**РОЛЬ ШТУЧНОГО ІНТЕЛЕКТУ
В НАДАННІ ЛОГОПЕДІЧНИХ ПОСЛУГ**

THE ROLE OF ARTIFICIAL INTELLIGENCE IN PROVIDING SPEECH-LANGUAGE PATHOLOGY SERVICES

Kateryna SURELO,
Student of the First (bachelor's)
Level of Higher Education,
Berdyansk State Pedagogical
University
66, Zhukovsky Str., Zaporizhzhia,
69000, Ukraine

Катерина СУРЕЛО,
здобувачка першого
(бакалаврського) рівня
вищої освіти,
Бердянський державний
педагогічний університет
вул. Жуковського, 66, м. Запоріжжя,
69000, Україна

surelokaterina@gmail.com

Hanna MYTSYK,
Candidate of Sciences in Pedagogy,
Associate Professor,
Associate Professor at the
Department of Applied Psychology
and Speech Therapy,
Berdyansk State Pedagogical
University
66, Zhukovsky Str., Zaporizhzhia,
69000, Ukraine

Ганна МИЦИК,
кандидат педагогічних наук, доцент,
доцент кафедри прикладної
психології та логопедії,
Бердянський державний
педагогічний університет
вул. Жуковського, 66, м. Запоріжжя,
69000, Україна

kolibri07s@ukr.net
https://orcid.org/0000-0002-4989-416X

ABSTRACT
The article focuses on the potentially transformative role of artificial intelligence in providing speech-language pathology services. The research identifies ways to apply generative artificial intelligence tools to optimize the efficiency of speech-language pathology services and improve the quality of life for individuals with speech disorders. Among the most important advantages of using generative artificial intelligence, the authors emphasize the increased accessibility and systematic delivery of speech-language pathology services. This is particularly important in regions with a shortage of speech-language pathologists, as well as for children from single-parent families or families where both parents work full-time, complicating their regular attendance at speech therapy sessions. This issue is also relevant for residents of rural areas, as well as for those living in active combat zones or temporarily occupied territories, where access

to speech-language pathology services and resources may be significantly limited or completely absent. The use of artificial intelligence allows for the practical implementation of a personalized approach to the correction of speech disorders, in particular expanding the capabilities of speech-language pathologists and reducing their workload.

Furthermore, the article discusses the challenges and ethical considerations associated with the use of artificial intelligence in education and healthcare. The authors highlight the need to consider the limitations of artificial intelligence to effectively leverage its advantages while minimizing potential drawbacks. Specifically, the article aims to stimulate interdisciplinary research that would unite experts from various fields to thoroughly explore the impact of artificial intelligence on the correction of speech disorders.

Key words: *artificial intelligence, speech-language pathologists, speech-language pathology services, speech disorders, generative AI tools, ChatGPT.*

Current relevance. Today, we live in the era of digital technologies, which are fundamentally changing all areas of our lives, particularly the fields of education and healthcare. These advancements are revolutionizing the way speech-language pathology services are provided, making them more accessible and systematic than ever before.

As digital technologies continue to evolve, their integration into various domains has opened new horizons for innovation and efficiency. Artificial intelligence (AI), in particular, has demonstrated immense potential in transforming traditional methods and practices within speech-language therapy. Recent studies [2; 3; 11] highlight how AI not only enhances the capabilities of speech-language pathologists but also makes therapy more personalized and effective for patients across all age groups.

A speech-language pathologist (SLPs), as defined by The American Speech-Language-Hearing Association (ASHA), is a professional dedicated to the practice of assessing and treating communication and swallowing disorders across all ages. The breadth of this field includes speech production, fluency, language comprehension and expression, cognitive communication abilities, voice, resonance, hearing, and even related feeding behaviors. SLPs play extremely important role in screening, assessing, evaluating, treating, and monitoring across pediatric (infants, children, adolescents, and young adults), adult, and geriatric clients with speech disorders across various educational and medical settings (e.g., schools, hospitals, and rehabilitation centers) [2].

AI technologies, such as machine learning algorithms and natural language processing tools, offer novel methods for automating routine tasks, analyzing complex data, and providing real-time feedback. Moreover, it enhances diagnostic and treatment accuracy, and ultimately improving patient outcomes. These advancements enable SLPs to provide care that is more personalized, accurate, and accessible, thus optimizing speech-language pathology services delivery and offering numerous benefits to the practitioners themselves.

