

Artificial Intelligence Tools to Improve Accessibility in Education for People with Disabilities

PHD CARLOS HERVÁS-GÓMEZ

Universidad de Sevilla, Spain

hervas@us.es

<https://orcid.org/0000-0002-0904-9041>

PHD ÁNGELA MARTÍN-GUTIÉRREZ

Universidad Internacional de La Rioja and Universidad de Sevilla, Spain

angela.martin@unir.net

<https://orcid.org/0000-0001-9847-245X>

MARÍA DE LOS ÁNGELES DOMÍNGUEZ-GONZÁLEZ

Universidad de Sevilla, Spain

mariandg@us.es

<https://orcid.org/0000-0002-9687-9325>

CARMEN MANZANARES-CASTILLO

Universidad de Sevilla, Spain

carmenmanzanarescastillo@gmail.com

<https://orcid.org/0009-0001-9876-2067>

PHD HĂISAN ANGEL-ALEX

"1 Decembrie 1918" University of Alba Iulia, Romania

angel.haisan@uab.ro

<https://orcid.org/0000-0002-0565-405X>

PHD NADIA BARKOCZI

Universitatea Tehnică din Cluj-Napoca, Romania

nadia.barkoczi@dssp.utcluj.ro

<https://orcid.org/0000-0002-0514-2417>

Abstract

The advancement of artificial intelligence (AI) is an undeniable issue and is increasingly present in education, including inclusive education. Many AI-based tools can enhance and support the cognitive potential of students with diversity, supporting quality education, which favors their full inclusion in society. Inclusive education contributes to reducing inequalities by promoting tolerance among all people. This study's main objective was to conduct a search, selection and subsequent review of existing AI-based tools that could be beneficial for improving the teaching-learning process and the quality of life of people with diversity. Following the results obtained, it is recommended that this line of research be continued with more in-depth studies to analyze the viability of each tool.

Keywords: accessibility, Artificial Intelligence, disability, diversity.

6.1. Introduction

UNESCO's (2022) recommendations on the Ethics of Artificial Intelligence address the approach and deployment of AI in the world's education systems. Educational institutions and administrative bodies relevant to the field of education should commit to further advancing digital literacy in AI in the classroom. Adequate AI literacy will empower the population and reduce digital divides and inequalities in access to digital technology resulting from adopting AI-based applications. Beyond the academic and future professional component, the aim is to help this group understand their development process and provide them with all the possible tools to make significant contributions to our society. The collaboration of all responsible bodies is needed to ensure that AI technologies empower learners and teachers to improve their experience, bearing in mind relational and social principles (UNESCO, 2022).

6.2. Artificial Intelligence in Education

The global landscape is becoming increasingly digitized, which has a particular impact on education today. The constant advances in Artificial Intelligence (AI), together with Machine Learning (ML) and Big Data, are practical and efficient tools for predicting the results of analysis encompassed within computationally demanding

engineering problems (Markou et al., 2024). Such devices have played an essential role in today's education sector and, therefore, in all socio-cultural domains (Borja & Camargo, 2024). Undoubtedly, AI offers helpful knowledge and information on many topics, but caution and contextualization must be exercised due to its susceptibility to misinformation and bias (Wang et al., 2024).

Fundamental aspects of the use of AI are the use, development and creation of content and digital tools that people must learn how to use and control for the development of digital competence. There is a need to design guidelines for teachers and students on how to use generative AI appropriately to provide intellectual and personal developmental support (Wang et al., 2024). Learning with technology and technological tools can reduce the difficulty and complexity and improve the efficiency of such learning, as long as it is adequately managed and controlled (Borja & Camargo, 2024).

At the same time, protecting the welfare and interests of global citizens underscores the pressing need to assess the rise of AI and chart a way forward based on the development of ethical frameworks that facilitate the regulation and growth of AI (Farhat et al., 2024).

AI makes allows analyzing the human cognitive process through tools such as Big Data, simulating the information process of human sight, hearing, touch, feeling, thinking and reasoning, and from this, it is possible to build one's neural network and generate algorithms that draw a visual representation (Borja & Camargo, 2024). Among them is the proliferation of sophisticated language models that can understand and develop human-like text, incorporating a component of greater accessibility and equality among academics (Farhat et al., 2024). Below is a list of tools that aim to improve accessibility and enrich the learning experience in the classroom.

