

The Role of AI in Supporting Dyslexic Students in the Language Classroom

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KLJUČNE BESEDE: disleksija, umetna inteligenca, učenje jezikov, inkluzivno izobraževanje

POVZETEK – Ta kvalitativna raziskava raziskuje transformativni potencial umetne inteligence (AI) pri izboljšanju učenja jezikov za učence z disleksijo. Da bi to dosegli, se s študijo poglobimo v obstoječo literaturo, da bi razumeli izzive, s katerimi se soočajo učenci z disleksijo, in prihajajočo vlogo AI pri reševanju teh izzivov. Nato prispevek poudarja tri inovativne načine, kako se lahko AI vključi v jezikovno učilnico za podporo učencem z disleksijo: (1) AI kot pomočnik pri pisanju, ki uporablja kontekstne namige za pomoč pri lektoriranju in izboljšanju pisanja učencev; (2) AI kot pomočnik pri pretvarjanju besedila v govor, ki zagotavlja slušno podporo pri nalogah branja in razumevanja; in (3) AI kot orodje za vadbo ciljnega besedišča, kjer AI ustvarja prilagojene vaje, ki učencem omogočajo obvladovanje ključnega besedišča. Vsak predlog je natančno preučen glede na njegove praktične posledice, koristi in morebitne omejitve, kar zagotavlja uravnotežen pogled na integracijo AI v izobraževalnih okoljih. Članek želi prispevati k diskurzu o tehnologiji kot načinu za doseganje boljšega učnega okolja za študente z disleksijo.

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ABSTRACT – The qualitative paper explores the transformative potential of artificial intelligence (AI) in enhancing language learning for students with dyslexia. To do so, the study delves into existing literature to understand the unique challenges faced by dyslexic learners and the upcoming role of AI in addressing these challenges. Then, the paper highlights three innovative ways AI can be integrated into the language classroom to support dyslexic students: (1) AI as a writing helper, utilizing context clues to assist in proofreading and refining student writing; (2) AI as a text-to-speech assistant, providing auditory support for reading and comprehension tasks; and (3) AI as a tool to practice target vocabulary, where AI generates personalized exercises enabling students to master key vocabulary. Each suggestion is scrutinized for its practical implications, benefits, and potential limitations, providing a balanced perspective on the integration of AI in educational settings. The paper aims to contribute to the discourse on technology as a way to achieve a better learning environment for students with dyslexia.

1 Introduction

Dyslexia poses significant challenges in the acquisition of language-related skills, impacting students' entire educational journey, as well as the learning of foreign languages. Since the very emergence of the term (initially coined as "word blindness" in Hinshelwood, 1917) over a century ago, through research into neuropsychological cases (e.g., Snowling & Hulme, 1989), to modern research into dyslexia across different languages (Miles, 2000) and the association between dyslexia and internalized problems (Francis et al., 2019), the very core of dyslexia remains true: dyslexia is a difficulty to learn how to decode (read) and how to write/spell. It is important to note in this regard that throughout history, researchers have posed different definitions for dyslexia. In Vel-

lutino et al.'s views (2004) dyslexia is a reading disability only, with dysgraphia being its writing manifestation (Romani et al., 1999). Still, this research follows the standard definition posed by the World Health Organization (1993) which classifies dyslexia as a challenge encompassing both reading and spelling.

Dyslexia nowadays is a widespread issue. According to the International Dyslexia Association (2011) 15–20% of the global population has some sort of a language-based learning disability; with 70–80% of those individuals likely being dyslexic.

The inherent difficulties with phonemic awareness, linguistic information retrieval and processing, working memory, and stabilizing sound-symbol relationships in one's native language are mirrored and often magnified when learning a foreign language (Simon, 2000).

As such, dyslexia complicates not just literacy development but also the mastery of new languages. As foreign language learning becomes increasingly important in today's globalized societies, understanding the link between dyslexia and second language acquisition becomes even more significant. According to Schneider (2009, p. 299) even subtle language processing issues will, "resurface when learning a foreign language". This, according to him, combined with the anxiety many dyslexic students feel when faced with yet another language to decode, may pose a noteworthy problem that needs to be addressed thoughtfully.

