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Application Status Analysis of AIGC Mobile Learning Terminal Technology for Higher Education Teaching

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Abstract: *Mobile learning adheres to the principle of student-centeredness, aiming for autonomous and personalized learning. It utilizes mobile terminal devices as tools and digital learning resources as foundations to fully stimulate autonomous and personalized learning among students. In recent years, AIGC mobile learning terminals have gradually replaced traditional mobile learning terminals based on single apps or mini-programs. AIGC mobile learning terminals, based on deep learning technology, leverage massive databases and real-time feedback capabilities, gradually replacing traditional teaching aids. They have become flexible, easy-to-use, and real-time mobile learning assistants in the hands of university teachers and students. Furthermore, they provide highly autonomous, personalized, and mobile teaching support for higher education, ushering traditional higher education into an unprecedented era of interactivity and intelligence.*

Keywords: *AIGC; mobile learning; higher education teaching quality*

1. Introduction

Artificial Intelligence Generative Content(AIGC) is profoundly transforming the world and exerting significant influence on education. The application of AIGC in education is broad and encompasses technologies such as machine translation, automatic document summarization, intelligent text generation, automated question answering systems, document classification and retrieval, and image recognition. These technologies facilitate the automatic generation of content across various mediums including text, images, audio, video, and virtual agents, spawning a plethora of applications and tools.

There is a deep global interest and active exploration of the use of generative AI in education. For instance, UNESCO has issued the world's first "Guidelines on the Use of Generative AI in Education Futures," urging countries to implement appropriate policies ensuring human-centered approaches in the use of generative AI in education. The U.S. Department of Education's Office of Educational Technology has published the "Future of Artificial Intelligence and Education" report, offering key insights and recommendations on the integration of AI with future teaching practices. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan has released interim guidelines for the use of generative AI in elementary and secondary education, outlining directions and practical requirements for its application in basic education. In China, the Cyberspace Administration of China has approved the "Interim Measures for the Management of Generative AI Services," which provides regulations and service standards for the development and governance of generative AI technology.

As an innovative and revolutionary AI technology, represented by ChatGPT, generative AI holds vast potential for application. However, it also brings potential risks. To seize the forefront in AI research and application and to support the construction of a strong higher education system using AI technology, it is crucial for Chinese universities to actively explore the potential applications of generative AI in higher education, identify and mitigate its potential risks, and address these important challenges.

2. Emergence and Development of Mobile Learning Terminal Technology

2.1 Emergence of Mobile Learning Concept

The concept of mobile learning originated around the year 2000 and was initially translated into Chinese from the English terms "Mobile Learning" and "Smart Device" [1]. Based on operating systems with capabilities such as network browsing, multimedia presentation, and application

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installation, mobile learning serves as a cornerstone in the technological, digital, and Lifelong Learning of higher education activities. As a product combining digital learning with mobile communication technology, mobile learning features interactivity, immediacy, precision, and personalization. Leveraging the mobility and convenience of its carriers, mobile learning terminal technology allows university students to access learning resources from university cloud classrooms at any time and from any location via the Internet, effectively breaking free from the constraints of physical classrooms. This fragmentation of classroom learning content into smaller units enables students to utilize fragmented time effectively, thereby meeting the demands of ubiquitous learning among university students to the fullest extent. It achieves autonomous and personalized learning goals for students.

Mobile learning is grounded in theories of communication and education, supported by mobile terminal technology, carried through mobile and portable electronic devices, and enriched with customized massive content as learning resources. Through methods such as task-driven learning, daily teaching integration, and scenario-based simulations, mobile learning fully stimulates the potential for student autonomous and personalized learning. It fundamentally resolves issues of asynchrony in time and spatial separation in university teaching activities, aiding the transition of students from passive absorption to active learning. Renowned American learning technology strategist Clark Quinn vividly describes mobile learning as a supplement to traditional university course learning, providing an inclusive learning environment by combining digital learning (E-learning) with mobile learning (M-learning). University students can determine when, where, what, with whom, and how they learn based on their personalized needs, thereby facilitating real-time interactive communication among students, teachers, and even between teachers.

