ARTIFICIAL INTELLIGENCE IN HELPING PEOPLE WITH DISABILITIES: OPPORTUNITIES AND CHALLENGES

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ABSTRACT

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Artificial intelligence (AI) is revolutionizing teaching, learning, and administrative processes in higher education. AI-driven personalized learning platforms, virtual tutors, content creation tools, chatbots, and adaptive learning platforms offer tailored educational experiences, fostering student engagement and autonomy. These tools promote active learning, enhance instructional content, and provide round-the-clock assistance. However, the integration raises ethical concerns like data privacy, algorithmic bias, and the displacement of traditional teaching roles. Therefore, ethical guidelines and regulatory frameworks are crucial for responsible AI implementation in higher education settings. The application of AI holds the potential to change the teaching and learning landscape, foster innovation, and create a more inclusive and personalized educational experience. In this regard, **the purpose of this paper** is to analyse commonly used AI-powered tools in higher education which could be used to better the digital accessibility for people with disabilities. The objectives of this paper are related to the study of the features of Intelligent Tutoring Systems and AI-powered virtual tutors, as well as AI-driven chatbots and virtual assistants; to conduct a comparative analysis of AI chatbots to track the differences in their features that are important to better the accessibility. The research hypothesizes that texts generated with AI-powered tools need to improve readability. The accessibility or, more specifically, the readability of generated texts was checked with the OpenAI ChatGPT and Microsoft Copilot chatbots. Results are compared based on key readability metrics.

Keywords: *artificial intelligence; higher education; learning experiences; text readability*

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INTRODUCTION

Artificial intelligence (AI) in higher education represents a big change toward more flexible, effective, and interesting learning experiences. Intelligent tutoring systems, predictive analytics, tailored learning environments, and administrative support tools are a few examples of AI applications in higher education (Kulik and Fletcher, 2016). These tools are designed to tackle a variety of issues in education, including enhancing student retention and engagement, expediting grading and feedback procedures, and promoting individualized instruction (Pane et. al., 2015).

Artificial Intelligence is used by Intelligent Tutoring Systems (ITS) to simulate one-on-one tutoring by offering customized instruction and feedback. ITS can greatly improve learning results by offering prompt, individualized support that is comparable to that of human tutoring (LeewayHertz, 2024). Using artificial intelligence, predictive analytics examines student data to forecast outcomes including academic achievement, course completion rates, and possible dropout concerns (Luckin et. al., 2016). According to Ahuja et al. (2022) to improve human-computer interactions for people with disabilities in ITS it is necessary to combine them with Augmented Reality (AR) and AI methodologies. According to the authors, the ITS interface is designed to enhance learning experiences for learning-disabled students. AR, where virtual images overlay the physical world, and Mixed Reality, an altered reality, engage users to interact with virtual objects. Their study presents an ITS learner module for learning disabilities identification, assessing 105 participants with or without disabilities. The results show that AR-based learning through ITS is effective, increasing motivation, ease of interaction, cognitive skill development, short-term memory enhancement, and making lessons more enjoyable, making the overall learning experience more stimulating and engaging (Ahuja et al., 2022).

AI-driven systems that adjust material delivery based on individual learning styles and preferences are called personalized learning environments (Raj and Renumol, 2021). There is evidence connecting personalized learning to improved academic performance, student satisfaction, and engagement (Makhambetova, Zhiyenbayeva and Ergesheva, 2021). One of the models of personalized learning environments is the flipped classroom model which offers significant benefits for students with disabilities, such as autism, by allowing teachers to focus on social skills through team-oriented, collaborative activities (Zaic, 2021). According to the same source, this approach encourages students to help each other in the learning process, reducing reliance on the teacher.

By automating processes like scheduling, grading, and answering student questions, artificial intelligence tools can relieve administrative and faculty workloads (Kumar, 2023). By allowing educators to concentrate more on instruction and student interaction, automation has the potential to improve learning outcomes across the board.

The individualized, flexible, and effective learning environments, as well as artificial intelligence in higher education, improve student experiences. However, obstacles including data privacy issues, ethical concerns, and the requirement for large infrastructure and training investments are necessary for its successful deployment (Konidena, Malaiyappan and Tadimarri, 2024). Bias, accountability, and possible unexpected repercussions are examples of ethical problems (Binns, 2018). Because data privacy is so important, it requires strong governance systems to guard against misuse and ensure that privacy laws are followed. Effective AI implementation necessitates large expenditures in technology infrastructure as well as administration and teacher training (Holmes and Tuomi, 2022). AI can significantly increase operational efficiencies and educational outcomes despite these obstacles, and these concerns must be carefully considered to guarantee that the advantages of AI are distributed to all relevant parties.

