

A Critical Review of AI-Assisted English Education in Cognitive Rehabilitation

Bona Xiao¹, Jun Cui^{2,*}

¹Liaoning Communication University, Liaoning, China; bonaxiao0822@hotmail.com

²Solbridge International School of Business, Woosong University, Republic of Korea; jcui228@student.solbridge.ac.kr

* Correspondence

Jun Cui
jcui228@student.solbridge.ac.kr

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Abstract

This paper examines the influence of AI-assisted English education on patients, particularly focusing on cognitive development and brain function. With the increasing integration of artificial intelligence in educational settings, AI-driven tools have emerged as effective resources for enhancing language learning experiences. This study highlights how personalized and interactive learning experiences can significantly benefit patients, especially those with language disorders, cognitive impairments, or various neurological conditions. Engaging in structured language learning exercises not only stimulates neuroplasticity but also enhances cognitive flexibility, improves memory retention, and strengthens executive functioning skills. Moreover, our study also discusses specific applications of AI-assisted English education within rehabilitative contexts, emphasizing its potential to facilitate recovery in patients suffering from conditions such as aphasia, cognitive decline, and those recovering from strokes. Furthermore, the research investigates how these AI tools can be tailored to meet the unique needs of individual patients, thereby maximizing their engagement and learning outcomes. While the advantages of AI in education are substantial, the paper also addresses several challenges that can arise, including issues related to access to technology, the potential for over-reliance on digital tools, concerns regarding data privacy, and the variability in individual differences in learning responses. Finally, addressing these challenges is crucial for maximizing the benefits of AI-assisted education inpatient rehabilitation. The findings suggest that AI-assisted English education can play a vital role in enhancing cognitive health and improving recovery outcomes. This warrants further research to explore its long-term effects and effectiveness across diverse patient populations, ultimately contributing to the broader field of cognitive rehabilitation and language learning.

1 Introduction

The integration of artificial intelligence (AI) across various sectors has profoundly transformed traditional practices, and education is no exception. As technology

continues to evolve, the potential for AI to enhance learning experiences and outcomes has garnered significant attention from educators, researchers, and healthcare professionals alike. This paper aims to explore the influence of AI-assisted English education on patients, particularly focusing on cognitive development and brain function. The increasing prevalence of language disorders and cognitive impairments among diverse populations necessitates innovative approaches to education and rehabilitation, making the exploration of AI's role in this context both timely and essential.

Additionally, Language disorders, such as aphasia, dyslexia, and other communication challenges, affect millions of individuals worldwide. These disorders can arise from various causes, including stroke, traumatic brain injury, neurodegenerative diseases, and developmental conditions. The impact of these disorders can be profound, affecting not only the ability to communicate effectively but also influencing cognitive functions such as memory, attention, and problem-solving. Consequently, individuals with language disorders often experience difficulties in social interactions, academic performance, and overall quality of life. As the demand for effective rehabilitation strategies increases, the need for innovative educational tools that cater to these individuals becomes paramount.

AI-driven educational tools offer personalized and interactive learning experiences that can significantly benefit individuals facing these challenges. Unlike traditional educational methods, which often adopt a one-size-fits-all approach, AI technologies can analyze individual learning patterns, preferences, and progress. This adaptability allows for the creation of customized learning paths tailored to each patient's unique needs, thereby enhancing engagement and motivation. For instance, AI algorithms can assess a learner's strengths and weaknesses in language skills and provide targeted exercises that focus on areas requiring improvement. This personalized approach is particularly advantageous for patients with cognitive impairments, as it can lead to more effective learning outcomes and facilitate cognitive recovery.

Moreover, the interactive nature of AI-assisted learning platforms fosters an engaging educational environment. These platforms often incorporate gamification elements, such as quizzes, challenges, and rewards, which can make the learning process more enjoyable. For patients undergoing rehabilitation, maintaining interest and motivation is crucial for successful recovery. The use of AI tools can create immersive and stimulating learning experiences that encourage patients to participate actively in their rehabilitation process. In addition to enhancing language learning, AI-assisted education can also stimulate neuroplasticity—the brain's ability to reorganize itself by forming new neural connections. Engaging in cognitively challenging activities, such as language learning, can promote neuroplasticity, which is essential for cognitive recovery in individuals with brain injuries or disorders. By providing targeted exercises that challenge cognitive functions, AI-assisted education can facilitate the development of new neural pathways, thereby improving overall cognitive function.

