

Research on the Effectiveness of AI Technology Empowering College Students' Self-regulated English Learning

Haiqiang Sun

School of Foreign Languages, Yancheng Teachers University, Yancheng, Jiangsu, 224002, China

ABSTRACT

With the rapid development of artificial intelligence (AI) technology, the traditional English teaching mode is facing profound changes. College students' self-regulated English learning is faced with practical difficulties such as low learning efficiency and untimely feedback. AI technology provides new possibilities for self-regulated English learning through innovative applications such as intelligent speech recognition, adaptive learning systems, and natural language processing. This kind of technological empowerment not only changes the way learning resources are obtained, but also reshapes the cognitive process of learners. The purpose of this study is to explore how AI technology can be deeply integrated into the whole process of college students' self-regulated English learning, build an intelligent and personalized new learning paradigm, and provide theoretical reference and practical guidance for improving the effectiveness of language learning.

KEYWORDS

AI technology; College students; English; Self-regulated learning; Effectiveness

1 Theoretical bases of AI technology empowering self-regulated English learning

The theoretical bases of AI technology empowering English self-regulated learning are mainly derived from constructivist learning theory and adaptive learning theory. Constructivism emphasizes learners' initiative in knowledge construction, and AI technology creates an immersive language environment for students through intelligent dialogue system and situational simulation, so that they can actively construct language knowledge system in real communication scenarios. The adaptive learning theory relies on the algorithm model to dynamically adjust the difficulty and path of the learning content, and the AI system can analyze the learner's language input and output data in real time, accurately identify grammar weaknesses and vocabulary blind spots, and push customized training tasks in a personalized manner. The cognitive load theory guides AI to optimize the way information is presented, and visualizes complex language rules through speech recognition and image recognition technologies to reduce cognitive load. In addition, affective computing technology focuses on learning mood fluctuations and intelligently adjusts task intensity to maintain a positive learning state, which together constitute a scientific support framework for AI-empowered self-regulated English learning.

2 The practical significance of AI technology to empower college students' self-regulated English learning

2.1 Improving learning efficiency and personalized experience

AI technology uses intelligent algorithms to accurately match and push English learning resources, significantly improving learning efficiency^[2]. Based on the learner's language level, learning style, and interest preferences, the AI system can automatically adjust the learning content and difficulty, and customize a personalized learning path for each student. Intelligent speech recognition technology corrects pronunciation errors instantly, and grammar analysis tools flag language errors in real time and provide correction suggestions, making the learning process more efficient and accurate. This personalized, real-time feedback learning model not only saves time searching for resources, but also enables learners to focus on intensive training of their weak areas to maximize learning effectiveness.

2.2 Breaking through the limitations of time and space and promoting self-management

The AI-empowered English learning platform breaks through the time and space limitations of traditional classrooms, allowing students to learn independently through mobile devices anytime, anywhere. The intelligent reminder function helps learners establish stable learning habits, and the learning progress tracking system enables learners to clearly grasp their learning trajectory. The virtual learning community creates an immersive language environment where learners can practice 24-hour conversations with AI or interact with global learners in the community. This flexible and self-regulated learning approach fosters self-management and a sense of lifelong learning, laying a solid foundation for future career

development^[3].

2.3 Mutual benefits between data-driven decision-making and teaching

AI technology has unique advantages in collecting and analyzing learning data, providing a scientific basis for learning effect evaluation. The systematic recording of learning behavior data enables teachers to accurately grasp the overall learning status and individual differences of the class, and adjust teaching strategies in a timely manner. Through visual learning reports, learners can understand their progress and shortcomings, and clarify the direction of their efforts. Big data analysis can also find common difficulties in English learning, and provide reference for the optimization of course content and teaching methods^[4]. This data-driven two-way feedback mechanism realizes the positive interaction between teachers and students, and promotes the continuous improvement of the quality of English education.

3 The current challenges faced by college students in self-regulated English learning

3.1 Insufficient sustainability of learning motivation

At present, the primary challenge of college students' self-regulated English learning is the difficulty in maintaining motivation, and most students only produce short-term learning behaviors under the pressure of exams or credits, and lack the internal motivation to support long-term perseverance. The instant gratification mechanism of smartphone entertainment apps is constantly distracting, resulting in learning behaviors that are easily interrupted by social softwares, short videos, etc. Some students set too high goals and become frustrated because they do not achieve results in the short term, or relax their study plans due to the easing of course pressure. This pattern of intermittent effort makes it difficult for language learning to form an accumulation effect, and eventually falls into the dilemma of "fishing for three days and drying nets for two days", which seriously affects the systematic improvement of English proficiency.

3.2 Difficulties in identifying high-quality learning resources

The information explosion in the Internet era has caused college students to face difficulty in screening high-quality English learning resources. The quality of online English learning materials is uneven, and some resources have problems such as outdated content, improper methods and even knowledge errors^[5]. The fragmented learning content pushed by non-professional platforms often lacks systematization and scientificity, and it is difficult for students to identify resources suitable for their own level. In the face of a large number of free and paid choices, students often fall into the paradox of choice, not only worrying about missing out on high-quality content, but also unable to evaluate the value of resources, and finally randomly select or frequently change learning materials, resulting in a lack of coherence and depth in the learning process, and it is difficult to build a complete knowledge system.

