Redefining the Competence of Higher Education Teachers in the AI Generated Content Era

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ABSTRACT

This article undertakes a comprehensive exploration of the transformation tendencies manifested in the roles and teaching capabilities of college teachers within the context of the expeditious advancement of large language models (LLMs). By meticulously reviewing a vast array of relevant domestic and international literature, it systematically dissects the prospective application scenarios of LLMs in the realm of higher education. Subsequently, a framework delineating the core competencies that college teachers are obliged to possess is proposed. The article proceeds to engage in an in-depth deliberation on the pathways and strategies conducive to facilitating the transformation of teachers' abilities, while also addressing the formidable challenges encountered and proffering corresponding countermeasure suggestions. The overarching aim is to furnish valuable references and profound inspiration for the professional progression of college teachers.

Keywords: Large language models (LLMs), College teachers, Competency transformation, Educational innovation, Teaching strategies.

1. INTRODUCTION

In recent years, with the emergence of large language models (LLMs), such as the GPT series, Ernie Bot, Qwen, et al. artificial intelligence (AI) technology has leaped from the laboratory stage to the practical application, profoundly impacting educational methodologies, learning forms and even the role of educators. As the primary platform for talent cultivation, colleges and universities, in the face of the rapid development of AI technology, must proactively embrace these changes and explore new frontiers in education. In particular, they need to focus on the professional development and capability transformation of faculty members to cultivate high-quality talents that meet contemporary demands.

Since the 1990s, initial explorations into artificial intelligence in education have been underway. Initially, AI applications were limited to auxiliary decision-making, automatic homework grading, and intelligent recommendation systems, which enhanced educational management efficiency but had limited impact on core teaching activities such as knowledge dissemination and cognitive development. However, recent advancements, particularly with LLMs, have fundamentally transformed this landscape. Leveraging powerful semantic understanding and generation capabilities, LLMs can now provide personalized learning materials, conduct complex logical reasoning, and facilitate creative thinking training, ushering in a new era of intelligent education. For instance, teachers can utilize LLMs to tailor individualized learning plans, monitor student progress in real-time, and simulate real-world scenarios to enhance communication skills and social adaptability. This highly customized and interactive teaching model represents a significant departure from traditional education.

The application of LLMs is quietly redefining the role of college educators. Previously seen as authoritative sources and transmitters of knowledge, teachers are now evolving into learning facilitators, collaborative explorers, and creativity inspirers. On one hand, LLMs alleviate some teaching burdens, allowing teachers to focus more on personalized tutoring, innovative thinking cultivation, and emotional support. On the other hand, rapid technological advancements present new challenges.

Teachers must continuously enhance their digital literacy and technology application skills. They need to master the effective use of AI tools to optimize teaching design and guide students in distinguishing between true and false information, fostering critical thinking and problem-solving abilities while preventing misuse or abuse of AI technology[1]. Additionally, with the widespread adoption of big data and cloud computing, teachers must also address ethical concerns such as data security and personal privacy protection.

In light of unprecedented technological changes, the smooth transformation of college teachers is not only related to their career growth, but also directly affects educational quality and long-term national competitiveness. Therefore, in-depth research on the transformation pathways of college teachers' capabilities within the context of AI-driven LLMs, along with the exploration of effective training mechanisms and policy support, holds significant practical and strategic value. This study will focus on this core proposition, comprehensively analyze relevant domestic and international practices, and propose a framework for college teacher development strategies to inject new vitality into China's higher education system.

2. LITERATURE REVIEW

Since the 1950s, when Alan Turing posed the philosophical question "Can Machines Think?", artificial intelligence has gradually permeated the field of education. Early research focused on intelligent tutoring systems (ITSs), which aimed to emulate human tutors by diagnosing students' weaknesses and providing targeted exercises to improve learning efficiency. By the late 1990s, with the proliferation of the internet and advancements in computing power, educational software and online learning platforms emerged, offering more abundant multimedia learning resources and instant feedback mechanisms[2][3]. Subsequently, the progress of machine learning and natural language processing (NLP) technologies enabled educational software to transcend simple rule-based systems, allowing for the understanding and generation. In particular, in recent years, LLMs based on the Transformer architecture[4], such as GPT-4 and ERNIE, have demonstrated remarkable capabilities in language comprehension and generation. These models can not only create poems and stories but also answer intricate questions and even perform logical reasoning and critical thinking to a certain

extent. This breakthrough marks a new stage in the application of AI technology in education.