Information and communication technology plays a pivotal role in modern education, particularly within classroom settings. ICT not only facilitates the acquisition and dissemination of knowledge through digital tools and resources but also enhances the interactive dynamics of the learning environment (Erjavec, 2012). By integrating technologies such as virtual labs, digital simulations, and online collaboration platforms, ICT empowers students to engage with complex scientific concepts in a more intuitive and accessible manner (Ruzić Baf, 2022). Furthermore, ICT supports the development of critical thinking and problem-solving skills by providing students with real-time data and the tools to analyze it (Harl, 2021). Thus, ICT is indispensable in fostering an educational atmosphere that is both informative and transformative, adequately preparing students for the challenges of the modern scientific landscape.

As education continues to evolve, teachers worldwide have started to harness technology's power to help their dyslexic students. Incorporating ICT into one's teaching practices, when teaching students with dyslexia, has shown promising outcomes, particularly in enhancing written language skills. Assistive technologies like text-to-speech and speech-to-text have not only facilitated immediate learning tasks but also contributed to the development of long-term, meaningful strategies for managing dyslexia (Almgren Bäck et al., 2023). By addressing the unique challenges dyslexic students face, these technologies help foster a more inclusive educational setting overall.

The advent of AI in education seems to announce a new era of intelligent cognition, where AI systems can mimic human brain processes, offering personalized and responsive learning support (Wang et al., 2023). For individuals with dyslexia, AI's potential lies in its capacity to provide a scaffold upon which information can be understood, cross-checked, and elaborated upon, offering a personalized approach to learning and understanding (Derbyshire, 2023). Moreover, the integration of AI in educational settings for dyslexic students could lead to broader benefits, such as improved men-

tal wellbeing and enhanced academic engagement. Research indicates that dyslexia is often associated with increased anxiety, which can adversely affect academic performance. AI, as a form of assistive technology, can offer a supportive layer in the learning environment, potentially mitigating these challenges and promoting a more inclusive educational experience (Hossain et al., 2021; Pontikas et al., 2022).

AI can also foster superb text-to-speech integration, targeting the phonological challenges associated with dyslexia, as explored in a plethora of prominent research. Harm and Seidenberg (1999) highlight the intricate connection between phonology and reading acquisition, suggesting that understanding these mechanisms can provide insights into dyslexia. Moreover, Hulme et al. (2012) emphasize the significant, causal role of phoneme awareness and letter-sound knowledge in reading proficiency. These studies emphasize the importance of phonology in reading, positioning AI-driven text-to-speech as a vital tool in bridging the gaps in phonological processing for students with dyslexia in the language classroom.

To harness AI's potential to help dyslexic students, Wang et al. (2022) propose an AI-based Augmentative Alternative Communication (AI-A 2 C) model for dyslexic students, which uses a hybrid AI classifier to provide the most appropriate pictograms for effective learning and reading. According to their findings, the model can improve the academic skills and social interactions of dyslexic students by reducing the time and effort required for communication. Gilbert et al. (2023) emphasize another use for AI in this regard: using AI to produce a highly-readable font for dyslexic people. Their project uses a generative adversarial network (GAN) to create a novel font that is highly readable by people with dyslexia, as predicted by the neural network model. Spoon et al. (2019) discuss the potential use of AI in detecting dyslexia in children. They address the need for earlier, easier, and less costly detection of dyslexia, and use AI to analyze a set of 56 photos of handwriting samples from grades K-6 for signs of dyslexia. Although the model boasts high 77.6% accuracy, they emphasize the potential dangers of this technology, such as false negatives. Botchu et al. (2023) discuss the use of the ChatGPT model to help students with dyslexia and find it can indeed be used to empower them in diverse learning environments.

Overall, these papers provide valuable insights into dyslexia and artificial intelligence and how these fields intertwine.

2 Methodology

This qualitative study presents an innovative proposition, postulating three ways to implement AI with the goal of supporting dyslexic students in the language classroom: AI as a writing helper, AI as a text-to-speech assistant, and AI as a tool to practice target vocabulary.