6.3. Artificial Intelligence Tools to Improve Accessibility in Education for People with Disabilities

Below are some AI tools that aim to improve accessibility and personalized learning for students with disabilities, making read-

ing and accessing educational material a more inclusive, flexible and enriching experience. These tools are the following:

Storysign¹

Huawei developed this tool as a mobile application to make reading more accessible for students with hearing difficulties. Its principal function is to translate text into sign language. This application uses the device's camera to scan the text of children's books. An animated "Star" avatar automatically translates the text into sign language. On the positive side, it offers the ability to adjust the speed of translation and other settings to suit individual reading preferences.

The educational possibilities of StorySign in the context of accessibility for people with disabilities, especially for children with hearing disabilities, are broad and significant. Here are some of the highlights:

- Improving sign language literacy by providing a platform for deaf children to improve their reading skills in their native language, i.e., sign language. Making printed books accessible through real-time translation facilitates learning and practice of reading in an interactive and engaging environment.
- Fostering a love for reading: helps instill an early love for reading by making books more accessible and engaging for deaf children, which is critical for educational and personal development.
- Educational inclusion: Providing a tool that allows deaf children to access the content of books in sign language promotes inclusion in educational settings where deaf and hearing children learn together. It helps deaf children feel more integrated and participatory in the academic community.
- Support for parents and teachers: it allows parents and teachers who do not know sign language to share stories and educational material with deaf children.
- Development of comprehension skills: the application is not only limited to the literal translation of the text but also interprets the context and grammar to provide an understanding

1. <https://storysign.storysign&hl=es&gl=us>

of the material, which is essential for developing reading comprehension skills.

- Personalization and diversification of learning: StorySign offers various educational materials tailored to different interests and skill levels, allowing for a more personalized and diversified learning experience.
- Transition tool: For some students, StorySign acts as a bridge between learning sign language and developing skills in reading and writing text, facilitating a smoother transition to more varied forms of communication.

Otter.ai²

The voice transcription application uses voice recognition and natural language processing technologies to convert conversation into text. This tool can improve accessibility in education, mainly because it allows access to auditory content and facilitates the creation of study materials, providing support for students with hearing diversity. In addition, it can improve lesson planning, collaboration and content sharing.

Some of the educational possibilities that Otter.ai offer are the following:

- Real-time transcription and note-taking for meetings: This is especially useful for students participating in conferences or seminars, as they can get detailed transcripts of the sessions to review later.
- Assisting journalists in transcribing interviews and taking notes for efficient reporting: Students in journalism or communication-related fields can significantly benefit from this function to process and analyze their interviews or research.
- Assists students in transcribing and summarizing lectures, facilitating the review and study of course material: This is particularly valuable for students seeking to maximize their understanding and retention of the material presented in lessons, allowing them to access accurate and detailed summaries for study.

2. <https://otter.ai/>

Microsoft AI for accessibility³

Microsoft AI for Accessibility is a program aimed at amplifying human capabilities through artificial intelligence for people with disabilities. This initiative focuses on developing and implementing AI solutions that help overcome barriers to communication, employment and mobility for people with disabilities. Although its main focus is not educational per se, the tools and technologies developed under this program have significant applications in education, primarily to support students with different types of disabilities.

Some of the educational possibilities that Microsoft AI for Accessibility provides are the following:

- Improving accessibility in educational tools: Implementing AI technologies to make educational applications and platforms more accessible to students with visual, hearing or mobility disabilities. This includes improved screen readers, speech recognition and sign language interpretation technologies.
- Personalization of learning: Using AI to adapt educational content to the specific needs of learners, taking into account their disabilities and learning preferences. This may include adjustments to the speed of content presentation, complexity levels and interaction methods.
- Enhanced communication tools: Development of applications and devices that use AI to facilitate communication for students with speech or hearing disabilities, enabling them to participate more effectively in collaborative educational environments.
- Vision support: Implementing AI technologies that help students with visual impairments interact with digital and physical content, e.g. through text-to-speech, image description and assisted navigation in educational environments.
- Behavioral analytics for educational support: Use of AI to analyze the behavior and interaction of students with disabilities on online learning platforms to identify barriers to learning and adjust educational strategies to improve effectiveness.