Despite the promising potential of AI-assisted English education, it is essential to acknowledge the challenges that accompany the integration of these technologies in rehabilitative contexts. Issues such as access to technology, data privacy concerns, and individual differences in learning responses must be carefully considered to maximize the benefits of AI in education. Addressing these challenges is crucial to ensure that AI-driven educational tools are accessible and effective for all patients, regardless of their backgrounds or circumstances. The integration of AI-assisted English education

presents a unique opportunity to enhance cognitive development and support rehabilitation for patients with language disorders and cognitive impairments. By leveraging personalized, interactive learning experiences, AI technologies can contribute significantly to improving communication skills and overall cognitive function, ultimately leading to better quality of life for individuals facing these challenges. This paper will delve deeper into the specific applications, benefits, and challenges of AI-assisted education inpatient rehabilitation, providing insights into its transformative potential in this critical area.

2 Literature review

2.1 The Role of AI in Education

Artificial intelligence (AI) technologies have significantly transformed the educational landscape, offering innovative solutions that cater to the diverse needs of learners. One of the most notable advancements is the ability of AI to provide tailored learning experiences that adapt to individual requirements. Traditional educational methods often adopt a standardized approach, which may not address the unique challenges faced by each student. In contrast, AI-driven tools utilize sophisticated algorithms to analyze student performance in real time, identifying areas where improvement is needed and offering customized content accordingly.

These AI systems can track various metrics, such as response times, accuracy, and engagement levels, to create a comprehensive profile of each learner. For instance, if a student struggles with specific vocabulary or grammar concepts, the AI can automatically adjust the curriculum to provide additional exercises and resources focused on those areas. This level of personalization is particularly beneficial in language learning, where students may possess varying levels of proficiency and unique learning styles. Some learners may thrive with visual aids, while others may benefit from auditory inputs or interactive simulations. AI technologies can accommodate these differences by offering a range of instructional materials and methods, ensuring that each student receives the support they need to succeed.

Furthermore, AI can facilitate a more engaging learning environment by incorporating gamification elements, such as quizzes, challenges, and rewards. These features not only make the learning process more enjoyable but also encourage students to take an active role in their education. By fostering a sense of achievement and motivation, AI-driven platforms can help learners persist through challenges, ultimately leading to improved language skills and cognitive development. The implications of AI in education extend beyond individual learners to encompass broader educational systems. For instance, educators can leverage AI analytics to gain insights into classroom dynamics and overall student performance. This data-driven approach allows teachers to identify trends, adjust instructional strategies, and allocate resources more effectively. As a result, AI not only enhances the learning experience for students but also empowers educators to make informed decisions that can lead to better educational outcomes.

2.2 Cognitive Function and Neuroplasticity

Cognitive function involves a range of mental processes that are essential for everyday functioning, including memory, attention, problem-solving, and language

skills. These cognitive abilities are crucial for effective communication, learning, and decision-making. Understanding the intricacies of cognitive function is vital, especially when considering the impact of language learning and rehabilitation on individuals with cognitive impairments.

Neuroplasticity, a fundamental concept in neuroscience, refers to the brain's remarkable ability to reorganize itself by forming new neural connections throughout life. This adaptability is particularly pronounced in response to learning experiences and environmental stimuli. Engaging in cognitive activities, such as language learning, can stimulate neuroplasticity, leading to enhanced cognitive function and promoting recovery in individuals with brain injuries or disorders.