The purpose of this article is to explore the role of artificial intelligence in providing speech-language pathology services, and to assess its potential benefits for both speech-language pathologists and individuals with speech disorders.

Methods and methodology used in this research included an analysis of scientific literature. This method involved a comprehensive review of existing academic papers, journals, and other relevant publications that focus on the integration of artificial intelligence in speech-language pathology. The purpose of this literature review was to gather, evaluate, and synthesize prior research findings to build a foundational understanding of the topic. This analysis helped identify trends, gaps, and consensus in the current research landscape, providing a critical evaluation of how artificial intelligence has been previously applied and studied in this field.

Results and Discussions. SLPs typically focus on either expressive language (e.g., using words in sentences to express ideas) or receptive language (e.g., understanding ideas expressed in words) [2]. They use various therapy materials, such as printed pictures or words on flashcards, to target language production at levels ranging from individual words to full conversations, and games to address various communication functions (e.g., questioning, answering, commenting). Digital tools that utilize artificial intelligence can assist in the development of such materials. ChatGPT is one of these tools. In this context, we will explore its potential uses in the paid version.

It can create therapy materials for developing vocabulary, narrative skills, language comprehension, literacy, and bilingual therapy, and/or simulate human-like communication (including grammar, syntax, pragmatics, and cultural competence). These features can provide clients, including those with autism, with a low-pressure communication environment without direct human interaction [2].

ChatGPT, along with other generative AI tools like DALL-E, can create unique, high-quality drawings for various client categories. These tools can generate individualized materials that better match the developmental level and interests of different age groups. For example, DALL-E can create specific illustrations for stories or exercises designed for younger children, incorporating characters and scenes that resonate with their experiences and preferences. For older children or adults, it can produce more sophisticated visual aids that align with their cognitive level and therapy goals.

Furthermore, SLPs can quickly update educational materials. For example, if visual materials need to be revised, this can be accomplished much faster and at a lower cost than with manual methods. Although the internet offers a vast array of images suitable for nearly any purpose, these images may not always capture the specific ideas envisioned by the SLPs,

accurately represent the scenes of a written story, or align with what the child might imagine. Generative AI tools, such as ChatGPT, can bridge this gap by creating highly specific and tailored visuals that perfectly complement the materials and align with the SLPs' vision. It should be noted, however, that ChatGPT is not the only AI-powered language model capable of assisting SLPs in creating the precise materials needed for speech therapy sessions; there are other generative image tools available, such as Leonardo.AI, Playground.AI, Midjourney, and GitHub Copilot, among others.

Additionally, ChatGPT can be a valuable asset in various aspects of speech therapy. It is capable of generating age-appropriate instructions tailored to the developmental levels of young children, enabling SLPs to communicate more effectively with their target audience. ChatGPT can also create diverse and engaging stories about fictional characters in seconds, providing personalized narratives for speech therapy sessions. Furthermore, it assists in the development of class or lesson plans by offering structured and creative activities that meet the specific needs of children.

In the context of the pandemic, as mentioned H. Qin the shift to remote learning presented unique challenges for school-aged children, particularly those in critical stages of phonological development [10]. With children staying at home, traditional methods for monitoring and supporting speech and language development were disrupted, often leaving emerging issues unnoticed. Even when these issues were identified, the high costs associated with therapy and the shortage of SLPs made timely and effective intervention difficult. As elementary students progress from «learning to read» to «reading to learn», undetected or unresolved speech and language difficulties can have long-term educational impacts [10].

AI offers significant potential to address these challenges by enhancing the accessibility and effectiveness of speech-language therapy. AI allows clients to practice their communication skills outside of speech therapy sessions, thereby enhancing their abilities [2]. This is especially important for children or adults from single-parent families or families where both parents work full-time, complicating their regular attendance at speech therapy sessions [7]. The situation is even more challenging for residents of rural areas [6], as well as those living in active conflict zones or regions under temporary occupation, where access to speech-language pathology services and resources is severely limited or nonexistent. This is currently a pressing reality for many children in Ukraine [1].