3. <https://www.microsoft.com/en-us/accessibility>

- Accessibility in assessments and exams: Application of AI solutions to make evaluations more accessible to students with various disabilities, ensuring they can demonstrate their knowledge and skills on an equal footing.

Voiceitt⁴

Voiceitt is a mobile application that uses artificial intelligence to make content accessible to students with speech difficulties. The app allows text to be converted into speech, making it easier for them to understand educational materials. Voiceitt analyzes the user's speech and creates a personalized voice model. This model is used to convert text into speech naturally and accurately. The application offers a variety of features that facilitate the accessibility of content for learners with speech difficulties. These features include text-to-speech conversion, language translation, subtitle generation and speech recognition.

Some of the educational possibilities that Voiceitt enables are as follows:

- Facilitating classroom communication: Voiceitt can help students with speech disabilities communicate more effectively with teachers and peers. This improves classroom participation and allows students to express their ideas and questions more clearly.
- Support in presentations and oral presentations: Students using Voiceitt can confidently participate in presentation activities and class discussions, as the tool allows them to convey their messages more understandably.
- Improved independence and self-esteem: By enabling students to communicate more effectively, Voiceitt can contribute to their independence and increase their self-esteem. This is vital for personal development and educational success.
- Use in assistive technology: Voiceitt can be integrated with other assistive technologies in educational settings, such as augmentative and alternative communication (AAC) devices, to provide a more complete communication solution.

4. <https://www.voiceitt.com/>

Kurzweil 3000⁵

Kurzweil is a virtual educational assistance platform specialized in children with learning difficulties, such as dyslexia and dysgraphia or students with attention deficit disorder, as well as other needs. Thanks to artificial intelligence, this platform personalizes learning individually, adapting to the needs of each student. In addition, it uses AI to convert images into text or audio through optical character recognition to provide reading-aloud for readers, which is vital for students with visual or reading difficulties. It includes multiple text-highlighting tools, for example, with different colors, which promotes the organization of ideas for students with problems in understanding a text.

Some of the educational possibilities that Kurzweil 3000 provides are the following:

- Text reading: Kurzweil 3000 converts printed and digital text into speech, allowing students to listen to books, documents, and course materials aloud. This functionality is essential for students with reading or visual impairments, as it improves their access to educational content.
- Comprehension tools: The application includes tools that help improve reading comprehension, such as highlighters, sticky notes, and the ability to create outlines. These tools allow students to interact with the text more actively, facilitating better retention of information.
- Writing functions: Kurzweil 3000 offers writing support through word prediction, spelling correction, and grammar suggestions, which benefits students with dyslexia or writing difficulties. In addition, the dictation tool converts speech into text, providing another way for students to generate written content.
- Study and organize: With tools for creating flashcards, summarizing texts, and organizing ideas, Kurzweil 3000 supports students' study strategies and helps them develop organizational skills essential for academic success.
- Access to content in different languages: The platform's ability to read texts in multiple languages can be a significant ad-

5. <https://www.kurzweil3000.com/KLogin.php>

vantage for students learning a new language or those whose first language is not the primary language of instruction.

TapTapSee⁶

This platform mainly helps people with visual diversity, as it provides explicit audio descriptions of environments, objects, people, or any image, thanks to artificial intelligence and vision technology, which makes allows identifying pictures through a device's camera. Artificial intelligence is present in this application when placing images to describe them since, using visual patterns, similarities and differences of familiar objects are compared for quick identification.

Some of the educational possibilities that TapTapSee offers are the following:

- Identification of didactic materials: TapTapSee can help students identify and differentiate didactic materials and resources, such as books, notebooks, and school supplies, facilitating their organization and independent access to these resources.
- Support hands-on learning activities: In subjects that include hands-on components, such as science or the arts, TapTapSee can assist students in identifying instruments, materials, and other items needed to conduct experiments, art projects, and more.
- Improved orientation and mobility in the educational environment: The app can help students become more familiar with and navigate more independently within the school environment by identifying site-specific features, such as classroom doors, signage, and common areas.
- Fostering independence and confidence: By enabling students with visual impairments to identify objects and text independently, TapTapSee contributes to their autonomy, confidence, and self-esteem, which are critical to their academic performance and emotional well-being.
- Integration into educational projects: Educators can integrate TapTapSee into classroom projects and activities to promote

6. <https://taptapseeapp.com/>

inclusion by designing assignments that leverage technology to include all students in collaborative learning and shared experiences.