Moreover, Research has shown that learning a new language can lead to structural and functional changes in the brain, resulting in improved cognitive abilities. For instance, studies indicate that bilingual individuals often exhibit greater cognitive flexibility, better problem-solving skills, and enhanced memory compared to their monolingual peers. These findings underscore the potential benefits of language learning, not only for communication but also for overall cognitive health. In the context of rehabilitation, harnessing the principles of neuroplasticity is crucial for individuals recovering from cognitive impairments. Engaging patients in language learning activities can provide the necessary cognitive challenges to stimulate brain activity and promote the formation of new neural pathways. By incorporating AI-assisted educational tools into rehabilitation programs, healthcare professionals can create targeted exercises that address specific cognitive deficits, thereby facilitating recovery and improving quality of life.

AI's role in education and the principles of cognitive function and neuroplasticity are interconnected in ways that can significantly benefit individuals facing language disorders and cognitive impairments. By leveraging AI technologies to create personalized, engaging learning experiences, educators and healthcare professionals can foster cognitive development and enhance rehabilitation outcomes, paving the way for improved communication skills and overall cognitive health.

3 AI-Assisted Language Learning

3.1 Personalized Learning Experiences

AI-assisted language learning platforms have revolutionized the way students acquire new languages by utilizing machine learning algorithms to create personalized learning paths tailored to individual needs. This personalized approach is particularly beneficial in the context of language education, where learners often exhibit diverse levels of proficiency, varying learning styles, and unique challenges. By analyzing user data—such as performance metrics, response patterns, and engagement levels—AI systems can identify a learner's strengths and weaknesses, allowing for the development of customized exercises that specifically target areas in need of improvement. For patients with cognitive impairments, the advantages of personalized learning experiences are manifold. Traditional educational methods often fall short in addressing the unique challenges faced by these individuals, leading to frustration and disengagement. In contrast, AI-driven platforms can adapt in real time, ensuring that the content remains relevant and accessible. For example, if a patient

struggles with vocabulary retention, the platform can automatically adjust to provide additional practice with those specific words, reinforcing learning through repetition and varied contextual use.

Moreover, personalized learning experiences can enhance engagement and motivation, which are critical factors in effective language acquisition. When learners see tangible progress and receive immediate feedback tailored to their performance, they are more likely to remain invested in the learning process. This is especially vital for individuals undergoing rehabilitation, as maintaining motivation can significantly influence their recovery trajectory. By offering a learning experience that is responsive to their needs, AI-assisted platforms can help patients feel more empowered and in control of their educational journey.

Additionally, the ability to set personalized goals and track progress over time can further enhance motivation. Many AI platforms provide visual dashboards that allow learners to see their achievements, set milestones, and celebrate successes. This sense of accomplishment can be particularly beneficial for patients who may struggle with self-esteem due to their cognitive challenges. By fostering a positive learning environment, AI-assisted language learning can contribute to improved outcomes and a greater sense of agency among learners.

3.2 Interactive Learning Environments

Interactive learning environments are another hallmark of AI-assisted language learning, fostering engagement and retention by allowing students to participate actively in their educational experiences. These environments often incorporate gamification elements—such as quizzes, challenges, and rewards—that make learning more enjoyable and dynamic. The incorporation of game-like features not only enhances the fun factor but also encourages learners to immerse themselves fully in the language acquisition process. For patients undergoing rehabilitation, the interactive elements of AI-driven platforms can be instrumental in maintaining interest and motivation. Engaging with content through interactive exercises, such as role-playing scenarios, language games, and real-time feedback, can create a stimulating and enjoyable learning atmosphere. This active participation is crucial for successful recovery, as it helps to combat feelings of boredom or frustration that can arise during the rehabilitation process.

Furthermore, interactive learning environments can promote social interaction and collaboration among learners. Many AI platforms allow users to connect with peers or language partners, facilitating communication practice and fostering a sense of community. For patients, this social aspect can be particularly beneficial, as it helps reduce feelings of isolation and encourages the development of social skills alongside language abilities. The use of AI to create adaptive, interactive learning environments also means that the difficulty level of tasks can be adjusted in real time based on the learner's performance. If a patient excels at a particular exercise, the platform can increase the complexity, ensuring that the learner is continually challenged. Conversely, if a patient struggles, the system can provide additional support or simplify tasks to prevent frustration. This level of adaptability ensures that learners remain engaged and motivated, which is essential for effective rehabilitation and cognitive recovery.