With the in-depth integration of AI in education, the required competencies of college teachers are also undergoing fundamental transformations. In the early days, due to the relatively rudimentary educational technology, teachers' ability requirements were primarily focused on instructional design, teaching management, and basic information technology operations. An article in the *Harvard Educational Review* highlighted that college teachers need to master data analysis skills and be proficient in using tools, such as learning management systems (LMS) and student information systems (SIS) to collect and analyze student data, thereby achieving personalized teaching objectives. In addition, teachers should learn to leverage predictive analytics to anticipate potential learning challenges and take proactive intervention measures[5].

Recent educational research has concentrated on exploring the specific applications of AI technology, particularly LLMs, in college instruction and the resultant changes in teachers' roles. Numerous studies concur that college teachers should possess the ability to integrate AI technology, especially LLMs, into the teaching process[6][7]. For instance, one study showed that by using LLM tools, teachers can design more attractive and interactive courses, such as virtual laboratories and gamified learning environments, significantly enhancing students' motivation and participation[8]. Another study indicated that AI can assist teachers in monitoring students' emotional responses, timely intervening in psychological crises and maintaining the safety and harmony of the campus. For instance, a survey in the *IT Professional* showed that teachers need to master the basic skills in using AI tools, including an understanding of LLM principles, the ability to employ AI-assisted teaching software to create interactive learning environments, and designing course modules that incorporate AI elements[9].

As LLMs become increasingly pervasive, teachers' roles and functions are diversifying. Modern teachers not only need to be proficient in digital tools but also possess data analysis capabilities to optimize teaching strategies using student learning data. More importantly, they should act as learning partners, guiding students in critical thinking and creative practice, rather than merely serving as knowledge transmitters. At the same time, teachers should cultivate critical

thinking skills to evaluate the effectiveness and scope of AI tools and avoid the misuse of technology[10]. In the current era of increasing AI prevalence, teachers should focus on cultivating students' emotional intelligence and interpersonal communication skills, helping them establish essential ethical awareness and legal knowledge in a world where the virtual and real realms intersect.

However, the dual-edged nature of technology cannot be underestimated. Over-reliance on AI may lead to a lack of genuine emotional connection between teachers and students, weakening the social function of education. Some studies have also pointed out that the content generated by LLMs may contain biases and errors[11]. Without proper supervision, it may mislead students and negatively impact the formation of their values and worldviews. Therefore, LLMs have brought unprecedented opportunities as well as severe challenges to college education. The evolving roles and competency requirements of college teachers necessitate further research to deepen our understanding of this phenomenon and explore effective strategies to promote the benign interaction between education and technology.

3. THE EVOLUTION OF THE ROLES OF COLLEGE TEACHERS IN LLM-ASSISTED TEACHING

Globally, colleges and universities have begun to actively explore the application of LLMs in education, leading to a series of innovative practices that underscore a significant transformation in the roles of teachers. Through the analysis of successful cases, we can gain insight into this process and observe how knowledge transmitters are evolving into new archetypes as learning guides and evaluators.

In 2020, researchers at Stanford University proposed an AI-based Super Teaching Assistant system designed to better understand students' needs while enhancing STEM (Science, Technology, Engineering, and Mathematics) education[12]. Developed by Assistant Professor Chris Piech and his team, this system aims to assist students in completing open-ended tasks such as coding by providing tutor-like support. At its core, the Super Teaching Assistant features an AI engine capable of "understanding" student requirements; it primarily focuses on helping learners acquire scientific methodologies and programming skills. Although these educational contents encompass numerous open-ended tasks, the system still offers structured learning opportunities. In certain instances, the Super Teaching Assistant can function as a one-on-one tutor by delivering personalized feedback directly to students, thereby fostering continuous learning through a rapid feedback loop.

Generative AI tools create opportunities for innovating and enhancing the core aspects of university activities. At the same time, they also bring risks to academic and research integrity, intellectual property rights, and data privacy. To better address these challenges, the University of Melbourne established the Generative Artificial Intelligence Taskforce (GAIT) in 2023, which is responsible for overseeing the university's response to the risks and opportunities associated with generative AI tools[13]. This mainly includes monitoring, managing, and investigating during teaching, research, and daily operations, and providing a set of AI principles and a series of resources to help guide actions in using AI tools.

Tsinghua University is actively advancing the virtual teaching assistant project. Leveraging the "100-billion-parameter multimodal large model GLM," it has developed several AI teaching assistant systems aimed at providing innovative support for instruction across various disciplines[14]. Beginning in the fall semester of 2023, eight courses have piloted these systems, with AI teaching assistants for five of those courses having been initially developed and implemented. These teaching assistant systems offer all-weather personalized learning support and intelligent evaluation feedback, facilitating deeper student engagement and stimulating interest in learning[15].