- Reading support and information access: Although TapTap-See is more focused on object identification, it can be complemented with other AI tools and assistive technologies that convert text to speech to facilitate access to printed or written information, offering a more complete learning experience.
- Social Skills Development: Identifying objects and environments can bridge group and social activities, allowing students with visual impairments to participate more actively in group discussions and projects.

Snap & Read⁷

Snap&Read is an artificial intelligence tool designed to improve accessibility and learning by offering a comprehensive solution for students with diverse needs, including reading difficulties, visual impairments and other learning challenges. This tool has many educational applications, facilitating access to curricular content and support for reading comprehension and writing.

Some of the educational possibilities provided by Snap&Read are as follows:

- Accessible reading: Snap&Read converts any printed or digital text into speech, enabling students with visual impairments, reading difficulties or dyslexia to access educational content equally.
- Personalization of learning: Allows text complexity to be adjusted to suit each student's reading comprehension needs, supporting pedagogical differentiation and personalized learning.
- Language support: With the ability to read texts in multiple languages, Snap&Read can be especially useful in multilingual educational environments and for students learning a new language.
- Integrated study tools: Underlining functionality and outlining help students organize information and study more effectively, improving retention and comprehension of content.

7. <https://snapandread.com/>

- **Writing support:** The tool offers writing assistance, such as word prediction and sentence construction, which is especially useful for students who struggle with writing and expressing ideas.
- **Developing independence:** By providing students with the tools to access and understand texts independently, Snap&Read fosters autonomy and self-confidence in learning.
- **Universal access to knowledge:** Snap&Read facilitates equitable access to information and educational resources, which creates an inclusive learning environment.

Microsoft Seeing AI⁸

Microsoft Seeing AI is a tool that uses artificial intelligence to help people with some visual diversity make their day-to-day work or school life more accessible. Some of the possibilities offered by this tool are the following: it speaks text as fast as it appears on the screen in front of the camera, provides audio guidance for documents, locates barcodes to identify products, and recognizes faces and even emotions.

Some of the educational possibilities offered by Microsoft Seeing AI are the following:

- **Reading printed and digital text:** Seeing AI can read printed text in real-time, including books, documents, menus and labels, which facilitates access to educational material for visually impaired students.
- **Object and scene identification:** The tool can visually describe what the phone's camera captures, which can be used in educational activities to help students understand their immediate environment and in science experiments or field trips.
- **Color and light recognition:** This can be useful in art or design classes for students with visual impairments, allowing them to participate more actively and autonomously in creative projects.
- **Barcode reading:** This facilitates product identification in home economics classes or for teaching independent living skills to students with visual impairments.

8. <https://www.microsoft.com/en-us/ai/seeing-ai>

- Face and emotion recognition: This feature can be used to teach and reinforce the recognition of emotions and facial expressions in social or emotional education classes, which is especially valuable for students with visual impairments.
- Image description in other applications: Integration with other applications allows visually impaired students to receive descriptions of images and graphics in digital documents or educational websites, improving their understanding of the content.

Beeline Reader⁹

Beeline Reader is an innovative tool that uses color gradients in the text to facilitate reading. It is especially designed for people with dyslexia, ADHD, or vision problems, although it also improves the reading experience for people without these conditions.

Some of the educational possibilities that Beeline Reader provides are the following:

- Improved reading comprehension: By visually guiding readers through the text with color gradients, Beeline Reader can help improve reading comprehension, allowing students to follow the text more efficiently and maintain concentration.
- Increased reading speed: Studies have shown that Beeline Reader helps readers finish articles more quickly and increases overall reading speed, which is beneficial for students with large volumes of reading material.
- Support for students with special needs: Specifically designed to be an inclusive tool, Beeline Reader is beneficial for students with dyslexia, ADHD or visual impairments, facilitating their access to educational material and improving their autonomy in learning.
- Use in diverse materials and platforms: The tool can be applied to various digital texts, from e-books and online articles to PDF documents, making it versatile for different educational needs and content formats.