In this regard, **the purpose of this paper** is to analyse commonly used AI-powered tools in higher education which could be used to better the digital accessibility for people with disabilities. The objectives of this paper are related to the study of the features of Intelligent Tutoring Systems and AI-powered virtual tutors, as well as AI-driven chatbots and virtual assistants; to conduct a comparative analysis of AI chatbots to track the differences in their features that are important to better the accessibility.

The **main research question** of this paper is whether the AI-powered tools under research are characterized by affordability. To answer this question, the authors investigated the readability of generated texts with two of the famous chatbots – OpenAI ChatGPT and Microsoft Copilot. Some basic metrics are applied to compare the readability of texts. **The research hypothesizes** that texts generated with AI-powered tools need to improve readability.

1. LITERATURE REVIEW

AI-powered virtual tutors and intelligent learning systems deliver personalized learning experiences that are driving change in the educational landscape. They predict student performance and modify teaching tactics based on machine learning, natural language processing, and data analytics (Kulik and Fletcher, 2016; Mileva, Petrov, Yankov, Vasilev, and Petrova, 2021). They have some advantages, such as student progress scores based on class data, immediate feedback, accessibility, and personalized content (Baker, 2016).

Widespread use of AI-powered educational tools has some equity challenges stemming from disparities in access to technology, and data privacy concerns arising from the collection and use of student data (Zawacki-Richter et al., 2019). Over-reliance on AI technologies for educational purposes can also lead to a decrease in interactions between people and hence a decrease in communication between them. Furthermore, modern AI systems are not yet sophisticated enough to understand the nuanced human emotions and motivations that are essential for teaching (Purdy, Zealley, and Maseli, 2019). Other drawbacks come from technical limitations as well as the significant amount of data required, including personal information about students and teachers, which poses important privacy and data protection concerns. (Zawacki-Richter et al., 2019).

Two main teaching methods apply intelligent learning systems and AI-powered virtual tutors. Conversational AI and natural language interaction are the main areas of focus for AI-powered virtual instructors, making them suitable for dialogue-based learning (Dwivedi et al., 2021) which promotes critical thinking and communication skills (Cui and Teo, 2023).

On the other hand, ITS places a major emphasis on cognitive modelling and data analysis, offering a formalized, systematic approach to individualized learning that is particularly successful in STEM fields (Dwivedi et al., 2021).

Although both systems have shown efficacy in raising student achievement, ITS has stronger empirical support in certain academic domains, such as science and mathematics (Wang et al., 2023). When it comes to language learning and other subjects where conversation is essential, virtual teachers are much more successful (Tao and Gao, 2022). On this basis, AI-powered virtual tutors and ITS will be increasingly developed in the future to support student collaboration in learning, enhance natural language processing (NLP) skills, add emotional recognition, and advance adaptive learning strategies (Zhang et. al., 2020).

There is also the view that chatbots and AI-powered virtual assistants, which come in various forms and levels of sophistication, are becoming increasingly important components of higher education digital ecosystems (Rojas and Chiappe, 2024). Chatbots are designed to perform certain tasks such as providing customer support, answering queries, and providing pre-programmed responses (Zhang et. al., 2020). They only work in specific contexts and have predefined response sets.

Using machine learning and deep learning, these systems progressively improve their performance. NLP techniques have evolved from simple keyword matching to deep learning models (Lauriola, Lavelli, and Aiolli, 2022) that understand context and purpose. While deep learning models, especially those based on neural networks, improve the ability of these systems to understand and generate language similar to human speech, machine-learning techniques allow these systems to learn from interactions (Soori, Arezoo, and Dastres, 2023). Advanced virtual assistants with integrated speech detection and synthesis technology enable voice interactions (Iannizzotto et al., 2018). Thanks to recent research and developments in context understanding, the performance of virtual assistants has greatly increased. Techniques such as attention mechanisms and transformers enable a more accurate interpretation of context during interactions (Choi and Lee, 2023). By using data analytics and machine learning algorithms to modify responses, virtual assistants and chatbots are becoming increasingly adept at tailoring interactions based on user preferences and past behaviour (Mohamed, 2023).