The study acknowledges the limitations inherent in qualitative research, including the subjective interpretation of data and potential bias in selecting and reviewing literature. Additionally, while these AI applications are proposed with the intent to support dyslexic learners, we acknowledge the conceptual nature of these suggestions. Actual

implementation and effectiveness can vary widely based on numerous factors including technological constraints, individual learner differences, and the educational context. Despite these limitations, we believe that the proposed AI applications hold significant potential to support dyslexic students and can inspire further research and practical implementation of AI technologies, contributing to educational strategies tailored to the needs of dyslexic learners in the foreign language classroom.

The authors declare that there is no conflict of interest regarding the publication of this paper.

3 Results & Discussion

In the following paragraphs, we synthesize and discuss the implications of the proposed AI applications, considering current educational trends, students' needs, and technological advancements.

AI as a Writing Helper

According to Hebert et al. (2018), “the writing difficulties of students with dyslexia can be partially attributed to their reading difficulties and can manifest in many ways in their writing, such as poor spelling, poor legibility, lack of diverse vocabulary, poor idea development, and/or lack of organization.” These difficulties are the main reason we consider the opportunity to implement AI and AI models.

AI models like ChatGPT excel beyond basic spell checks by understanding and generating context-rich text, assisting not only with spelling but with grammar, and providing stylistic suggestions, thus offering comprehensive writing support. Simple spell-checkers fail to grasp wider context, while ChatGPT is trained to consider larger amounts of textual data. Its ability to offer real-time, context-aware suggestions elevates the quality of students' writing, ultimately enhancing their foreign language skills. ChatGPT can suggest synonyms, ways to enhance arguments and ideas, and tips to improve writing structure, all based on individualized, user-inserted data. This, in turn, helps students with dyslexia beyond simple spelling issues. This is particularly important in foreign language learning settings where dyslexic students may struggle with more than just mere spelling due to limited knowledge of English. Yet, although AI can be useful in this regard, some researchers emphasize the importance of integrating such tools in the classroom thoughtfully, ensuring they complement traditional learning methods (such as teacher's error correction) rather than completely replacing them (Imran et al., 2023).

AI as a Text-to-Speech Assistant

AI as a text-to-speech (TTS) assistant significantly enhances the learning experience of dyslexic students by providing auditory access to written content. This technology effectively bridges the gap between written text and comprehension, accommodat-

ing the unique learning styles of individuals with dyslexia. It not only facilitates the decoding process by converting text into speech but also enables students to engage with the material at their own pace. The multisensory approach of TTS tools aids in improving word recognition, enhancing vocabulary, and fostering a deeper understanding of the text, making learning more inclusive and accessible.

ChatGPT in particular can help in numerous ways. In the classroom, it can read aloud textbooks, articles, and assignments, ensuring that dyslexic students can access and comprehend written content effectively. During exams or assessments, ChatGPT can assist by orally presenting questions and instructions, mitigating reading-related stress. During at-home, self-study, ChatGPT can help convert digital materials, such as e-books and web articles, into spoken format, enabling independent learning. Providing such auditory output, the model can aid phonemic awareness, which correlates to the findings of Harm et al. (1999) and Humle et al. (2012).

It is also important to note that TTS has been shown to help students with reading difficulties. Keelor et al. (2023), for instance, found that TTS tools significantly help students aged 8 to 12 to read and comprehend the given material better, compared to students who read with no TTS support. Bonifacci et al. (2021) found that TTS helps with mind-wandering in dyslexic students while Wood et al. (2017) compared TTS tools with oral read-alouds and found that they show similar results. TTS would also be beneficial for foreign language learners as they would be able to hear the correct pronunciation of words in their text material. This is particularly important for students learning English as a foreign language as English does not follow phonetic pronunciation rules.

Furthermore, modern TTS software offers an abundance of options: voice options, personalized pronunciation settings, generation of synthetic audio files, and additional supportive tools like text highlighting (Peters & Bell, 2007). As such, TTS software can help students decode texts faster and better. Because, ultimately, without mastery of lower-level decoding skills students will not know how to use higher-level language skills to understand text on a deeper level (Cain, 2004).

AI as a Tool to Practice Target Vocabulary

Numerous dyslexic students struggle with proper vocabulary retention as they have difficulties with reading and writing target lexical items. To help them learn and practice target vocabulary, AI-powered systems can intelligently craft exercises that are tailored to each student's learning curve, curriculum, and preferences.