3.3 Improper use of learning strategies

Many college students have the problem of single or inappropriate strategy in self-regulated English learning, relying too much on mechanical memorization of words and ignoring the application of context, resulting in superficial vocabulary mastery. It is difficult to achieve the all-round development of listening, speaking, reading and writing by focusing on the training of test-taking skills and ignoring the cultivation of practical language skills. Some students fail to adapt their learning methods to the characteristics of their language skills, such as using reading comprehension strategies for listening training, or simply applying native language thinking patterns to writing. In addition, the lack of guidance on metacognitive strategies makes it difficult for learners to effectively monitor and evaluate their own progress, and it is impossible to detect and correct ineffective learning behaviors in time, resulting in a serious imbalance between time investment and effect output.

3.4 Digital distraction and attention diversion

The digital distractions caused by the proliferation of smart devices have become a major obstacle to self-regulated English learning, with social media notifications, instant messaging pop-ups, and short video pushes constantly interrupting learning, and students are distracted every 15 to 20 minutes on average. The habit of multitasking leads to scattered cognitive resources. On the surface, multiple activities are carried out at the same time, but in fact it reduces the depth and efficiency of learning^[6]. Some students fall into a vicious circle of learning, attention diversion, guilt, and re-learning, which not only affects the current learning effect, but may also form a long-term attention deficit behavior pattern. Although the generation of digital natives is familiar with technology operations, they lack the awareness and

ability to self-manage the digital environment, and it is difficult for them to maintain a continuous and focused learning state in the fragmented era.

4 The application mechanism of AI technology in self-regulated English learning

4.1 Intelligent voice interaction correction pronunciation mechanism

AI speech recognition technology analyzes the phonemic accuracy, intonation fluency and rhythmic characteristics of learners' pronunciation in real time through the collaborative operation of acoustic models and language models. The system converts learners' speech input into a spectrum map and compares it with the standard pronunciation template in multiple dimensions to accurately locate the specific location and degree of pronunciation deviation. The intelligent feedback mechanism not only flags incorrect phonetic transcriptions, but also visualizes the acoustic differences through a waveform diagram, with demonstration audio and step-by-step guidance to help learners adjust their oral muscle movement patterns. The adaptive training module pushes targeted exercises based on the type of error, such as continuous reading and weak reading training or stress position correction, and optimizes the memory curve through the spaced repetition algorithm. This immersive voice interaction environment effectively breaks through the traditional classroom time limit, allowing learners to polish their pronunciation anytime and anywhere, and gradually build up the voice intuition and expression confidence of native speakers.

4.2 Dynamic planning mechanism for personalized learning paths

The learner portrait system based on machine learning algorithms integrates multi-dimensional data such as vocabulary test, grammar mastery assessment, and four-dimensional ability radar chart of listening, speaking, reading and writing, and establishes a refined ability baseline model. The system uses reinforcement learning technology to dynamically adjust the learning path, automatically inserts a vocabulary reinforcement module when it detects a continuous decline in reading comprehension accuracy, and pushes speech comparison training when it finds difficulty in listening and pronunciation. Knowledge graph technology deconstructs language knowledge points into an interrelated node network, identifies learners' cognitive blind spots and weak links in real time, and intelligently plans the optimal learning sequence. The adaptive recommendation engine comprehensively considers the learning style preference (visual/auditory/kinesthetic), biological rhythm characteristics and daily available time to generate a personalized curriculum and micro-lesson combination to ensure that the learning content not only meets the cognitive load theory but also meets the individualized needs, so as to achieve a true sense of aptitude teaching.

4.3 Contextualized language generation training mechanisms

The AI-driven virtual scenario simulation system uses natural language processing technology to construct highly simulated cross-cultural communication scenarios, such as business negotiations, academic seminars, or travel directions. The built-in multimodal generation model of the system can automatically adapt to the learner's language level and dynamically generate dialogue scripts and task instructions that match the learner's cognitive ability. The language model based on the Transformer architecture analyzes the sentence structure, vocabulary choice and pragmatic strategy output by the learner in real time, and provides instant feedback from the three dimensions of fluency, accuracy and appropriateness. Intelligent error correction not only corrects grammatical errors, but also provides explanations for cultural misuse, such as pointing out inappropriate idioms for specific situations. Contextual training promotes the transformation of language knowledge into communicative skills through role-playing and task-based activities, so that learners can gradually develop cross-cultural sensitivity and language resilience in a safe trial-and-error environment ^[7].