The primary function of AI teaching assistants is to assist students in completing extensive assignments. By employing automatic knowledge point extraction and knowledge base support, they significantly enhance the accuracy of responses to inquiries. Additionally, these systems provide continuous and detailed feedback to students, thereby fostering improvements in writing skills.

In this context, the role of teachers has evolved from being mere knowledge authorities to becoming guides and supporters. The common characteristic among educators now is their utilization of technological tools to augment teaching effectiveness. Teachers are no longer one-dimensional knowledge disseminators but integrate multiple roles, including content developers, learning partners, evaluators, and technology integrators. This transformation necessitates that

teachers have a high degree of adaptability and innovative capability to meet the demands of contemporary educational environments while promoting deep-level learning and growth among students.

4. CORE COMPETENCIES OF COLLEGE TEACHERS FOR THE FUTURE

To effectively address the role transformation of educators brought about by LLMs, college teachers must develop a comprehensive set of core competencies that align with contemporary demands, thereby ensuring enhanced teaching quality and fostering the holistic development of students' potential. These competencies encompass various dimensions, including technology, data analysis, critical thinking, emotional intelligence, and ethical considerations. Consequently, educators are required to be adept in cutting-edge technologies while also embodying profound humanistic qualities. In the following sections, we will provide an in-depth exploration of the five-part core competency framework essential for future college teachers, as shown in "Figure 1".
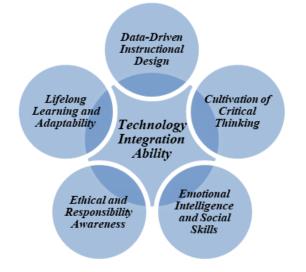

Figure 1 Core competence framework of college teachers in the context of AI large models.

4.1 Technology Integration Ability

The ability to integrate technology is a fundamental competency for college educators in the contemporary era. It necessitates that teachers not only master but also creatively apply emerging technologies, such as Large Language Models (LLMs), to optimize classroom instruction and enhance the overall learning experience. College instructors should develop skills in interpreting, evaluating, and applying knowledge generated by LLMs while gaining an understanding of their operational mechanisms—such as the Transformer architecture and principles of self-supervised learning, as well as recognizing both their advantages and potential limitations. Concurrently, it is essential to cultivate a critical perspective that enables educators to assess the reliability of information, guiding students in distinguishing between truth and falsehood while fostering a rational approach toward technological products. By integrating AI technology into curriculum design, teachers can leverage the powerful capabilities of LLMs, including text summarization, speech-to-text conversion, and intelligent question-answering, to streamline verbose materials, enhance lesson preparation efficiency, and optimize management of educational resources. Additionally, utilizing chatbots can significantly improve interactivity within the classroom environment while facilitating diverse teaching methodologies that increase engagement.

4.2 Data-driven Instructional Design

Data-driven instructional design represents a significant application of LLMs within educational contexts. With support from big data analytics and artificial intelligence (AI), educators should be equipped to collect and analyze student learning data effectively; this analysis will inform personalized teaching strategies tailored to meet individual needs, thereby achieving the objective of educating students according to their unique aptitudes. Through AI algorithms' assistance,

teachers can recommend optimal learning resources along with appropriate difficulty levels based on each student's performance metrics; this ensures that all learners are adequately challenged beyond their comfort zones without experiencing frustration or boredom. Furthermore, introducing virtual assistants allows for regular analysis of students' learning states according to data such as the completion of tasks and test scores recorded in the LMS, adjust the teaching pace accordingly, focus on those students with poor performance, provide additional assistance and support, promote personalized learning, and meet the needs of different levels.

4.3 Cultivation of Critical Thinking

The cultivation of critical thinking mandates that teachers impart to students the skills of discerning the authenticity of information, foster independent thinking and a spirit of criticism, and preclude blind acceptance of technological outcomes. It is incumbent upon teachers to direct students to question the provenance of information and enhance their judgment capabilities. Concurrently, they ought to stimulate innovative thinking, encourage students to maintain an open attitude towards their own beliefs and assumptions, and possess the courage to challenge authoritative viewpoints, thereby cultivating the habit of independent cogitation and refraining from readily believing unverified information, especially the spurious content generated by AI in social media.