This personalized methodology ensures that vocabulary learning will not only be effective but also genuinely engaging. Moreover, AI's capability to analyze individual learning patterns and adapt accordingly means that each student receives a unique learning experience, maximizing the potential for vocabulary retention. The interactive nature of AI-driven exercises fosters a deeper connection with the language, turning vocabulary practice from a mundane task into an interactive, enriching experience. As students interact with these smart systems, they are not just memorizing words; they are immersing themselves in the language, understanding nuances, and developing a richer, better command over it.

ChatGPT, as one such easily-available AI model, can generate a variety of vocabulary exercises tailored to the specific needs of dyslexic students. For instance, once given the foreign language lexical goals, it can create interactive flashcards with audio pronunciations, helping students associate the written word with its correct pronunciation; formulate contextual sentences where target vocabulary words are used, aiding students in understanding how these words are employed in real-life scenarios; and generate crossword puzzles or word searches using the target vocabulary, making learning engaging and game-like. Such an engaging approach would certainly be beneficial for dyslexic students, while we also think that non-dyslexic students would also welcome this novel approach in vocabulary practice in the foreign language classroom.

4 Conclusion

Through a systematic examination of three innovative AI applications – AI as a writing helper, AI as a text-to-speech (TTS) assistant, and AI as a tool to practice target vocabulary – this study has hopefully provided some insights into the potential of these novel technologies to revolutionize education for dyslexic learners. While acknowledging the limitations, it is evident that AI, particularly ChatGPT, holds promise in providing tailored assistance, fostering inclusivity, and enhancing the foreign language learning experience for dyslexic students. Yet, AI requires thoughtful integration into the language classroom as its best role is a complementary one alongside traditional language teaching methods.

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Vloga umetne inteligence pri podpori učencem z disleksijo, ki se učijo tujega jezika

Ta kvalitativni raziskovalni članek z naslovom Vloga umetne inteligence pri podpori študentom z disleksijo raziskuje transformativni potencial umetne inteligence (AI) v jezikovni učilnici, zlasti za učence z disleksijo.

Jezikovne učilnice lahko na splošno predstavljajo veliko ovir za študente z disleksijo. Medtem ko imajo ti učenci močno kritično mišljenje in dobre ustne komunikacijske sposobnosti, so lahko ključni elementi učenja tujega ali drugega jezika – branje, pisanje in obvladovanje besedišča – pomembna ovira. Koren teh izzivov je pogosto v fonološki obdelavi, sposobnosti možganov, da prepoznajo in manipulirajo z zvoki, ki sestavljajo besede. Slabosti na tem področju lahko študentom z disleksijo otežijo povezovanje črk z ustreznimi glasovi in obratno, kar vodi do težav s tekočim branjem, natančnostjo črkovanja in razvojem besedišča. Poleg tega jim lahko težave s kratkoročnim spominom otežijo ohranjanje novih besed in slovničnih struktur, ki so v govorjenem jeziku hitro predstavljene.

Posledično se učenci z disleksijo v jezikovnem razredu soočajo s številnimi izzivi pri branju, črkovanju in pisanju. Ti izzivi postanejo še posebej očitni, ko poskušajo obvladati

tuje, nefonetične jezike, kot je angleščina. Tuji jeziki postajajo v današnjih globaliziranih družbah vedno bolj pomembni. Tako se učenci v državah, kot je Severna Makedonija, začnejo učiti tujega jezika že na začetku osnovnega izobraževanja – v 1. razredu. Učijo se angleščine skozi celotno (obvezno) izobraževalno pot, večina pa se angleščine uči celo na nekaterih fakultetah. Zaradi poudarka na usvajanju tujega jezika postaja razumevanje povezave med disleksijo in usvajanjem drugega jezika še toliko pomembnejše.