Researchers also note that using ChatGPT can reduce the workload on SLPs by providing specific examples for collaborating with parents and teachers, adapting reading materials, and developing progress monitoring assessments [3]. Additionally, studies have evaluated how ChatGPT can help people with aphasia identify the words they intend to say, demonstrating

its potential to support language recovery and communication skills [9]. Furthermore, A. Zhang et al. highlight significant advancements in the use of machine learning algorithms, a type of AI, to detect hypernasal speech and assess hypernasality in patients with cleft palate [11]. Their systematic review demonstrates that AI and ML algorithms can achieve a high level of agreement with evaluations conducted by SLPs.

While AI offers considerable potential, it should be approached with caution, as is the case with any new technology. There are several important limitations that must be taken into account. For instance, ChatGPT's generated content, while often impressive, can sometimes include inaccuracies or ambiguities, which could lead to misinformation if not carefully monitored by SLPs. The effectiveness of AI systems heavily depends on the quality and diversity of the data they are trained on. Biases present in training data can lead to biased outputs, which is a significant concern for SLPs. Ensuring that AI systems are trained on diverse and representative datasets is essential to minimize bias and improve the accuracy and relevance of their responses. Additionally, AI-generated responses can sometimes be irrelevant or inappropriate due to a lack of deep contextual understanding. AI does not possess subjective experiences or emotions, which limits its ability to truly connect with clients on an emotional level [8]. Moreover, the ethical implications of using AI in therapy cannot be overlooked [8]. Issues of privacy, data security, and the potential misuse of AI-generated content pose serious concerns that must be addressed. As the field continues to evolve, it is imperative that practitioners remain vigilant and critical of these tools, ensuring that their integration enhances rather than diminishes the quality of speech-language pathology services.

While AI-generated art can be visually striking, it often lacks the emotional and conceptual depth found in human-created art. AI generative image tools often make logical errors, such as poorly detailed fingers in the images (Fig. 1b), extra body parts or omitting necessary ones. The presence of snow in a room with a closed window (Fig. 1b), a huge apple (Fig. 2a), and a seamstress's hand pierced by a sewing machine needle (Fig. 1a) highlights logical errors and the limitations in the AI's understanding of real-world objects and their functions. The images can also suffer from asymmetrical objects and nonsensical text (Fig. 2a), further emphasizing the limitations in detail and context comprehension by AI.

a)   *b)*
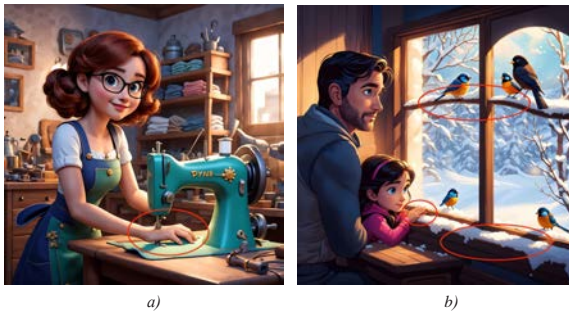
Fig. 1. The logic errors of AI image generators

Furthermore, AI sometimes struggles with simplicity. For example, when asked for a simple flat vector illustration, AI may produce a complex artwork instead. These errors highlight the challenges in creating abstract art, which is typically formless and unique, and the limitations in the AI's ability to accurately interpret and replicate simplistic designs.

a)   *b)*

Fig. 2. The logic errors of AI image generators

Among the limitations, it is important to recognize that incorporating AI into speech therapy necessitates substantial resources, including training for SLPs, infrastructure to support AI technologies, and ongoing technical support. SLPs need to have a sufficient level of digital competence to confidently and critically utilize AI tools in alignment with their professional responsibilities and objectives. This requires higher education institutions to prepare for this integration by enhancing digital competence, offering practical training in relevant scenarios, and ensuring that SLPs are well-equipped to effectively use AI in their practice [4; 5].

Conclusion. In summary, AI systems are best regarded as supplementary tools that enhance, rather than replace, the critically essential work of speech-language pathologists. SLPs play an indispensable role in delivering personalized care, understanding each client's unique circumstances, and providing empathetic support. While AI and other tools present exciting opportunities for creating visual materials for children and aiding speech therapy sessions, it is crucial to use these technologies judiciously. Recognizing their limitations allows for the effective utilization of their advantages while addressing potential drawbacks. By adopting this balanced approach, we can ensure that AI-enhanced tools are beneficial in screening, assessing, evaluating, treating, and monitoring.

