensive view of the learning process.

3.6 Enhancing Global Education Equity and Inclusivity

In developing countries, opportunities to access high-quality educational resources are often limited. DeepSeek R1 bridges the gap in high-quality educational resources by ensuring that financial levels no longer determine who can use advanced artificial intelligence tools. For students, this means that everyone has equal access to the latest and best intelligent technologies, regardless of their financial situation, and cost barriers will no longer be a limiting factor for students' accessibility. For universities, DeepSeek R1 can be used to reduce spending on artificial intelligence technology and invest more funds in other needs of students. At the same time, DeepSeek R1 can promote adaptive learning, allowing students to access a wide range of educational resources while utilizing accessibility features to achieve inclusive education (OECD, 2024).

4. Continuously Promote the Healthy and Innovative Development of Education Models

The rapid development of DeepSeek, ChatGPT, PaLM, T5, LLaMA, and others has greatly promoted progress in the field of natural language processing and enhanced the capabilities of large language models. Significant progress has been made in solving traditional educational problems through the use of artificial intelligence tools such as DeepSeek, such as creating interactive course plans, providing real-time feedback on assignments, and even acting as virtual mentors. DeepSeek can achieve text generation, assisted translation, question answering, data search, and summarization, providing personalized learning experiences, evaluating student learning situations, predicting learning outcomes, and assisting educational decision-making. Unlike other large models, DeepSeek focuses on professional educational applications to create a more comprehensive AI learning ecosystem. Around the application in higher education and academic research, the future should explore upgrading education specific artificial intelligence models with higher accuracy, logical coherence, and educational adaptability, and build a safe, compliant, and ethical digital teaching environment (Huang, 2024). Specific development prospects can be opened up from the following points:

4.1 Enhance the Interpretability of the Education Model

The education big model is usually composed of complex neural network structures, and its decision-making process may be difficult to explain and understand. In order to establish the credibility and acceptability of the education model, further research should be conducted in the future on how to enhance the interpretability of the model's decision-making process, so that teachers, students, and other stakeholders can understand and trust the model's recommendations and evaluations.

4.2 Enhance Personalized Learning with Precise Support

One major application of the education big model is to provide personalized learning support. In the future, research on large models can explore how to better utilize models to understand students' learning needs, interests, and learning styles, thereby providing more accurate and tailored learning advice and resources, improving learning efficiency and quality.

4.3 Real Time Detection and Regulation of Students' Emotions

Emotions play a crucial role in the learning process, exerting a significant impact on students' academic performance, motivation, information retention, and mental health. In the future, educational models can focus on accurately identifying and understanding students' emotional states, and providing timely emotional support and guidance when needed.

4.4 Build a Scientific Evaluation System for Large-scale Models

It is very important to evaluate the effectiveness and impact of the education model. In the future, an effective evaluation method and indicators should be established in conjunction with the development of large-scale models to understand the comprehensive impact of large-scale models on students' learning outcomes, learning processes, and learning experiences. Based on evaluation, the education department can optimize the rational allocation of funds in artificial intelligence investment.

4.5 Bridge the Global Education Digital Divide

The application of the education big model may lead to uneven distribution of educational resources and exacerbate educational inequality, especially for students with special needs and those from economically disadvantaged families. In the future, the development of education models can further explore how to improve design to achieve a fair and inclusive learning environment and path, ensuring that their application does not exacerbate educational poverty.

4.6 Establish an Ethical and Moral Framework for Artificial Intelligence

The application of educational models has raised ethical issues such as privacy protection, data usage, and model ethical responsibility. In the future, emphasis can be placed on establishing appropriate ethical and moral frameworks to guide the development, use, and evaluation of educational models.

4.7 Strengthen the Cross-cultural Adaptability of Intelligent Collaboration

The research and application of educational models need to consider the differences among learners from different cultures and backgrounds. By continuously improving the cross-cultural adaptability of large models, we aim to better meet the diverse learning needs of global learners and enhance the quality of education.

4.8 Support Lifelong Learning and Sustainable Social Development

The research on the education model should not only focus on the short-term effects of the learning process, but also consider the long-term learning and development of students. In the future, we should actively explore how the education model can support students' long-term learning goals, promote their sustained growth, achieve lifelong learning, jointly build a learning society, and promote sustainable human development.