4.4 Big data-driven learning behavior analysis mechanism

The learning behavior tracking system supported by the distributed computing framework records the learner's operation trajectory on the intelligent platform in all dimensions, including multi-level information such as clickstream data, dwell time, modification traces and interaction frequency. The time series database stores months-long learning journey data into an individualized digital twin archive. The association rule mining algorithm identifies high-frequency behavior patterns, such as pre-test surprise learning rhythm or fragmented revision habits. Cluster analysis techniques classify learners with similar behavioral characteristics and discover potential groups of learning strategies. The visual dashboard presents a real-time three-dimensional assessment report of learning engagement, knowledge mastery, and skill transfer, helping teachers accurately locate student groups that need intervention. The predictive analytics module builds a regression model based on historical data, warns of possible learning bottlenecks in advance, provides data

support for personalized tutoring, and realizes the paradigm shift from experience-driven to evidence-driven.

4.5 Cross-modal content understanding enhancement mechanism

The multimodal fusion technology breaks the limitations of traditional text-centrism and builds a three-dimensional learning resource library integrating text, images, audio and video. The computer vision algorithm automatically analyzes scene switching, character expressions and body language in the original English soundtrack movie, and extracts emotional expression clues and non-verbal communication elements. Speech emotion recognition technology analyzes the intonation changes and pauses in speech videos, and reveals the skills of using persuasive language. Knowledge graph technology establishes a semantic association network of cross-media content, and places words in the real context for multi-dimensional interpretation, such as deepening the understanding of lexical connotation and pragmatic color by comparing the differences in the expression of the same event in different news reports. Augmented reality technology superimposes virtual information on physical textbooks, and scanning text illustrations can trigger relevant cultural background explanations or situational dialogue demonstrations, promoting deep learning and enabling the acquisition of language knowledge from a flat to a three-dimensional understanding and from isolated to interconnected concepts.

4.6 Psychological intervention mechanisms supported by affective computing

The emotion AI system monitors the changes in learners' emotional states in real time through multi-modal fusion technologies such as facial expression recognition, speech sentiment analysis and text sentiment mining. The micro-expression capture camera analyzes subtle facial feature changes such as frowning brows and drooping corners of the mouth, the voiceprint feature extraction algorithm detects emotional fluctuation signals with increased speech speed and increased pitch, and natural language processing technology analyzes the frequency of negative words used in learning logs. The affective computing model establishes an emotional state assessment framework based on physiological signals and behavioral data, and automatically triggers psychological intervention strategies when anxiety or depression exceeds the threshold when it is detected. The adaptive learning system then adjusts the task difficulty curve and inserts motivational quotes to motivate or guide mindful breathing exercises to help learners return to optimal learning. Long-term emotion data analysis can also identify individual's unique stress triggers and coping patterns, provide learners with customized emotion management suggestions, and build a positive and healthy digital learning ecosystem. This psychological intervention mechanism supported by affective computing not only focuses on the immediate improvement of learning effect, but also attaches more importance to the cultivation of learners' long-term mental health and sustainable learning ability. By continuously tracking the pattern of emotional changes, the system can help learners build self-awareness and emotional regulation ability, cultivate psychological resilience in the face of challenges, and lay a solid psychological foundation for lifelong learning.

5 Conclusion

AI technology has brought a paradigm change to college students' self-regulated English learning, and its value is not only reflected in the innovation of technical tools, but also in the upgrading of learning concepts. Practice has proved that the rational use of AI technology can effectively improve learners' autonomy and sustainability, but we should also be wary of the cognitive inertia caused by technology dependence. Future research should pay more attention to the optimal balance of human-machine collaboration, and give full play to the enabling role of intelligent technology while maintaining the essence of humanities education. Educators need to actively guide college students to establish scientific self-regulated learning strategies, so that AI technology can truly become a catalyst for improving language skills, and ultimately realize the sustainable development of technology-empowered education.

About the Author

Haiqing Sun, Master's Degree, Associate Professor, research interests: Foreign Linguistics and Applied Linguistics.

References

- [1] Yuan Bingjie. Research on College English Translation Teaching Strategies under New Media Technology [J]. English Teachers, 2024, 24(21): 134-136.
- [2] Sun Zhuo. Discussion on the Application of Modern Information Technology in College English Teaching [J]. East China Science & Technology, 2024, (11): 133-135.
- [3] Zhang Dongxue. Analysis of the Reform Path for Learner-Centered Ideological and Political Education in College Classrooms [J]. Teaching and Research on National Common Language and Characters, 2024, (3): 22-24.
- [4] Tao Xiao, Huang Xiaohong. Reform of Course Design and Teaching Methods for College Business English Integrated with Information Technology [J]. China Multimedia & Network Teaching Journal (First Half of the Month), 2024, (5): 17-20.
- [5] Tao Tingting. Architectural Design of an Intelligent Translation System for College English Teaching Based on Artificial Intelligence Technology [J]. Modern Information Technology, 2024, 8(8): 51, 54 + 59.
- [6] Wang Xiaofang. Mining Ideological and Political Elements in English Major Education under the Background of Information Technology and Case Analysis - A Review of "Research on the Informatization Teaching Reform of College English and the Exploration of Micro-lecture Teaching Mode" [J]. China Sciencepaper, 2022, 17(9): 1064.
- [7] Luo Yuanyuan. An Action Research on the English Autonomous Learning Ability of Tibetan College Students Based on the Flipped Classroom - Taking Lhasa Normal College as an Example [J]. Overseas English, 2023, (12): 210-213.