Virtual assistants and chatbots offer different user experiences and interactions. Installing and integrating chatbots into websites, messaging apps, and customer support systems is easier than virtual assistants (Huseynov, 2023), which are more complex due to their advanced algorithms and ability to connect to multiple services and devices (Madhuri and Lakshmi, 2020). Frequently asked questions, e-commerce support, customer service, and basic user interaction are just some of the many services they offer. By answering queries, providing round-the-clock support, and helping with troubleshooting, AI-powered chatbots, and virtual assistants ease the burden on human agents (Goyal, Minz, and Sha, 2023). Nevertheless, these AI systems must address issues including accessibility, fairness and bias, data security and privacy, and technological limitations (Ferrara, 2023). In terms of accessibility, these AI-powered tools can be educational tools designed to support people with intellectual disabilities by overcoming communication barriers and improving education quality (Mateos-Sanchez et. al., 2022). The same authors claim that these tools use competency-based knowledge and active methodologies, empowering subjects for real-life situations and achieving full participation.

The collection and processing of vast amounts of personal data lead to data privacy and security issues, with bias and fairness difficulties caused by inherent biases in training data

(Choi, Jeon, and Kim, 2019). Technological limitations include interpreting complex text, dealing with ambiguous questions, and maintaining coherent discourse in extended interactions (Harris, 2021). Since AI-based chatbots and virtual assistants need to be usable by everyone, including those with disabilities, accessibility is another important concern. Future development should prioritize universal accessibility for these tools (Bizjak, 2022), ensuring they are accessible to users with disabilities and diverse linguistic backgrounds, and expanding their language support to make them more globally accessible (Mishran and Ayak, 2023).

Some authors are developing virtual AI assistants for persons with partial vision impairment (Raghavan et al., 2021). The application aims to enhance functionality for partially blind users, providing navigation, identification, recognition, and information about the world (Raghavan et al., 2021). It features a chatbot for real-time object detection, a barcode scanner for product information, and the ability to detect human faces to understand their presence and the number of people in the room. The chatbot can ask questions regarding the performance of desired tasks in the learning process in the classroom or assist students in taking action. AI-driven chatbots and virtual assistants have a significant role in human-computer interaction for learners, including disabled ones but considering some practical, ethical, and technological limitations.

Based on the literature review, we can conclude that often chatbots and virtual assistants are used in combination to deliver a better user experience to people with various disabilities. On the one hand, they can support learners with cognitive difficulties in reading the learning material and perceiving textual and visual content (Bernard and Arnold, 2019). On the other hand, they can help people with visual impairments to interact with other learners based on the description of the tasks to be submitted in the form of audio input, and the virtual assistant in combination with the chatbot helps students make decisions based on the formed description (Olguín-Gil et al., 2021).

Some limitations of the literature review include:

- the studied authors form a non-exhaustive list of the sources in which the accessibility of learning tools for higher education is affected in different contexts;
- not all groups of users and their disabilities, which can be supported by the studied learning tools, are affected. Rather, the authors focus on the most common use cases;
- further research and development are needed to overcome these barriers and improve the performance and reliability of these AI systems.

2. CRITICAL ANALYSIS OF AI TOOLS FOR BETTER ACCESSIBILITY

Intelligent Tutoring Systems and AI-powered virtual tutors are becoming more and more common in a variety of educational settings. The language-learning app Duolingo leverages AI to deliver individualized language courses, giving users immediate feedback and modifying the level of difficulty in response to their performance (Henry, 2023). Personalized learning experiences are offered by Squirrel AI which is an adaptive learning platform that specializes in STEM education and uses AI algorithms, machine learning, and Big Data Analytics (Squirrel Ai Learning lnc., 2024).

Another platform for adaptive learning, Knewton, optimizes the learning path by continuously adjusting it based on data from student interactions (Conklin, 2016). By adapting instructional materials to each student's unique learning style, has been shown to significantly increase student engagement and learning outcomes (Conklin, 2016).

The Cognitive Tutor from Carnegie Learning is an ITS created to improve math learning. It uses cognitive modelling to comprehend students' mental processes and offer individualized training (Koedinger and Aleven, 2021).

An ITS for math and scientific education called ALEKS (Assessment and Learning in Knowledge Spaces) uses artificial intelligence to evaluate a student's knowledge and offer tailored learning routes to fill in gaps and build on strengths (Harati et al., 2021). It has proven successful in enhancing students' comprehension and recall of difficult subjects by providing highly personalized learning opportunities (Harati *et al.*, 2021).