5. Deepening Artificial Intelligence to Promote the Construction of the Teachers

The rapid development of big models such as DeepSeek has prompted teachers worldwide to think about what artificial intelligence technology is, what it can do inside and outside the classroom, and how to use artificial intelligence to support teaching and learning (Chiu, 2024; Falloon, 2020), in order to fully leverage the potential advantages of artificial intelligence in education, address ethical challenges such as ethics, privacy, and safety, and promote students' cognitive development and mental health growth (Zhai, 2022). Teachers are the fundamental force in implementing high-quality education. Teachers should learn to use artificial intelligence safely and effectively in teaching, understand, utilize, and integrate various artificial intelligence technologies to improve teaching methods,

simplify teaching management processes, enhance teaching effectiveness, and create a healthy, safe, and effective learning environment for students (Carolus et al., 2023). In summary, artificial intelligence literacy goes beyond basic digital abilities, including the ability to master basic artificial intelligence principles, use artificial intelligence tools, analyze artificial intelligence systems in a sharp manner, and address ethical issues related to the use of artificial intelligence (Sperling et al., 2024).

In September 2024, UNESCO released the "AI Competency Framework for Teachers" for K-12 teachers worldwide, emphasizing the need for teachers to understand AI related knowledge, apply AI in education, and develop their corresponding professional competencies to help the world better integrate AI literacy into modern education development systems in the future (Miao, 2023). However, we lack a design framework for the artificial intelligence capabilities of university teachers. Based on multiple documents from UNESCO on the transformation of education through artificial intelligence, as well as important viewpoints from globally renowned universities on empowering education with artificial intelligence, teachers' artificial intelligence literacy can be developed from six dimensions: knowledge, teaching, evaluation, ethics, development, and people-oriented values, in order to clarify the direction of their AI capability development.

5.1 The Knowledge Concept of Teaching Students according to their Aptitude

The ability to distinguish between AI based tools and traditional tools is crucial for teachers to maximize teaching effectiveness. With a keen understanding of artificial intelligence, teachers can not only use it to create compelling content, but also elucidate its fundamental principles and applications. These knowledge enable teachers to select the most suitable artificial intelligence tools based on specific students and tasks, ensuring that they utilize the best available teaching resources.

5.2 The Teaching Concept of Human Computer Collaboration

The ability to choose artificial intelligence tools will significantly enhance teachers' teaching practices, enrich the teaching content provided, and enhance students' learning experiences. By carefully selecting artificial intelligence applications that align with the theme of each lesson, teachers can create a more attractive and interactive classroom environment. This integration enables them to innovate course design, effectively combine professional knowledge and artificial intelligence tools to enrich teaching methods, and promote students' deeper understanding of learning materials. Teachers can assist in coordinating the use of artificial intelligence technology, teaching content, and teaching strategies to achieve cooperative educational methods that benefit both teachers and students.

5.3 A Holistic Evaluation Perspective

Teachers should have the ability to utilize artificial intelligence tools to promote learning assessment. By carefully designing assessment methods suitable for AI based environments, effectively monitoring and improving students' learning outcomes, ensuring that the integration of AI technology is aligned with learning goals, and promoting students' all-round growth. In addition, teachers can strategically choose artificial intelligence tools to assist students in self-assessment, encourage them to actively exert their own initiative in the learning process, enhance their professional knowledge and skills, and enable students to fully realize their self-learning potential.

5.4 Ethical Concept of Integrity and Responsibility

Teachers should understand that humans bear ultimate responsibility for biases against artificial intelligence, possess the ability to critically evaluate the benefits and potential risks of using AI tools in learning environments, and correctly teach students the importance of integrity and accountability in interacting with technology. Teachers should prioritize protecting sensitive content such as test questions, grades, and personal data, and implement best practices to protect this information from negative impacts such as AI privacy issues and biases. Teachers can enhance students' AI literacy by informing them on how to use AI safely and responsibly to form a serious attitude towards their digital interactions, enabling them to make informed decisions.