2.2 Development of Mobile Learning Terminal Technology

In 2008, Chinese scholars led by Huang Ronghuai compiled the first domestic monograph on mobile learning titled Mobile Learning: Theory, Current Status, Trends. This book first elucidated the relevant technologies, application modes, theoretical foundations, and methods of mobile design in mobile learning, further pointing out that "mobile learning terminal technology supplements existing school network teaching platforms by incorporating mobile devices, enabling learners to access required learning resources at different times, conduct self-tests and self-assessments, and promptly receive classroom feedback." [2] Wang Wei and others researched various types of mobile learning terminals, proposing the use of smartphones, PDAs, laptops, LCD e-books, and other categories of mobile terminal devices, and conducted a comprehensive evaluation of their contributions to mobile learning. [3] Regarding the development platforms and accompanying learning resources for mobile learning, Zhang Chi and colleagues evaluated mainstream mobile learning resources and development platforms in their study "Design Research on Fragmented Learning Resources in Mobile Learning", proposing segmented learning resource designs suitable for mobile learning. [4] Since 2016, a large number of mobile learning apps and WeChat mini-programs aimed at addressing smart learning in universities have been introduced, including the Chaoxing Erya Learning Platform for PCs, Chaoxing Erya Learning App, Yu Classroom Mini-program, DingTalk App, etc. Marina conducted a detailed analysis in her paper "Application Research of Mobile Learning Technology in High School Physics Classrooms," examining the use of the independently developed mobile teaching platform Ruiyi Tong in assisting teaching at the school. Through discussions on various functions provided by Ruiyi Tong for students such as report feedback, cloud notes, and online Q&A, the study clarified that mobile learning, as a product of modern education, contributes to building a more flexible learning environment and promotes the development of smart teaching in universities. [5]Lai Zhixin proposed in "Research on Hybrid Teaching Design and Application Based on Smart Teaching Platform Rain Class" that in recent years, various mobile learning applications developed based on smart mobile devices have become the mainstream trend for out-of-classroom learning in universities. Applications such as Rain Class, Chaoxing Erya Learning Platform for PCs, The class of Lan Moyun, and Classroom Pie have been widely accepted by university teachers and integrated into their daily teaching practices. [6] Therefore, based on existing research achievements, using such mobile learning software and smartphone apps in teaching is advantageous for fully stimulating students' learning motivation, fostering good habits of autonomous learning, and serving as a beneficial supplement to traditional classroom teaching models.

2.3 AIGC Entering the Mobile Learning Terminal Field

Artificial Intelligence Generated Content (AIGC) refers to the use of massive data, high-precision

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models, complex algorithms, and real-time transformation of graphical, textual, audio, and video content. This type of AI-generated content is not merely a compilation of existing database content but rather innovative original content. The technology spans multiple domains including text, audio, video, music, and program code, often appearing in the form of chatbots, surpassing traditional content creation tools comprehensively. Chinese academician Pan Yunhe pointed out in the article "Artificial Intelligence Moving Towards 2.0" that generative AI led by ChatGPT signifies a significant transition from the era of AI 1.0 to AI 2.0. [7]On November 30, 2022, an AI tool named ChatGPT was launched, developed by OpenAI as a powerful AI chatbot capable of conversational chat, information retrieval, knowledge services, and AI-generated content creation. It is essentially a large-scale language model (LLM) trained using reinforcement learning from human feedback, capable of understanding and processing human text with strong content generation capabilities. Since its introduction, many internet companies in China's education sector have begun integrating AIGC with mobile learning terminal software, strategically expanding into new educational formats.In May 2023, TAL Education Group, a subsidiary of GaoTu Education Group, announced the development of MathGPT, a large-scale model specializing in mathematics, focusing on problem-solving and instructional algorithms in the global mathematical community, research institutions, and students from primary to secondary schools. MathGPT officially launched and began internal testing in August of the same year.