Students can learn to code with the help of Codelearn, an ITS that teaches computer science and programming. It offers adaptive exercises and real-time feedback (Majdinasab, Nikanjam, and Khomh, 2024). To enable better learning outcomes in programming, it makes use of data analytics, expert systems, and adaptive learning algorithms.

Some conclusions about *accessibility issues of Duolingo, Squirrel AI, Knewton, Cognitive Tutor, ALEKS, and Codelearn* can be highlighted. These conclusions are based on our qualitative assessment by testing each of these platforms. Little font sizes, poor colour contrast, and a deficiency of alternate text for photos hinder Duolingo's visual accessibility. It is difficult for people with visual impairments to explore Squirrel AI due to its lack of screen reader support, complicated material, poor keyboard navigation, and restricted customization choices. Users with diverse learning requirements may find Knewton challenging due to its uneven adherence to accessibility regulations and the dearth of other format options. It is challenging for people with visual impairments to utilize Cognitive Tutor due to its intricate interface and lack of alternatives for simplified information. Users with hearing impairments additionally have difficulties with ALEKS's screen reader restrictions, complicated material, and inadequate audio options. The visual deficits in Codelearn include

Intelligent Tutoring Systems and AI-powered virtual tutors could be criticized from several points of view. Individual learning styles, needs, and emotional states may not be fully understood by AI systems, which could prevent them from offering thoughtful support. Additionally, they lack the empathy and emotional intelligence of human tutors, which can result in unfair or erroneous evaluations and suggestions (Wang et al., 2024). With a huge amount of personal data being gathered and processed by AI tutors, problems concerning privacy are raised around data access and utilization.

The digital divide gives rise to issues of equality and accessibility since it can exacerbate educational gaps between students from different socioeconomic backgrounds (Afzal et al., 2023). The growth of autonomous learning abilities may be hampered by an over-reliance on AI systems, which could result in a decline in critical thinking and problem-solving abilities (Zhai, Wibowo, and Li, 2024). If AI misunderstands a student's input or direction, miscommunication may result since it might not be able to efficiently clear the confusion.

AI-driven virtual assistants and chatbots with a variety of uses and functionalities include Siri, Alexa, Google Assistant, Cortana, ChatGPT, Watson Assistant, Replika, and Mitsuku. Apple's virtual assistant, Siri, uses voice commands, gesture-based control, focus-tracking, and a natural-language user interface (Apple Inc., 2024). It is accessible on a variety of devices and operating systems. Alexa is a speech service that runs on the cloud and is compatible with devices such as the Echo, Echo Dot, and Echo Show (Amazon.com, Inc., 2024). It can be used to play music, get information, get the news and sports scores, and manage smart homes. Available on smartphones, smart speakers, and other devices, Google Assistant is an AI-powered virtual assistant that allows speech searches, voice commands, and voice-activated device control (Google, 2024). Microsoft's virtual assistant Cortana is incorporated into Windows 10, Windows 11, and other Microsoft products, as well as it works by utilizing the Bing search engine (Microsoft, 2017).

OpenAI created ChatGPT which supports an AI language model that can produce writing that appears human depending on input (OpenAI, 2024a). It can have discussions, give thorough information, produce original material, and respond to inquiries on a range of subjects. Another tool - IBM Watsonx Assistant, is a conversational AI solution that allows organizations to create AI Assistants for seamless customer experiences, boosting productivity and business scale (IBM, 2024). It features a user-friendly interface, Large Language Models, Natural Language Processing, and Intelligent Context Gathering for accurate, contextual answers (IBM, 2024). Replika is an AI chatbot created to be a user's friend and it participates in text chats to offer companionship, talk, and emotional support (Luka, Inc., 2024). Award-winning chatbot Mitsuku was created with the help of the Pandorabots platform which is well-known for its conversational skills and for repeatedly passing the Loebner Prize Turing Test (Sandeep, 2024).