4.4 Emotional Intelligence and Social Skills

In the milieu of the escalating prevalence of AI, the cultivation of students' non-cognitive abilities, such as empathy, cooperation aptitude, and interpersonal communication skills, assumes particular significance to compensate for the inadequacies of AI in emotional interaction. Non-cognitive abilities encompass aspects like emotional regulation, interpersonal communication, self-awareness, and creativity[16]. Employing diverse pedagogical methods, via group work and discussions, the mutual understanding and trust among students can be augmented, and their communication, coordination, and problem-solving competencies can be enhanced. Additionally, more practical opportunities and platforms can be furnished for students. For instance, students can be organized to engage in internships, practical training, social practice activities, or partake in a rich variety of extracurricular pursuits, such as clubs, academic competitions, volunteer services, etc., with the aim of cultivating students' interests, hobbies, and specialties and elevating their comprehensive qualities and competitiveness.

4.5 Ethical and Responsibility Awareness

In the current era, with the extensive deployment of AI technology, educators are tasked with the crucial responsibility of inculcating in students the observance of ethical norms and legal statutes. Teachers are obliged to direct students in establishing appropriate ethical frameworks, learning to utilize AI tools in a responsible manner, respecting the privacy and intellectual property rights of others, and averting the risks of technological misuse. Through the introduction of relevant concepts such as data privacy, algorithmic bias, and copyright infringement to students, an understanding of the usage boundaries of AI technology can be instilled. By dissecting existing AI-related ethical quandary events, such as the abuse of facial recognition technology or the moral dilemmas of self-driving cars, students can be steered towards contemplating decision-making benchmarks in complex scenarios.

4.6 Lifelong Learning and Adaptability

Confronted with the incessantly evolving technological tide, educators must adhere to the principle of lifelong learning. They should routinely refresh their knowledge reservoirs, acclimate to technological metamorphoses, exhibit the courage to embrace novel challenges, maintain contemporary teaching strategies, and manifest the self-enhancement and self-renewal characteristics of educators. Periodically assessing their teaching methodologies and student feedback, seeking avenues for amelioration, and demonstrating the courage to experiment with novel concepts without trepidation of failure are essential aspects of this continuous educational evolution.

5. CHALLENGES AND COUNTERMEASURE PROPOSALS

The rapid progression of LLMs has instigated revolutionary alterations within the educational domain, yet concurrently, it has engendered a constellation of intricate quandaries. Regarding the core competencies of prospective college educators, a gamut of issues, ranging from deficient infrastructure and the pedagogical skills disparity

among teachers, to ethical dilemmas such as student variances and data security concerns, have materialized as formidable impediments along the trajectory of educational modernization.

5.1 Principal Challenges

5.1.1 Disparity in Technological Access and Infrastructure Development

Despite the extensive application potential of LLMs in education, pronounced discrepancies in technological access and infrastructure establishment are discernible among global institutions of higher learning. Owing to economic circumstances or geographical constraints in numerous countries and regions, the procurement of stable and dependable Internet services proves arduous, which incontrovertibly circumscribes the proliferation and profound utilization of LLMs. Moreover, antiquated campus equipment and software compatibility conundrums also impede the seamless integration of novel technologies.

5.1.2 Psychological Hurdles and Proficiency Gaps for Teachers in Embracing Novel Technologies

A segment of teachers exhibits circumspection or even aversion towards nascent technologies, apprehensive that AI technology might supplant the role of human instructors and experiencing psychological angst regarding the demarcation between "plagiarism" and "originality". The paucity of efficacious training regimens might precipitate a dearth of operational competencies among certain teachers, thereby further aggravating the application-level intricacies.

5.1.3 Student Individual Disparities and Fairness Considerations

While LLMs offer the prospect of personalized learning, they might also accentuate the asymmetry in the dissemination of educational resources. The presence of disparities in students' learning predilections, technological exposure levels, and policies might culminate in certain students being incapable of fully capitalizing on technological prerogatives, thereby precipitating unfair occurrences.

5.1.4 Ethical Conundrums of Data Security and Privacy Safeguarding

During the employment of LLMs in education, information security and privacy breaches have emerged as non-negligible ethical predicaments. For instance, when leveraging large models to refine unpublished original reports and papers by teachers and students, the jeopardy of article leakage looms. Some service providers of large models might amass the data input by users. In the event of inadequate data security protocols or malevolent data exploitation, the leakage of the content of these unpublished articles might transpire, potentially inflicting damage upon the academic accomplishments of teachers and students, such as susceptibility to plagiarism by others.

5.2 Countermeasure Suggestions

In light of the aforementioned challenges, a series of proposed solutions are presented as follows.