In the same year, NetEase Youdao launched the NetEase Youdao AI Oral Teacher and the NetEase Youdao Dictionary AI Chinese Composition Correction function, both developed based on the "Confucius Says" large-scale model. NetEase Youdao AI Oral Teacher not only provides flexible practice scenarios but also can assume various roles according to user needs, guiding users through multi-round conversations with patience and encouragement. After the conversation ends, the product swiftly generates a "result report," scoring users on pronunciation, grammar, and other dimensions. Additionally, the AI teacher offers personalized grammar refinement and pronunciation suggestions to help users improve their spoken language skills effectively. Meanwhile, iFLYTEK introduced the iFLYTEK AI Learning Machine T20 Pro, which goes beyond traditional learning machines by not only correcting basic errors like word and punctuation mistakes and recognizing stylistic and rhetorical errors but also offering advanced corrections focused on writing requirements, analyzing the entire structure and literary style. This learning machine inspires writing ideas and enhances writing suggestions through AI polishing technology.

3. Current Status of AIGC Mobile Learning Terminal Technology Development

3.1 Text Domain

Generative artificial intelligence (AIGC) is typically based on deep learning technologies and learns the intrinsic patterns and characteristics of data through training on large datasets. This approach has demonstrated tremendous potential in the field of text creation. Notable examples of such tools include ChatGPT, Wenxin Yiyan, iFlytek Spark, Alibaba Tongyi Qianwen, and Kimi Assistant. These tools accept commands through chat interfaces and provide feedback in textual form. Firstly, these tools analyze user commands, which are not singular but accumulated through extensive training with numerous commands. The feedback generated is tailored to meet user expectations, facilitating tasks such as writing stories, literary reviews, and manuals. These creative and inspirational texts can serve as raw material for users, who can further refine them to produce original content. Secondly, these tools function as intelligent conversational assistants, engaging in multi-turn dialogues with users to provide a wealth of useful information. They also assist in data processing and quantitative analysis, significantly reducing the cognitive load on users for non-creative tasks.Lastly, these tools can help users with code processing. They restructure and analyze user-provided code based on various programming languages' rules, data models, algorithm structures, and programming languages, and automatically generate code or error explanations according to the user’s requirements.

In summary, these advancements reflect the significant breakthroughs and value of current AIGC tools and offer numerous possibilities for applications in higher education and mobile learning. However, due to technological limitations, issues such as generating fabricated facts, biased or harmful content, and failing to follow user instructions can arise with tools like ChatGPT.

3.2 Audio and Video Domain

Unlike the abstract semantics focused on text, the simulation and synthesis of audio and video

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require capturing more visual detail, making the generation of audio and video content (such as speech, music, and video) more challenging. Despite this, recent years have seen significant advancements in AIGC within the audio and video domains, with tools generally falling into two main categories. The first category includes voice assistants such as Xiao Ai, Siri, and various smart speakers. Initially designed as lifestyle aids to check time, weather, news, and control connected or smart home devices, these assistants have evolved with AIGC advancements to become crucial tools for mobile learning. Portable AI language teachers can now facilitate practice in any setting and play various roles to guide users through multi-turn dialogues based on their needs. The second category encompasses video generation applications, including tools like Runway and Pikalabs. These applications can transform user-provided text descriptions into video scripts, leveraging advanced AI language processing and content generation technologies to produce short videos. Moreover, AIGC video applications feature AI-generated digital avatars that offer new perspectives and creative opportunities for traditional short video content. By introducing highly realistic and creative virtual characters, these tools overcome the high costs of traditional CGI methods, enabling creators to efficiently generate hyper-realistic 3D avatars and produce immersive short videos simply by inputting textual descriptions of facial features, hairstyles, and other attributes.

3.3 Image Domain

Generative artificial intelligence (AI) has a wide range of applications across various fields, including image generation, audio synthesis, and natural language processing. In the field of image generation, generative AI can learn the features of a set of images and create new images similar to them. Mainstream AIGC (Artificial Intelligence Generated Content) image generation tools include DALL-E, Midjourney, and Stable Diffusion, each with its unique features and applications. For instance, Midjourney, as an AI image generation tool, showcases a variety of intelligent characteristics. It can efficiently recognize, deeply analyze, and flexibly handle various image generation needs. Midjourney features automatic color matching capabilities, allowing it to intelligently recommend or automatically adjust color combinations based on user requirements, making it a favored tool among design professionals. It generates renderings through real-time analysis of big data, learning and optimizing from vast amounts of graphic data to train high-precision models, thus providing users with a simple and efficient drawing experience. Using intelligent optimization algorithms based on AI technology, it can quickly filter out the most suitable graphics, colors, and combinations for users through data mining and machine learning, and automatically generate corresponding renderings. Additionally, it creates text-based images through machine learning algorithms, learning and self-optimizing based on user behavior, operations, and needs to offer more intelligent drawing solutions and renderings.