Disleksija kot učna težava močno otežuje pridobivanje jezikovnih veščin. Kot je bilo že omenjeno, ne vpliva samo na pismenost maternega jezika, temveč tudi na učenje tujih jezikov. Zgodovinske in sodobne raziskave so disleksijo opredelile kot težavo pri dekodiranju (branju) in kodiranju (pisanju/črkovanju), pri čemer je ocenjeno, da neko obliko motenj pri učenju jezika doživi 15–20% svetovnega prebivalstva. Skozi leta so bili uporabljeni različni pristopi za obravnavo disleksije in pomoč učencem z disleksijo. Z izvajanjem posebnih strategij je učiteljem uspelo ustvariti bolj vključujoče in podporno okolje za svoje učence z disleksijo. Zagotavljajo individualiziran pouk, prilagojen učenčevim specifičnim potrebam, pri pouku pa uporabljajo tudi informacijsko in računalniško tehnologijo (IKT). Uporaba IKT je v preteklih desetletjih postala temelj jezikovnega poučevanja, ne samo za učence z disleksijo, ampak za vse učence na vseh stopnjah usvajanja jezika na splošno. Ker se IKT razvija v smeri vključevanja AI, postaja potencialna uporaba novih izobraževalnih orodij, ki temeljijo na AI, še posebej pomembna. To je še posebej pomembno danes, ko postaja AI, zlasti z uporabo določenih modelov AI, kot je ChatGPT, vse bolj priljubljena po vsem svetu.

Z vidika AI, ki se še naprej razvija, je vznemirljivo videti njene potencialne aplikacije pri podpori učencem z disleksijo v jezikovnem razredu. AI ponuja množico edinstvenih priložnosti za reševanje posebnih izzivov, s katerimi se soočajo učenci z disleksijo, hkrati pa ustvarja bolj privlačno in učinkovito učno izkušnjo.

V razpravi o predhodnih raziskavah članek podrobno opisuje pomen AI v izobraževanju, ki velja za novo mejo v inteligentnem učenju, ki lahko posnema procese človeških možganov. To je še posebej pomembno za učence z disleksijo, saj jim AI lahko ponudi prilagojene priložnosti za učenje. Poleg tega dokument omenja potencial AI za izboljšanje duševnega počutja in akademskega sodelovanja s prilagojeno ter odzivno podporo pri učenju.

Preden preide na praktično uporabo AI v jezikovni učilnici za pomoč učencem z disleksijo, prispevek navaja vrsto različnih izzivov, s katerimi se soočajo učenci z disleksijo. Omenja, da so “inherentne težave s fonemskim zavedanjem, iskanjem in obdelavo jezikovnih informacij, delovnim spominom ter stabiliziranjem zvokovno-simbolnih odnosov v maternem jeziku očitne in pogosto še bolj izrazite pri učenju tujega jezika” (Simon, 2000).

Raziskovalni članek predlaga konceptualni model za vključitev AI v poučevanje študentov z disleksijo, pri čemer priznava subjektivno naravo kvalitativnih raziskav in morebitne pristranskosti pri izbiri literature. Predlagane aplikacije AI, čeprav še vedno konceptualne, naj bi imele velik potencial za praktično izvedbo, odvisno od variacij, ki izhajajo iz tehnoloških omejitev, razlik med posameznimi učenci in izobraževalnimi konteksti.

Potencial AI ni le v njenih tehničnih zmogljivostih, ampak v njeni zmožnosti prilagajanja učne izkušnje. Študenti z disleksijo se pogosto spopadajo s tradicionalnimi pristopi, ki ustrezajo vsem. Vendar pa lahko AI analizira učenčeve prednosti, slabosti in stil učenja, da ustvari ciljno usmerjene intervencije. Ta osebni pristop bi zagotovil, da

učenci z disleksijo ne bodo zapostavljeni ali preobremenjeni. Upajmo, da bo to povzročilo občutek dosežka in globlje "sodelovanje" s ciljnimi, tujim jezikom.

V razdelku Rezultati in razprava prispevek izpostavlja tri možne inovativne načine uporabe AI v jezikovni učilnici za pomoč učencem z disleksijo pri usvajanju tujega jezika.