Coevally, AI-assisted language learning platforms offer significant advantages

through personalized learning experiences and interactive environments. By tailoring content to individual needs and fostering active engagement, these platforms enhance motivation and retention, ultimately leading to improved language skills and cognitive function. For patients with cognitive impairments, the integration of AI in language education provides a promising avenue for rehabilitation, empowering them to navigate their learning journeys with confidence and success.

4 Applications in Patient Rehabilitation

4.1 Language Disorders

Patients with language disorders, such as aphasia, encounter significant challenges that can profoundly affect their ability to communicate effectively. Aphasia, often resulting from brain injuries such as strokes, manifests in various forms, impacting speech production, comprehension, reading, and writing. Traditional rehabilitation methods may not always provide the tailored support that these patients require. However, AI-assisted English education presents a promising solution through targeted exercises designed to address specific language deficits.

Indeed, AI technologies, particularly those employing speech recognition, can play a crucial role in enhancing communication skills for individuals with language disorders. For instance, platforms equipped with advanced speech recognition capabilities can provide real-time feedback on pronunciation, intonation, and fluency. This immediate feedback loop allows patients to adjust their speech patterns and practice more effectively, thereby improving their speaking skills over time. By offering personalized exercises that focus on specific areas of difficulty—such as word retrieval, sentence structure, or conversational skills—AI tools can create a supportive learning environment that caters to each patient's unique needs. Moreover, AI-assisted platforms can incorporate interactive elements that make language learning engaging and enjoyable. For example, patients may participate in virtual conversations or role-playing scenarios that simulate real-life situations. These activities not only enhance language comprehension and production but also help to build confidence in communication. The gamification of exercises—through points, rewards, and progress tracking—can further motivate patients to practice consistently, which is essential for effective rehabilitation. The adaptability of AI systems also means that exercises can be modified in real time based on the patient's performance. If a patient struggles with a particular task, the platform can simplify it or provide additional support, ensuring that the learning experience remains accessible and encouraging. This personalized approach is vital for patients with language disorders, as it helps them feel empowered in their recovery journey, fostering a sense of achievement and progress.

4.2 Cognitive Impairments

Individuals with cognitive impairments, such as those resulting from strokes, traumatic brain injuries, or neurodegenerative conditions, can face a myriad of challenges that affect their daily functioning and quality of life. Cognitive impairments often impact memory, attention, problem-solving skills, and executive functioning, making it difficult for individuals to engage in meaningful activities.

AI-assisted educational tools offer innovative solutions that promote cognitive rehabilitation through targeted exercises designed to enhance these essential skills.

AI-driven platforms can provide a wide range of cognitive exercises that are tailored to the specific needs of patients. For example, memory games, attention tasks, and problem-solving challenges can be integrated into the learning experience, engaging patients in activities that stimulate cognitive function. These exercises can be designed to gradually increase in complexity, allowing patients to build their skills progressively while maintaining motivation. By engaging patients in meaningful language learning activities, AI can facilitate cognitive recovery and improve overall quality of life.

Furthermore, AI-assisted tools can incorporate elements of personalization that are crucial for effective cognitive rehabilitation. By analyzing user data, these platforms can identify areas where patients may struggle and adapt the exercises accordingly. For instance, if a patient exhibits difficulties with attention, the platform can offer tasks that focus on enhancing concentration and minimizing distractions. This level of customization ensures that rehabilitation efforts are aligned with the individual's specific cognitive profile, resulting in more effective outcomes.

Additionally, the social aspect of AI-assisted learning can play a significant role in cognitive rehabilitation. Many platforms facilitate interaction with peers or language partners, allowing patients to practice their skills in a supportive environment. This social engagement can help reduce feelings of isolation and promote emotional well-being, which is essential for recovery.