4. Current Application Status of AIGC Mobile Learning Terminal Technology in Higher Education

4.1 Enhancing Teaching Efficiency and Quality

In 2023, the U.S. Department of Education's Office of Educational Technology released a report titled "The Future of Artificial Intelligence and Teaching," which presented key insights and recommendations on the integration of artificial intelligence with future teaching. [9] This report also indicates that AIGC (Artificial Intelligence Generated Content) tools, as advanced educational productivity tools, are gradually replacing traditional teaching aids. Leveraging vast databases and powerful real-time feedback capabilities, these tools have become flexible, user-friendly, and real-time teaching assistants in the hands of higher education instructors. They provide highly autonomous, personalized, and mobile teaching support, ushering traditional higher education into an unprecedented era of interactivity and intelligence.In higher education teaching applications, text-based tools such as ChatGPT and Wenxin Yiyan, as well as video tools like Runway and Pikalabs, have been integrated into various aspects of curriculum development, teaching resources, and assessment standards, effectively aiding teachers in improving lesson preparation efficiency and teaching quality.

First, in curriculum development, text-based tools like ChatGPT can generate teaching outlines, course objectives, teaching methods, and independent inquiry activities based on descriptions provided by teachers, such as course keywords, themes, goals, and methods. This allows teachers to save time and effort on course design and focus on classroom execution and improvement.Second, in teaching resources, audio and video applications like Runway and Pikalabs can organize, filter, and integrate

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teaching content provided by teachers. Utilizing their AI models' natural language processing capabilities and content generation technologies, these tools can convert teaching scripts into short instructional videos, making student learning more visual, intuitive, and engaging. Zhu Hongtao's article, "Development and Practice of Teaching Short Videos Driven by AI Large Models," explains how AI short videos can be optimized for different subjects. For instance, animated videos can help students understand difficult-to-demonstrate content like civil engineering and topographic surveying, while scenario simulation videos can guide students through practical processes in mechanical maintenance and medical anatomy. [10]Third, in teaching quality assessment, AIGC applications with grading and evaluation functions, such as Iwriting and IELTS Master, have been put into use. These tools can generate reliable, effective, and specific evaluation standards based on criteria provided by teachers, including creating various types and difficulties of test questions, scoring criteria, and feedback templates. This significantly reduces the workload for teachers in test design and grading, and aids in more accurately assessing students' learning outcomes and teaching quality.

4.2 Enhancing Student Learning Experience and Outcomes

In September 2023, Stanford University released a foundational training guide on maximizing the use of ChatGPT for its students, aimed at helping them effectively leverage AIGC tools for academic research and project execution [11]. Thus, AIGC tools should not only serve as intelligent teaching assistants for educators but also become valuable partners in mobile, autonomous, and efficient learning for students, enhancing their learning experience and outcomes.

Firstly, AIGC tools offer personalized tutoring, generating tailored guidance based on students' real-time questions or needs. For instance, the MathGPT application by TAL Education focuses on mathematical problem-solving algorithms, providing answers that include analysis, detailed explanations, and key points. Analysis offers problem-solving strategies, detailed explanations provide specific calculations, and key points highlight essential aspects of the problem, helping students understand and reflect on the material.

Secondly, AIGC tools provide engaging interactions. Traditional higher education often uses a one-to-many model in classrooms, limiting teachers' attention to individual students' interests and ideas. In contrast, chat-based AIGC tools can respond to students' academic thoughts and topics with interactive, stimulating content such as chats, games, and group discussions. This helps students gain inspiration, knowledge, and ideas in a relaxed environment, enhancing their communication and creativity skills.