9. <https://www.beelinereader.com/>

- Promoting independence in learning: By enabling students to better access and comprehend texts independently, Beeline Reader promotes independence and confidence in students with and without disabilities.
- Integration with educational platforms: Beeline Reader has been integrated with leading educational and accessibility platforms, such as Bookshare and Blackboard Ally, facilitating its adoption in academic environments and improving the accessibility of educational content for all students.

Ava¹⁰

Ava is an application designed to facilitate real-time group communication, mainly intended for people with hearing difficulties. This application transcribes the participants' conversations and displays them on the screen. Participants speak, and the microphone picks up the audio, using speech recognition technology and algorithms to transcribe.

Ava offers several educational possibilities to improve the accessibility and inclusion of deaf and hard-of-hearing people in academic and e-learning environments.

Some of the educational options that Ava offers are the following:

- Live captioning for all situations: Ava provides live captioning solutions for deaf and hard-of-hearing people, making online and in-person conversations accessible. This is particularly useful in educational environments where clarity and comprehension are crucial to learning.
- Ava Scribe: This service combines Ava's artificial intelligence with professional Scribes to ensure accurate captioning without compromising quality. Ava Scribe is ideal for meeting ADA (Americans with Disabilities Act) requirements and providing a fully inclusive educational environment. It is beneficial when a high level of accuracy is required, such as lectures, master classes, and educational events.
- Ava Connect: Ava Connect allows closed captioning integration into any video conference with a single click while main-

10. <https://es.ava.me/>

taining all the functionalities that users appreciate about Ava. This feature is invaluable for students and educators in remote or hybrid learning environments, ensuring all participants can follow discussions without barriers.

- Transcripts and summaries of conversations: Ava also offers the ability to store transcripts and generate accurate summaries of conversations. This feature is helpful for students who wish to review class material or for educators who need to keep records of class discussions.
- Accessibility in diverse educational environments: Ava is helpful not only in the classroom but also in tutorials, study groups, conferences, and any other educational situation where clear communication is essential.

VoiceOver (iOS)¹¹

It is an accessibility feature built into iOS devices like iPhones and iPads. It offers screen reading for the visually impaired, where users activate VoiceOver in the accessibility settings, and once activated, it provides auditory feedback on what is on the screen, allowing users to navigate and use their devices without seeing the screen.

Some of the educational possibilities that VoiceOver enables are as follows:

- Improved accessibility: Voice tools can help students with visual impairments or reading difficulties by converting text to speech, allowing them to access educational content more effectively.
- Language learning: Speech technology can be a valuable tool for students learning new languages, providing accurate pronunciations and enabling listening and speaking practice in the target language.
- Improved reading and comprehension: By listening to text read aloud, students, especially those who are auditory learners, can improve their reading comprehension.
- Personalized feedback: Some AI tools can provide feedback on pronunciation and fluency when learning a new language, which is beneficial for independent practice.

11. Accessibility, Apple, ES.

- Motivation and engagement: Interaction with voice technologies can be more engaging for learners, especially younger learners, motivating them to participate actively in their learning.
- Teaching efficiency: Educators can use voice tools to create accessible learning materials, such as audiobooks or verbal instructions, saving time in lesson preparation and offering different content formats to meet the needs of all learners.

Classcript¹²

Classcript is an artificial intelligence tool that transcribes and summarizes audio and video content played on a device. The application is easy to use and offers a variety of functions, including automatic transcription, automatic summarization and translation.

Some of the educational possibilities that Classcript allows are as follows:

- Audio and video transcription: Classcript can transcribe hours of audio or video content into unlimited text, which is invaluable for students with hearing disabilities or those who prefer to review study material in written format. The ability to choose the language from a list of over 50 languages makes this tool accessible to a global audience.
- Accurate transcripts: Classcript's AI is specifically trained to generate highly accurate transcripts. This accuracy ensures that students receive an accurate representation of the lecture material, which is crucial for learning and concept review.
- Transcript Summaries: Besides transcribing, Classcript can generate summaries of transcripts highlighting key points, important information, and reminders. This can help students focus on the most relevant aspects of the material, optimizing study time and improving information retention.
- Integrated chat for consultations: The tool includes an integrated chat that allows users to consult doubts about the class and receive instant answers. This feature promotes an interactive and dynamic learning environment where students can clarify concepts and further delve into the study material in an efficient manner.