Kot prvo navaja uporabo AI kot pomočnika pri pisanju. Tradicionalno so bili črkovalniki glavni steber pomoči pri pisanju, saj ponujajo osnovno odkrivanje napak. Vendar modeli AI, kot je ChatGPT, predstavljajo pomemben korak naprej. Ti modeli presegajo črkovalne popravke z analizo slovnice, strukture stavkov in celo slogovnih elementov. Predstavljajte si študenta z disleksijo, ki se spopada s soglasjem osebka in glagola ali glagolskimi časi. Pomočnik pri pisanju z AI ne prepozna samo teh napak, ampak tudi predlaga ustrezne popravke in poda pojasnila, s čimer študentu pomaga resnično razumeti slovnična pravila poleg črkovalnih napak. Poleg tega lahko AI analizira celoten slog in predlaga izboljšave v toku stavkov ali pri izbiri besed. To lahko študentu pomaga pisati bolj jasno in jedrnato v ciljnem jeziku. Tako ta izčrpna povratna informacija daleč presega osnovno preverjanje črkovanja in študentom z disleksijo omogoča samozavestno in učinkovito pisno izražanje.

Poleg tega raziskovalni članek predlaga uporabo AI kot pomočnika za pretvorbo besedila v govor. Za učence z disleksijo je lahko tekoče branje glavna težava na njihovi poti učenja jezika. Pomočniki za pretvorbo besedila v govor, ki jih poganja AI, lahko premostijo to vrzel z zagotavljanjem vedno pomembne slušne podpore za študente z disleksijo. V jezikovni učilnici lahko ti pomočniki glasno berejo učbenike, članke ali naloge, kar učencem omogoča, da sledijo in razumejo gradivo prek vizualnih in slušnih kanalov. To lahko bistveno izboljša razumevanje, zlasti zapletenih konceptov ali neznanega besedišča. Prednosti uporabe AI pa presegajo stene učilnic. Orodja AI lahko pretvorijo digitalne materiale, kot so e-knjige in spletni članki, v govorno obliko, kar učencem omogoča učenje in vadbo ciljnega jezika v njihovem tempu, v udobju doma. Ta osebni pristop bi učencem z disleksijo zagotovo pomagal pri neposrednem spopadanju z bralnimi izzivi in spodbujal večjo neodvisnost pri učenju ciljnega jezika.

Nazadnje raziskovalni članek predlaga uporabo AI kot orodja za vadbo ciljnega besedišča. Ena od resničnih prednosti AI je v njeni zmožnosti prilagajanja učne izkušnje. Praksa tradicionalnega besedišča pogosto vključuje učenje na pamet, kar je za učence z disleksijo lahko dolgočasno in neučinkovito. Modeli AI lahko spremenijo ta proces z ustvarjanjem interaktivnih vaj, prilagojenih individualnim potrebam in učnim stilom. Predstavljajte si program, ki analizira učenčev napredek in razumevanje besed ciljnega besedišča, nato pa ustvari ciljno usmerjene vaje, ki krepijo tisto besedišče, ki potrebuje nadaljnjo vajo. To lahko vključuje igre, kvize ali interaktivne dejavnosti, ki vključujejo različne načine učenja. S prilagajanjem učenja besedišča lahko AI naredi učenje besedil privlačno.

Prispevek se zaključi z obetavno noto, ki potrjuje transformativni potencial tehnologij AI pri revoluciji izobraževanja za učence z disleksijo. Predvideva prihodnost, v kateri lahko AI premosti vrzel med tradicionalnimi pedagoškimi metodami in posebnimi potrebami učencev z disleksijo v jezikovnem razredu. Vendar pa raziskovalni članek priznava pomen nadaljnjih raziskav in razvoja. Strogo testiranje aplikacij AI v izobraževalnih okoljih v realnem svetu je ključnega pomena za zagotovitev njihove učinkovitosti in praktičnosti.

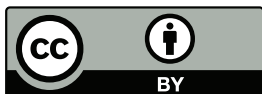
Poudarek je na premišljeni integraciji. AI ne bi smela nadomestiti tradicionalnih učnih metod, temveč jih dopolnjevati. S sodelovanjem z izkušenimi učitelji lahko AI ustvari

bolj vključujoče in učinkovito učno okolje za učence z disleksijo. Tako idealna jezikovna učilnica prihodnosti izkorišča prednosti človeškega strokovnega znanja in edinstveno zmogljivost AI. Učitelji se lahko osredotočijo na prilagojeno poučevanje in spodbujanje podpornega vzdušja, medtem ko AI zagotavlja ciljno usmerjene posege in privlačne učne izkušnje za vse učence.

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