AI-assisted educational tools have the potential to significantly enhance rehabilitation outcomes for patients with language disorders and cognitive impairments. By offering targeted exercises that address specific challenges, providing real-time feedback, and fostering engagement through interactive elements, these platforms can empower individuals on their path to recovery. Ultimately, the integration of AI inpatient rehabilitation not only improves language and cognitive skills but also enhances the overall quality of life for individuals facing these challenges.

5 Challenges and Considerations

5.1 Access to Technology

While AI-assisted education offers numerous benefits, access to technology remains a significant barrier for many patients, particularly those from underserved communities. Socioeconomic factors can heavily influence an individual's ability to access the necessary devices, such as tablets or computers, as well as reliable internet connectivity. For patients who may already be facing challenges related to health or cognitive impairments, the added hurdle of technology access can exacerbate existing inequalities in education and rehabilitation. Additionally, The digital divide is a pressing issue that affects various demographics, including low-income families, the elderly, and individuals living in rural areas. These groups may lack the financial resources to purchase devices or may live in regions with inadequate internet infrastructure. As a result, they may be unable to benefit from AI-assisted educational resources, which could otherwise enhance their language learning and cognitive

rehabilitation experiences.

To address these disparities, it is crucial for policymakers, educators, and technology providers to collaborate on initiatives that promote equitable access to technology. This may include providing subsidized devices, expanding internet access in underserved areas, or developing community programs that offer training and support for using AI-driven educational tools. By ensuring that all patients have the opportunity to engage with AI-assisted education, we can work towards a more inclusive approach to language learning and cognitive rehabilitation.

5.2 Data Privacy Concerns

The integration of AI in education raises important questions about data privacy and security. Educational platforms often collect sensitive information about users, including performance data, personal details, and even health-related information in some cases. This data is crucial for personalizing learning experiences and improving educational outcomes, but it also poses significant risks if not handled properly.

Ensuring the protection of this data is essential to maintain user trust and comply with legal regulations, such as the General Data Protection Regulation (GDPR) in Europe or the Health Insurance Portability and Accountability Act (HIPAA) in the United States. Users must be informed about how their data will be collected, used, and stored, and they should have control over their information. Transparency in data practices is vital for building trust between users and educational platforms.

Moreover, educational institutions and technology providers must implement robust security measures to protect user data from breaches and unauthorized access. This includes utilizing encryption, conducting regular security audits, and establishing clear protocols for data handling. By prioritizing data privacy and security, stakeholders can create a safer environment for users, encouraging more individuals to engage with AI-assisted educational tools without fear of compromising their personal information.

5.3 Individual Differences in Learning Responses

Another significant challenge in the implementation of AI-assisted educational tools is the variability in individual responses to these technologies. Not all individuals respond similarly to AI-driven learning experiences, and factors such as age, cognitive ability, and prior experience with technology can greatly influence learning outcomes. For instance, younger learners who are more familiar with technology may adapt quickly to AI-assisted platforms, while older adults or individuals with cognitive impairments may require additional support and training to engage effectively.

Additionally, cognitive differences can affect how individuals process information and interact with learning materials. Some patients may excel in visual learning, while others may benefit more from auditory or kinesthetic approaches. AI systems must be designed with these individual differences in mind to ensure that they provide a truly personalized learning experience.

To address these challenges, it is essential for developers and educators to conduct thorough assessments of learners' needs and preferences before implementing AI-assisted educational programs. This may involve using adaptive learning

technologies that can modify content and delivery based on real-time feedback from users. By recognizing and accommodating individual differences, AI-assisted educational tools can become more effective and inclusive, ultimately improving learning outcomes for a diverse range of patients.

While AI-assisted education holds great promise for enhancing language learning and cognitive rehabilitation, several challenges must be addressed to maximize its potential. Ensuring equitable access to technology, safeguarding data privacy, and accommodating individual differences are critical considerations that stakeholders must prioritize. By tackling these challenges, we can create a more inclusive and effective framework for utilizing AI in education and rehabilitation.