Some conclusions about *accessibility issues of AI assistants with* Watsonx Assistant, Alexa, Cortana, ChatGPT, Alexa, Replika, and Mitsuku can be highlighted. These conclusions are based on our qualitative assessment by testing each of these platforms. For certain users, Siri's efficacy is limited due to its difficulties with non-standard speech patterns, speech impediments, and various accents. Not all natural languages are supported or the lack of support we can see. Although Alexa's screen reader compatibility is typically strong, people with hearing impairments may experience issues with certain spoken replies not being correctly displayed as text. Limited customization possibilities for Alexa might potentially be problematic for users with varying demands related to auditory processing. The same is valid for Google Assistant and Cortana too. Because ChatGPT is text-based, it is not as accessible to users who prefer voice interaction or who have visual impairments. The setup and customization of Watson Assistant can be challenging, and certain interfaces might not be completely keyboard- or screen-reader-optimized. Replika has problems with emotional tones, limited speech capabilities, and accessibility concerns with text. However, because Mitsuku only accepts text input and output, it is not as accessible to blind users who utilize speech or screen reader input. It also has uneven screen reader support, few customization options, and no speech recognition.

Our critical analysis shows the wide range of uses and powers of AI-powered chatbots and virtual assistants, from enterprise solutions to personal help. On this basis, we can conclude that AI-driven virtual assistants and chatbots have faced numerous issues, including privacy and security concerns, algorithmic bias, accuracy and reliability, dependence and overreliance, and job displacement. Ethical concerns, limited understanding, and learning are the main issues that users face. The other serious issues could be related to security risks like potential vulnerabilities that expose users to cyberattacks and data breaches. AI systems can exhibit biases based on the data they were trained on, leading to unfair treatment of certain groups, including users with disabilities. Discrimination has also been reported in instances where chatbots and virtual assistants provide biased or discriminatory responses if their knowledge bases are not designed properly.

Understanding context is another issue, as these systems often struggle to understand the context of a conversation, leading to misunderstandings or incorrect responses. That can be led by the low level of language knowledge of non-native speakers. On the other hand, overreliance on virtual assistants can lead to reduced human interaction, which may affect social skills and relationships. This can lead to an increased risk of developing or worsening cognitive impairment, social isolation, and digital divide.

Each of the abovementioned tools can be integrated into the learning process in higher education, using its advantages and limiting the misuse of users' data. Part of the AI-powered tools that students often use in the preparation process for various courses are chatbots. For example, through them they look for solutions to programming tasks; solutions to case studies in economics courses, generate data or files that conform to a certain structure; and generate texts that support the writing of projects or papers. But still, these AI tools have their imperfections for example, the generated texts remain unintelligible, using learned phrases or they are too general. This necessitates research into the readability of written content to check that it is accessible, comprehensible, and engaging for different audiences, including those with disabilities. This includes learning sentence structure, vocabulary complexity, and formatting. That is why in this paper we check the readability of texts generated with some of the most famous AI chatbots.

3. METHOD

3.1. Research Motivation

In this paper, the authors examine an important aspect of computer interfaces’ accessibility – the readability of textual content. It is essential for people with cognitive disabilities as it ensures that written content is understandable and usable by all users without causing any cognitive challenges. If texts comply with readability metrics, it will improve comprehension and reduce cognitive overload for people with cognitive disabilities. To support people with learning disabilities, it is necessary to improve texts to ensure easy orientation in application interfaces and navigation between screens. Readable content is essential for screen reader users (e.g. visually impaired or cognitively impaired), providing logical and structured content, simplifying the reproduction of quality audio matches, and avoiding complex incomprehensible jargon. Readable content improves the user experience by increasing the degree of accessibility on different devices, such as smartphones or tablets, through clear, concise text that is easier to perceive. Ensuring the readability of textual content is also in line with digital accessibility standards, thus ensuring that it conforms to the formal framework imposed internationally and nationally.

Therefore, in this paper, the authors pay serious attention to this very important aspect of the digital accessibility of AI-powered learning tools. The following paragraphs present the study design and the materials under study.

3.2. Research Material

In this paper, we investigate the readability of texts generated by AI chatbots because they are one of the most popular AI tools in higher education among students and researchers (Todoranova and Penchev, 2023). We use OpenAI ChatGPT and Microsoft Copilot to generate texts that respond to two different prompts:

- "Write me an essay about the importance of AI in higher education. Use no more than 400 words and include an introduction, literature review, and conclusion.";
- “Write me an essay about the Wuthering Heights book. Use no more than 400 words and include an introduction, main thesis, and conclusion.”.

Both tools generate texts in English that follow the specified structure but cite different sources in the Literature Review section when the first prompt is used. For the first prompt, the length of the text generated with ChatGPT is 340 words, and the one generated with Copilot is 383 words. For the second prompt, the text generated with ChatGPT is 406 words, and the one generated with Copilot is 406 words too.

3.3.Research Design

The research procedure we follow in this paper includes three stages (Fig. 1): AI text generation; Text preprocessing; and Readability analysis.