12. <https://www.classcript.com/>

6.4. Discussion and Conclusions

Through technologies and AI, it is possible to evolve in the educational field and improve the teaching and learning process. Technologies allow us to adapt didactic activities automatically through smartphones, computers, or tablets. Through tools designed for this type of device, the subjects can acquire and develop competencies to have a real option of development and access in the midst of the technological era. The presence of AI represents an increasingly natural alternative for the development of the academic and professional profile of students, especially for people with diversity. The research reviewed highlights the community's awareness of the importance and advantages of knowing about AI to include students and future citizens due to the tremendous social, economic and educational impact of the development of these technologies. However, there are difficulties for teachers in implementing these tools in the classroom (Biggs, 2023).

Therefore, the great value and interest of AI training to develop digital content and create greater accessibility to this group at risk of exclusion is exposed. The acquisition and implementation of the critical elements to be digitally and technologically competent will facilitate the functionality and operability of students with diversity in the current environment. The aim is to train this group in using technological tools and devices and to adapt them to their immediate needs.

It is essential to design training that reaches the centers of the educational communities, based on the recommendations of UNESCO (2022), to include a proposal in the different educational plans of the member countries for its promotion, implementation and investment. Likewise, in training, it is necessary to strengthen the collaborative relationship with non-governmental entities linked to the development of AI technologies, enabling greater mastery and practical knowledge for a more inclusive society. Finally, it is essential to review and update the current educational materials and improve the instructions and tools for use in specific protocols.

It is recommended for future research to expand and redo the search for tools due to the continuous advancement of technology, as well as to implement each device in people with diversity to verify their current viability.

Acknowledgements

This study was funded by the VI Research and Transfer Plan of the University of Seville (VI PPIT-US), as part of the project entitled “Development of Skills in the Production of Educational Videos with Artificial Intelligence for Teaching: An Initiative for Initial Teacher Training (VIDIA-EDU)” within the 4th Teaching Plan of the University of Seville (Spain). Call for Support for Teaching Coordination and Innovation (ref. 221). Call 2023/2024.

References

- Biggs, E. E. (2023). Strengthening professional networks to serve students with autism who have communication needs. *Intervention in School and Clinic, 58*(3), 173-182. <https://doi.org/10.1177/10534512221081250>
- Borja-Acevedo, M., & Camargo-Mendoza, J. (2024). Music software with a machine learning-based feedback system as an alternative for initial piano study in children. *Inteligencia Artificial, 27*(73), 92-110. <https://doi.org/10.4114/intartif.vol27iss73pp92-110>
- Farhat, F., Silva, E., Hassani, H., Madsen, D., Sohail, S., Himeur, Y., Alam, M., & Zafar, A. (2024). The scholarly footprint of ChatGPT: a bibliometric analysis of the early outbreak phase. *Frontiers in Artificial Intelligence, 6*. <https://doi.org/10.3389/frai.2023.1270749>
- Markou, G., Bakas, N., Chatzichristofis, S., & Papadrakakis, M. (2024). A general framework of high-performance machine learning algorithms: application in structural mechanics. *Comput. Mech.* <https://doi.org/10.1007/s00466-023-02386-9>
- UNESCO (2022). *Recommendation on the ethics of Artificial Intelligence*. United Nations Organization for Education, Science and Culture. https://unesdoc.unesco.org/ark:/48223/pf0000381137_spa/PDF/381137spa.pdf.multi
- Wang, N., Wang, X., & Su, Y. (2024). Critical analysis of the technological affordances, challenges and future directions of generative AI in education: A systematic review. *Asia Pacific Journal of Education*. <http://doi.org/10.1080/02188791.2024.2305156>
- Xie, T., Wang, X., Cifuentes-Faura, J., & Yongkang, X. (2023). Integrating immersive experience into hybrid education: a case study in fin-tech experimental education. *Scientific Reports, 13*, 22762. <https://doi.org/10.1038/s41598-023-50259-1>