Lastly, AIGC tools offer constructive feedback. Applications like Iwriting and MathGPT provide systematic, targeted evaluations based on students' submitted assignments, including completion times and states. This feedback helps students track their progress, identify areas for improvement, and adjust their learning strategies, thereby improving efficiency and quality. Consequently, the adoption of AIGC tools allows students to receive real-time, effective learning support anytime and anywhere, fostering their learning autonomy and significantly enhancing their learning experience and outcomes.

4.3 Improving the Efficiency and Quality of Academic Research in Higher Education

The "AIGC Development Trends Report 2023" published by Tencent Research Institute highlights that advances in foundational generative algorithms and pre-trained models, driven by extensive data training, have led to a qualitative leap in AIGC technology. Multimodal technologies have diversified AIGC's capabilities, enabling it to independently generate new text, audio, video, and images [12]. Consequently, AIGC is increasingly valued in academia for its ability to synthesize existing research, propose new ideas, and excel in data research, coding, and decoding.

For example, ChatGPT can assist in literature retrieval and review. It can rapidly generate relevant literature on a specific topic through natural language dialogue and summarize or analyze documents based on themes and keywords. Despite the potential for "illusion" or fabricated information due to technical limitations, ChatGPT's efficiency, convenience, and connectivity in literature retrieval far exceed human memory and computational abilities.

AIGC also aids in compiling and reviewing academic viewpoints, especially in interdisciplinary research. Researchers often need to integrate diverse cultural perspectives, disciplinary backgrounds, and academic viewpoints. ChatGPT, with its training models and vast data, can summarize and analyze articles, charts, and images, and assist in logical organization, generating new viewpoints, and

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facilitating discussions, thus significantly enhancing research efficiency and scope.

Furthermore, AIGC supports researchers in revising and polishing papers, improving writing and translation quality. Whether dealing with qualitative or quantitative research, researchers need to present new ideas in clear, logical academic language. ChatGPT helps reorganize and refine academic language, aligning it with common logical structures and improving vocabulary, grammar, and overall coherence, thereby optimizing the article's organization.

4.4 Introducing New Ethical Risks in Academia

In June 2024, the Sydney Morning Herald reported that thousands of undergraduate and even higher-degree students at universities in Sydney were accused of academic misconduct, including plagiarism, online exam cheating, paper ghostwriting, and excessive use of AI-generated writing.[13] The proportion of students using AI for ghostwriting has reached an all-time high in 2024, particularly since the advent of tools like ChatGPT. This surge in "ghostwriting" and cheating incidents has sparked widespread discussion in the educational sector. Due to some students lacking academic proficiency, the use of AIGC applications can often have the opposite effect, such as generating counterfeit or plagiarized content presented as their own academic work, thereby damaging both the students' and the institutions' academic integrity and ethics.

In response, China's "Academic Degrees Law of the People's Republic of China", enacted in April 2024, explicitly classifies "AI ghostwriting" as an academic misconduct. Individuals found guilty of such practices may have their degrees revoked by the degree-granting institutions following a review by the academic degree evaluation committee. For students' academic achievements, originality remains the most crucial standard for assessing academic prowess, though efficiency and quality are also important considerations. A complete ban on AIGC tools for paper writing could significantly reduce research efficiency, especially for non-original content that requires organization, such as data collection, literature review, outlining, editing, and formatting. Therefore, universities need to provide reasonable guidance and caution students to remain vigilant when using AIGC tools, ensuring the accuracy and rigor of their research.

Furthermore, since AIGC-generated content often relies on existing knowledge systems, there is a risk of research becoming repetitive and redundant, potentially leading students into cognitive biases and inertia that hinder academic exploration and development. Hence, university educators should actively guide students in developing academic depth and critical thinking through classroom instruction.

5. Conclusion

Currently, while AIGC mobile learning terminals have gradually replaced traditional teaching tools, becoming flexible, user-friendly, and real-time learning assistants for higher education faculty and students, universities must carefully consider students' ability to accept and learn new tools and methods. Through a series of measures, institutions should guide students in strengthening their academic ethics and effectively utilizing AIGC tools in their academic practices, thereby helping these new tools become valuable partners in students' mobile, autonomous, and efficient learning.

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