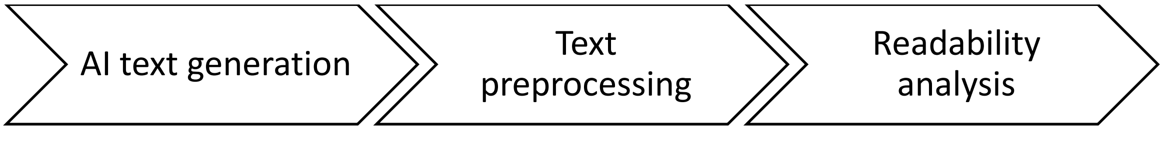

Fig. 1. Stages of Research Procedure

Source: Own Elaboration

At the first stage of the process - AI text generation, we generate texts with selected AI chatbots. We set a prompt that we want the final result to respond to. This is already described in 3.1.

In the second stage - Text preprocessing, we copy the texts generated with the AI chatbots and perform pre-processing, removing possibly included citations of sources unrelated to the study of the text's readability. We also removed the section headings so that only the main text remains to be analyzed. All URLs in the texts are removed as well.

The final phase - Readability analysis, applies text readability analysis tools that examine the length of generated words, sentences, paragraphs, and specific readability metrics. As Sharif (2023) points out, some common readability metrics include the Flesch Reading Ease Score, Flesch-Kincaid Grade Level, Gunning Fog Index, Coleman-Liau Index, Automated Readability Index (ARI), SMOG Index, Dale-Chall Readability Formula, Linsear Write Formula, Raygor Readability Estimate, and McLaughlin SMOG Formula. The author writes that these metric scales consider sentence length, syllable count, and grade level. Higher scores indicate better readability, while lower scores indicate better comprehension. Other metric types include the Dale-Chall Readability Formula, Linsear Write Formula, Raygor Readability Estimate, and McLaughlin SMOG Formula. These metric systems help assess the readability of text for various audiences, ensuring it is easily understood and accessible.

4. RESULTS

Following the research procedure from 3.2., we use the generated texts with ChatGPT and Copilot, which are of different lengths. At the prompts set in 3.1, Copilot generates text 43 words longer than ChatGPT for the first task. For the second prompt, both tools generated texts of equal size. We remove the generated section titles in the text - Introduction, Literature Review, and Conclusion- according to the first prompt in both tools. For the second one, both tools created section titles Introduction, Main Thesis, and Conclusion, which were deleted in the pre-processing stage of our research process. Into the text based on the first prompt, Copilot includes links to sources within the text that have been removed. Added citations after the generated text, which however are missing from the ChatGPT text. ChatGPT cites two sources within the text, but they are not appended with a bibliographic description as in Copilot. For the second prompt, no citations are added.

For readability analysis, we choose to use the Readable tool, which evaluates the text related to the importance of AI in higher education according to some metrics described in Table 1.

Table 1

Readability Analysis Results of AI-generated Texts Based on Prompt Related to the Importance of AI in Higher Education

Metric	ChatGPT Text	Copilot Text
Word Count after pre-processing	336	379
Syllable Count	705	768
Sentence Count	15	21
Paragraph Count	5	6
Spelling Errors	2	2
Grammar Errors	0	0
Readability and Quality Issues	43	49
ReadablePro Rating	E	E
Flesch-Kincaid Grade Level	16.1	15.4
Gunning Fog Index	18.3	18.0

Source: Own Elaboration

The syllable, sentence, and paragraph count depend on the total number of words generated. For this reason, the number of paragraphs and sentences in the Copilot text is longer than in ChatGPT. From Table 1 it is noticeable that no grammar errors were found, but there are 2 spelling errors per tool. They stem from abbreviations used in the text.

The ReadablePro Rating metric is a custom Readable text readability indicator that ranks from A to E (Readable, 2024). It shows the degree of text interpretation and comprehensibility by each user. Both generated texts are rated at the lowest rating, which means that the percentage of intelligibility by the general audience will be low.

Table 1 also describes the results for the Flesch-Kincaid Grade Level and Gunning Fog Index metrics. The first one shows for which audience the text is intended, based on the age of the users - children, students, or adults. The results for both texts fall on the scale of 11-18 points, which means that they are intended for users over the age of 17, who are referred to as skilled readers (ClickHelp, 2024a). This metric can also be related to the low ReadablePro Rating, namely that the generated texts are intended for IT professionals or at least for people who have more in-depth knowledge in the field of artificial intelligence. Since the prompt used is related to the importance of AI in higher education, it is assumed that the text is understandable and suitable for computer science students.