6 Discussion

The emergence of AI-assisted education, particularly in the realm of language learning and cognitive rehabilitation, presents a unique opportunity to transform how patients with language disorders and cognitive impairments engage with educational content. This discussion will delve into the implications of AI technologies in education, explore the potential benefits and challenges, and emphasize the importance of ongoing research and collaboration among stakeholders.

6.1 Potential Benefits of AI-Assisted Education

AI-assisted education offers numerous advantages that can enhance the learning experience for patients with language disorders. One of the most significant benefits is the ability to provide personalized learning experiences. Traditional educational methods often adopt a one-size-fits-all approach, which may not address the unique needs of individuals with cognitive impairments. AI-driven platforms can analyze user data to tailor content, pacing, and instructional methods to suit each learner's strengths and weaknesses. This personalization not only improves engagement but also fosters a sense of ownership over the learning process, motivating patients to actively participate in their rehabilitation.

Furthermore, AI technologies can facilitate immediate feedback, a critical component of effective learning. Immediate feedback allows patients to recognize their mistakes and correct them in real time, reinforcing learning and enhancing retention. This instant response mechanism can be particularly beneficial for individuals with language disorders, as it helps them quickly identify areas for improvement and encourages continuous practice. Additionally, the interactive nature of AI-assisted tools, which often incorporate gamification elements, can make the learning experience more enjoyable and less intimidating, thereby reducing anxiety associated with traditional educational settings.

6.2 Challenges to Address

Despite the potential benefits, several challenges must be navigated to fully realize the advantages of AI-assisted education. Access to technology is one of the most pressing issues. As highlighted earlier, socioeconomic factors can create barriers that prevent certain populations from engaging with AI-driven educational resources. Addressing

this digital divide is essential for ensuring that all patients, regardless of their background, have equal opportunities to benefit from these innovative tools. This may involve initiatives to provide subsidized devices, improve internet connectivity in underserved areas, and develop community-based programs that offer training and support.

Data privacy concerns also warrant careful consideration. The sensitive nature of the information collected by AI educational platforms necessitates stringent data protection measures. Users must be assured that their data will be handled responsibly and securely. Transparency in data practices is crucial for building trust, and educational platforms must comply with legal regulations to protect user privacy. Engaging users in discussions about data usage and providing them with control over their information will foster a sense of security and encourage greater participation in AI-assisted educational initiatives.

Individual differences in learning responses present another challenge. Each patient brings unique cognitive abilities, learning styles, and prior experiences with technology to the educational experience. AI systems must be designed to accommodate these differences, allowing for adaptive learning pathways that respond to real-time feedback. This adaptability is vital for maximizing the effectiveness of AI-assisted education, ensuring that each patient receives the support they need to thrive.

6.3 The Need for Ongoing Research and Collaboration

To harness the full potential of AI-assisted education, ongoing research is essential. Future studies should focus on the long-term effects of AI-driven educational interventions on diverse patient populations. This research will provide valuable insights into the efficacy of various AI tools and their impact on cognitive rehabilitation outcomes. Additionally, collaboration among educators, healthcare professionals, technology developers, and policymakers is crucial for creating a comprehensive framework that addresses the challenges associated with AI-assisted education.

By fostering interdisciplinary partnerships, stakeholders can work together to develop best practices, share resources, and advocate for policies that promote equitable access to technology. This collaborative approach will be instrumental in overcoming barriers and ensuring that AI-assisted education is accessible to all patients, regardless of their circumstances.

7 Conclusion

In summary, AI-assisted education holds great promise for enhancing cognitive function and rehabilitation outcomes for patients with language disorders and cognitive impairments. While the benefits are substantial, addressing challenges related to access, data privacy, and individual learning differences is crucial for maximizing the potential of these technologies. Through ongoing research and collaboration, stakeholders can develop strategies that promote equitable access to AI-assisted educational resources, ultimately improving the lives of individuals facing language and cognitive challenges. By prioritizing these efforts, we can create a more inclusive and effective educational landscape that leverages the power of AI to

support diverse learners in their journey toward recovery and communication proficiency.

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