5.5 The Development Concept of Open and Mutual Learning

Teachers should actively seek various learning opportunities to expand their knowledge and skills in the field of artificial intelligence integration. Teachers can use various search strategies to effectively explore and evaluate various artificial intelligence tools, ensuring that the tools used are at the forefront of educational technology progress. Encourage teachers to actively participate in ongoing professional development activities, including seminars, skills training, and online courses, to deepen their understanding and application of artificial intelligence in teaching. In addition, promote teachers to share their experiences and insights in using artificial intelligence tools with peers both inside and outside their institutions, creating a collaborative environment for exchanging best

practices and innovative ideas. Actively assist other teachers in utilizing artificial intelligence tools such as DeepSeek to design engaging and effective learning activities. By continuously learning, sharing, and supporting peers, teachers can make significant contributions to the collective growth and success of the education industry in empowering education with artificial intelligence.

5.6 Human Centered Values

Teachers evaluate artificial intelligence tools to enhance students' educational experiences in terms of personalized learning and participation, and maintain students' physical and mental health during the use of artificial intelligence, ensuring that students establish a harmonious and balanced concept of technology application. In addition, teachers should clarify to students the broader social impact of artificial intelligence, including its role in employment, interpersonal relationships, and social dynamics. By integrating the people-oriented concept into education, we aim to cultivate a new generation of learners who are proficient in using artificial intelligence and possess critical thinking skills. Teachers should always ensure that education is centered on human values and work together to create an educational environment that values student well-being.

The high-level artificial intelligence literacy of teachers will have a significant impact on education and teaching, student growth, and social development: (1) preparing students for the future. Artificial intelligence is rapidly becoming an indispensable part of various industries and sectors. Teachers with high-level artificial intelligence literacy should provide students with necessary knowledge and skills, enabling them to effectively use various artificial intelligence tools and achieve practical abilities necessary for sustained success in a world driven by intelligent technology (George, 2023)；(2) Addressing ethical issues and their impact on society. Artificial intelligence technology has raised ethical issues such as privacy, discrimination, and opacity. Teachers with high-level artificial intelligence literacy can guide students to use artificial intelligence responsibly, understand its limitations, and comprehend its wide-ranging impact on social development (Saylam, 2023)；(3) Transforming educational and teaching methods. Teachers with high-level artificial intelligence literacy can change traditional education models through personalized learning experiences and automated management tasks provided by artificial intelligence, fully utilizing the high-quality teaching resources provided by artificial intelligence to improve teaching effectiveness (Huang et al., 2024).

6. Conclusion

With the rapid iteration of artificial intelligence, big models such as DeepSeek R1 will play an increasingly important role in higher education. In the future, it is worth paying attention to the development trends of DeepSeek's transformation of higher education, including: DeepSeek R1 will develop into an exclusive virtual mentor for students, guiding them to successfully complete their studies and promoting their career development; DeepSeek R1 will promote global higher education collaboration by connecting students and educators from around the world to enhance cross-cultural learning experiences; DeepSeek's personalized approach will make it an ideal choice for lifelong learning, helping individuals continuously improve their professional skills and learn new skills throughout their entire career.

At the same time, DeepSeek R1 has pointed out a more ethical and secure direction for the development of artificial intelligence, which is to have smaller and more efficient open source models, with data completely under control and not being obtained or used by external companies. Learners do not need to worry about personal data being collected and used arbitrarily when using artificial intelligence models. This further ensures the safety, reliability, and controllability of artificial intelligence technology, forming a trustworthy, traceable, and regulated artificial intelligence model.

DeepSeek R1 is not only an artificial intelligence tool, but also an important transformative force in the field of higher education. By addressing key challenges such as personalized learning, teacher burnout, and distance education, it has the potential to fundamentally change the way we teach and learn. Although ChatGPT has paved the way, DeepSeek R1 is pushing artificial intelligence in the field of education to new heights. Looking ahead, one thing is clear: artificial intelligence tools such as DeepSeek R1 and ChatGPT are redefining the education model. It is now time for students, teachers, and higher education institutions to embrace artificial intelligence technology and unleash its full potential.

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