The Gunning Fog Index metric is a Grade Level based readability score that was created as a human algorithm, it's now included in the suite of digital readability solutions (Readable, 2024). Index values typically vary from 0 to 20, with a value of 18 points indicating that the texts are too hard to read for the majority of readers (ClickHelp, 2024b). This demonstrates once more that the writings produced by both chatbots are meant for readers with a basic understanding of computer science, making them appropriate for students learning to deal with artificial intelligence.

The text produced in response to the prompt on the book review of "Wuthering Heights" (Table 2) is slightly different from those of Table 1.

For example, the text comprehension level for the book "Wuthering Heights" is a higher degree according to the ReadablePro Rating, Flesch-Kincaid Grade Level, and Gunning Fog Index metrics. ChatGPT's text turns out to be slightly more difficult to understand than Copilot's, as Copilot's values for these three metrics are lower. Although the number of words before and after processing the text is the same, Copilot has divided the text into more paragraphs than ChatGPT. According to our expert assessment, the texts for the book "Wuthering Heights" are at the level of a high school senior or a literature student, as both tools generated an analysis of the book rather than a narrative of the content. This means that for the correct perception of the texts, users must know the contents of the book.

Table 2

Readability Analysis Results of AI-generated Texts Based on Prompt Related to "Wuthering Heights" Book Review

Metric	ChatGPT Text	Copilot Text
Word Count after pre-processing	401	401
Syllable Count	740	680
Sentence Count	18	24
Paragraph Count	5	6
Spelling Errors	1	1
Grammar Errors	0	0
Readability and Quality Issues	30	32
ReadablePro Rating	D	C
Flesch-Kincaid Grade Level	15.59	11
Gunning Fog Index	17.5	13

Source: Own Elaboration

The complexity of the generated texts stems precisely from the set prompts in which the word “essay” is used. This also implies a higher degree of complexity in the written speech.

Based on the practical experiment, some basic conclusions can be drawn:

- if the prompt is formulated clearly and gives correct instructions, the chatbot generates a text that corresponds to the described structure and respects the approximately set length of the text;
- depending on the prompt, the length of the texts and their structure differs, and this also leads to differences in the number of sentences and paragraphs;
- the texts of both chatbots are without grammatical errors;
- the level of intelligibility of the texts depends on whether the prompt requires the generation of text with a specialized focus or not.

5. DISCUSSION

Based on the results of the practical experiment, we can make a comparative analysis of the tested tools. To support the analysis, we also use the official documentation published by OpenAI (2024b) and Microsoft (2024). We summarize various comparison criteria in Table 3.

Table 3

Comparison between OpenAI ChatGPT and Microsoft Copilot

Criteria	OpenAI ChatGPT	Microsoft Copilot
1. Primary Purpose	General-purpose conversational AI and writing assistant.	AI assistant integrated within Microsoft 365 apps (like Word, Excel, PowerPoint, Outlook).
2. Usage Context	General conversation, creative writing, coding, education, and customer service.	Office-related tasks (document creation, data analysis, email management).
3. Content Output	Generates text, code, summaries, translations, creative content, answers questions, files, and more.	Generates and formats documents, automates workflows, creates presentations, summarizes emails, and analyzes data.
4. Core AI Model	Based on OpenAI’s GPT models (like GPT-3.5 and GPT-4).	Uses GPT-4, with integration into Microsoft's Azure OpenAI Service for additional enterprise features.
5. Platform	Accessible via the web and various platforms (desktop,	Built into Microsoft 365 apps, which have strong accessibility