Bibliography

1. Мицик Г. М., Гусак А. А., Черепанова А. С. Щодо формування у здобувачів спеціальності 016 Спеціальна освіта практичних навичок організації корекційно-розвиткової роботи під час дистанційного навчання. *Наукові записки Бердянського державного педагогічного університету. Серія: Педагогічні науки: зб. наук. пр. Вип. 3.* Бердянськ: БДПУ. 2022. С. 80–91. DOI: 10.31494/2412-9208-2022-1-3-80-91

2. Du Y., Juefei-Xu F. Generative AI for Therapy? Opportunities and Barriers for ChatGPT in Speech-Language Therapy. 2023. URL: https://openreview.net/pdf/d71591f5 d16f8658962344f73065cc3a9a420c49.pdf (дата звернення: 04.06.2024).

3. Goldman S. R., Taylor J., Carreon A., Smith S. J. Using AI to Support Special Education Teacher Workload. *Journal of Special Education Technology*. 2024. 10.1177/01626434241257240

4. Mytsyk H. Utilizing the opportunities provided by the educational and speech therapy laboratory in the formation and development of future special education teachers' digital competence. Correction and rehabilitation innovations: implementation of European experience: Scientific monograph. Riga, Latvia: «Baltija Publishing». 2023. P. 175–200. https://doi.org/10.30525/978-9934-26-325-5-11

5. Mytsyk H. M., Pryshliak M. I. Using the potential of student self-management in the formation and enhancement of the digital competence of future teachers of special education. *Information Technologies and Learning Tools*. 2022. Vol. 91. Issue 5. P. 145–157. https://doi.org/10.33407/itlt.v91i5.5052

6. Mytsyk H., Pryshliak M. Telepractice in the System of Providing Correctional and Developmental Services to Children with Speech Disorders: Interaction at a Distance. *Journal of History Culture and Art Research*. 2020. Vol. 9. Issue 3. P. 94–105. doi: http://dx.doi.org/10.7596/taksad.v9i3.2674

7. O'Callaghan A. M., McAllister L., Wilson L. Barriers to accessing rural paediatric speech pathology services: Health care consumers' perspectives. *Australian Journal of Rural Health*. 2005. Vol. 13. Issue 3. P. 162–171.https://doi.org/10.1111/j.1440-1854.2005.00686.x

8. Privitera A. J, Ng S.H.S., Kong AP-H, Weekes B.S. AI and Aphasia in the Digital Age: A Critical Review. *Brain Sciences*. 2024. Vol. 14. Issue 4. Article 383. https://doi.org/10.3390/brainsci14040383

9. Purohit A. K., Upadhyaya A., Holzer A. Chatgpt in healthcare: Exploring ai chatbot for spontaneous word retrieval in aphasia. In *Companion Publication of the 2023 Conference on Computer Supported Cooperative Work and Social Computing* (pp. 1–5). 2023.

10. Qin, H. (2024, May). Generative AI Applications in Helping Children with Speech Language Issues. In *Proceedings of the AAAI Symposium Series* (Vol. 3, № 1, pp. 399–400).

11. Zhang A, Pyon RE, Chen K, Lin AY. Speech Analysis of Patients with Cleft Palate Using Artificial Intelligence Techniques: A Systematic Review. *FACE*. 2023. Vol. 4. Issue 3. P. 327–337. doi:10.1177/27325016231187985

References

1. Mytsyk, H. M., Husak, A. A., & Cherepanova, A. S. (2022). Shchodo formuvannia u zdobuvachiv spetsialnosti 016 Spetsialna osvita praktychnykh navykiv orhanizatsii korektsiino-rozvytkovoi roboty pid chas dystantsiinoho navchannia [About developing of students of specialty 016 Special education practical skills in the organization of correctional and developmental work during distance education]. *Naukovi zapysky Berdianskoho derzhavnoho pedahohichnoho universytetu. Seriia: Pedahohichni nauky*, 3, 80–91 [in Ukrainian].