5.2.1 Government Funding and Policy Support

The governmental authorities ought to augment financial allocations towards educational technology. Specifically, greater emphasis should be placed on infrastructure enhancement in geographically remote regions and the implementation of teacher training initiatives. Such measures are essential in curtailing the technological discrepancies among different areas. Through increased funding, the availability and quality of technological resources in underprivileged regions can be improved, thereby leveling the playing field for educational institutions across the board. Additionally, the formulation of supportive policies can encourage the adoption and integration of advanced technologies, such as LLMs, in educational settings.

5.2.2 Policy-making at the School Level

Educational institutions are required to formulate more comprehensive and inclusive learning programs that account for the diverse characteristics and needs of students. In their long-term strategic blueprints, schools should prioritize the sustainable and secure utilization of educational technology. This entails the development of meticulous privacy protection regulations to safeguard the personal and academic data of

students and teachers. Concurrently, the establishment of dedicated administrative departments is crucial for the seamless coordination and effective execution of technology-related projects. These departments can oversee the integration of new technologies, ensure compliance with privacy policies, and address any emerging technical or ethical issues promptly.

5.2.3 Teacher Training and Professional Development

The organization of regular workshops and seminars is of utmost importance. These events should feature invitations to industry-leading experts who can impart their knowledge and experiences through sharing best practices. Complementary to this, the provision of online learning resources offers teachers the flexibility to engage in continuous professional development at their own pace. By availing themselves of such opportunities, teachers can stay abreast of the latest technological advancements and acquire the necessary skills to proficiently utilize LLMs and other educational technologies. This, in turn, mitigates the skill gaps that currently exist and empowers educators to enhance the quality of teaching and learning experiences.

5.2.4 Promoting Student Participation and Social Equity

The design of adaptable and flexible teaching models is essential to accommodate the heterogeneous learning requirements of students. Special attention must be directed towards marginalized and vulnerable student groups to ensure that they are not left behind in the digital age. By tailoring instructional strategies and providing additional support, schools can ensure that every student can derive benefits from technological progress. This not only enhances individual learning outcomes but also contributes to the reduction of the digital divide, promoting social equity in education.

5.2.5 Strengthening Ethical and Safety Education

The integration of data security and privacy rights education into the formal curriculum is a fundamental step. By doing so, students and teachers alike can be made cognizant of the potential risks associated with the use of educational technologies and the importance of

safeguarding personal and academic information. This heightened awareness can foster a culture of responsibility and ethical behavior within the educational community, leading to the creation of a secure and reliable network environment. Through classroom instruction, case studies, and practical exercises, individuals can be equipped with the knowledge and skills necessary to protect their digital identities and maintain the integrity of educational data.

6. CONCLUSION

This article has conducted an in-depth analysis of the profound and far-reaching impact of LLMs on higher education. It has unveiled the significant historical transformation of the teacher's role, which has evolved from a conventional instructor to a multi-faceted facilitator. In the face of a plethora of challenges, including disparities in technology access, psychological impediments, issues of fairness, and ethical concerns, the education community has demonstrated remarkable tenacity and an enterprising spirit. Through continuous exploration and experimentation, it has gradually uncovered solutions that are commensurate with the demands of the new era.

The metamorphosis of the capabilities of college teachers is not only intrinsically linked to their individual professional vitality but also serves as a crucial hallmark of the modernization of the entire education system. The profound integration of future education and artificial intelligence holds the promise of limitless potential. The real-time analysis of students' learning trajectories, in conjunction with the formulation of customized teaching strategies, has the capacity not only to enhance learning efficiency but also to unlock the latent potential of each individual student. In the domain of scientific research, the utilization of large models for comprehensive literature reviews and concept extraction is anticipated to pioneer novel research perspectives and expedite the pace of knowledge innovation. Teachers, as the vanguards in this transformative process, will persistently spearhead the change, functioning as the nexus that bridges technology and the humanities. They will play a pivotal role in nurturing the next generation of thought leaders and industry trailblazers.

As technology continues to progress and educational concepts reach increasing levels of maturity, future research endeavors should be centered on the exploration of more refined and

sophisticated educational programs. For instance, the development of intelligent diagnostic tools that can accurately identify learning disabilities with enhanced precision. Additionally, efforts should be directed towards deepening interdisciplinary collaborations, integrating disciplines such as psychology, neuroscience, and educational technology to jointly construct a learning environment that fosters comprehensive development. Simultaneously, it is imperative to reinforce the formulation of ethical guidelines and safety standards. This will ensure the legality and transparency of technology applications and establish a paradigm for global educational innovation, thereby setting a high standard for the international community to emulate.

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