Criteria	OpenAI ChatGPT	Microsoft Copilot
	mobile). Supports screen readers and keyboard navigation.	features across desktop, web, and mobile versions.
6. Screen Reader Compatibility	Designed to be compatible with screen readers like JAWS, NVDA, VoiceOver, and TalkBack.	Designed to be compatible with screen readers.
7. Keyboard Navigation	Supports keyboard shortcuts and tab navigation for users who cannot use a mouse.	Full keyboard support as part of Microsoft 365, ensuring that all functions are accessible without a mouse.
8. Voice Recognition and Input	Compatible with voice input tools but does not natively offer voice interaction.	Integrated with Microsoft 365's voice dictation and control features (e.g., dictation in Word, voice commands in Microsoft Teams).
9. Accessibility Features Integration	Reliant on platform-specific tools (web, API) for enhanced accessibility features.	Support Microsoft products for ensuring real-time captions, live transcription, and immersive reader tools.
10. Text-to-Speech and Speech-to-Text	Supports text-to-speech through compatible screen readers; does not natively support speech-to-text.	Uses Microsoft's built-in speech-to-text and text-to-speech features.
11. Captioning and Transcription	No built-in live captioning; can help generate captions or transcripts through manual input.	Offers live captions and real-time transcription for meetings in Microsoft Teams; fully integrated into the Microsoft ecosystem.
12. Support for Alternative Inputs	Supports alternative inputs indirectly through compatible platforms (e.g., voice control on iOS/Android).	Supports a wide range of alternative input methods natively, including speech recognition, eye control, and alternative keyboards.
13. Compliance with Accessibility Standards	Committed to meeting WCAG standards, but accessibility depends on third-party tools for different platforms.	Strong adherence to WCAG, Section 508, and EN 301 549 standards across Microsoft 365, benefiting Copilot users.
14. Multilingual Support	Supports multiple languages but may have limitations for non-English users.	Extensive multilingual support for multilingual users. Better support of non-English speaking people.
15. Integration Environment	Standalone web and API access, available on platforms like OpenAI's website, and integrated in apps (e.g., Slack, Snapchat).	Integrated directly within Microsoft 365 (Office) apps (Word, Excel, PowerPoint, Microsoft Teams, Outlook, etc.).

Source: Own Elaboration

Table 3 includes 15 comparison criteria. The criteria include its primary purpose, usage context, content output, core AI model, platform compatibility, keyboard navigation, voice recognition, accessibility features, text-to-speech, captioning, transcription, compliance with accessibility standards, and multilingual support. As it became clear from the practical experiment, the level of readability of the texts at a prompt with a specialized focus is comparable - the texts are approximately equally difficult to read. A minimum computer science student level is required to understand the content. However, with general-purpose text, Microsoft Copilot does better than OpenAI ChatGPT, as it generates text with better readability. Because Microsoft Copilot is fully integrated with the Microsoft ecosystem, this makes it much more widely used, including by people with disabilities. Integrates with Microsoft Office applications and communication tools. People with disabilities can use Copilot during online meetings, process documents, and presentations and perform their daily tasks with the help of the chatbot. On the other hand, ChatGPT integrates with far fewer applications, making its use among users, including those with disabilities, much more limited than Copilot. Copilot is based on the AI model GPT-4, not like the free version of OpenAI ChatGPT, which means that users are not motivated to pay for the paid version of ChatGPT, but can directly use Copilot. The good thing about both products is that they can generate a wide range of output artefacts, not just text. Both chatbots support multilingual interaction, but it is most advanced for English-speaking users. This means that non-English speaking users face problems interacting in their native language. Chatbots are documented to meet accessibility standards, but we have not researched these criteria. We report a limitation of the study that we will overcome in future research.

Analysis of these benchmarks shows that Copilot should be more useful than ChatGPT for the general audience, including users with disabilities. Adding to that, Copilot takes advantage of Microsoft's well-established digital accessibility infrastructure, which once again makes it useful for users and well-integrated with various third-party products.

CONCLUSION

Through improving learning outcomes, streamlining administrative procedures, and enabling tailored instruction, artificial intelligence is completely changing the higher education landscape. An evolution toward more flexible, effective, and interesting teaching methods is symbolized by the use of AI technology, such as predictive analytics and intelligent tutoring systems. AI in higher education should be concentrated on improving human-AI cooperation, making sure AI-powered learning resources are accessible and scalable to a wide range of students, including those in underserved areas, and developing explicit ethical frameworks and guidelines to direct the responsible development and application of AI in education.

In summary, our experiment reveals that a clear and correct prompt can generate text that follows a specified structure and length. The length and structure of texts vary depending on the prompt, leading to varying sentences and paragraphs. The understandability of the texts depends on the prompt's focus. The experiment also proves the hypothesis put forward in the introduction, namely that texts generated with AI-powered tools need to improve readability. To improve the output of the chatbot, expert evaluation of the artefact should also be done since readability metrics do not unambiguously indicate whether the text is useful or not. In general, chatbots write texts with a very general focus and only give direction to the user on the topic they are researching if they are used for text interaction. This means that AI models will still be developed in the direction of ensuring accessibility for people with disabilities.

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