2. Du, Y., & Juefei-Xu, F. (2023). Generative AI for Therapy? Opportunities and Barriers for ChatGPT in Speech-Language Therapy. Retrieved from: https://openreview.net/pdf/d71591f5d16f8658962344f73065cc3a9a420c49.pdf

3. Goldman, S. R., Taylor, J., Carreon, A., & Smith, S. J. (2024). Using AI to Support Special Education Teacher Workload. *Journal of Special Education Technology*, 10.1177/01626434241257240

4. Mytsyk H. (2023). Utilizing the opportunities provided by the educational and speech therapy laboratory in the formation and development of future special education teachers' digital competence. Correction and rehabilitation innovations: implementation of European experience: Scientific monograph. Riga, Latvia: «Baltija Publishing». P. 175–200. https://doi.org/10.30525/978-9934-26-325-5-11

5. Mytsyk H. M., & Pryshliak M. I. (2022). Using the potential of student self-management in the formation and enhancement of the digital competence of future teachers of special education. *Information Technologies and Learning Tools*, 91(5), 145–157. https://doi.org/10.33407/itlt.v91i5.5052

6. Mytsyk, A., & Pryshliak, M. (2020). Telepractice in the system of providing correctional and developmental services to children with speech disorders: interaction at a distance. *Journal of History Culture and Art Research*, *9*(3), 94–105. doi: http://dx.doi.org/10.7596/taksad.v9i3.2674

7. O'Callaghan, A. M., McAllister, L., & Wilson, L. (2005). Barriers to accessing rural paediatric speech pathology services: Health care consumers' perspectives. *Australian Journal of Rural Health*, *13*(3), 162–171. https://doi.org/10.1111/j.1440-1854.2005.00686.x

8. Privitera, A. J., Ng, S. H. S., Kong, A. P. H., & Weekes, B. S. (2024). AI and Aphasia in the Digital Age: A Critical Review. *Brain Sciences*, *14*(4), 383. https://doi.org/10.3390/brainsci14040383

9. Purohit, A. K., Upadhyaya, A., & Holzer, A. (2023, October). Chatgpt in healthcare: Exploring ai chatbot for spontaneous word retrieval in aphasia. In *Companion Publication of the 2023 Conference on Computer Supported Cooperative Work and Social Computing* (pp. 1–5). https://doi.org/10.1145/3584931.3606993

10. Qin, H. (2024, May). Generative AI Applications in Helping Children with Speech Language Issues. In *Proceedings of the AAAI Symposium Series* (Vol. 3, No. 1, pp. 399–400).

11. Zhang, A., Pyon, R. E., Chen, K., & Lin, A. Y. (2023). Speech Analysis of Patients with Cleft Palate Using Artificial Intelligence Techniques: A Systematic Review. *FACE*, *4*(3), 327–337. doi:10.1177/27325016231187985

АНОТАЦІЯ

У статті акцентовано увагу на зростаючу роль штучного інтелекту в наданні логопедичних послуг. Дослідження визначає шляхи застосування генеративних інструментів штучного інтелекту для оптимізації ефективності логопедичних послуг та покращення якості життя осіб із порушеннями мовлення. Серед найважливіших переваг застосування генеративного штучного інтелекту автори наголошують на підвищенні доступності та систематичності отримання логопедичних послуг. Це особливо важливо в регіонах із дефіцитом логопедів, а також для дітей із неповних сімей або з сімей, де обоє батьків працюють повний робочий день, що ускладнює їхнє регулярне відвідування логопедичних занять. Ця проблема є актуальною для мешканців сільської місцевості, а також для осіб, які проживають у зонах активних бойових дій чи тимчасово окупованих територіях, де доступ до логопедичних послуг і ресурсів може бути значно обмеженим або повністю відсутнім. Використання штучного інтелекту дозволяє на практиці реалізувати індивідуальний підхід до корекції мовленнєвих порушень, зокрема розширює можливості логопедів та знижує їхнє робоче навантаження.

Окрім того, у статті обговорюються проблеми та етичні аспекти, пов'язані з використанням штучного інтелекту у сферах освіти та охорони здоров'я. Автори підкреслюють необхідність врахування обмежень штучного інтелекту для ефективного використання його переваг при одночасній мінімізації потенційних недоліків. Зокрема, стаття має на меті стимулювати проведення міждисциплінарних досліджень, які б об'єднували фахівців різних галузей, щоб забезпечити повноцінне вивчення впливу штучного інтелекту на корекцію мовленнєвих порушень.

Ключові слова: штучний інтелект, логопеди, логопедичні послуги, мовленнєві порушення, генеративні інструменти штучного інтелекту, ChatGPT.