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AI-Powered Adaptive Education for Disabled Learners

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AI-Powered Adaptive Education for Disabled Learners

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ABSTRACT

Artificial intelligence (AI) has widely established itself in education and efficiently supports and understands the teaching-learning process. The concurrent development of Adaptive Learning aims to provide effective customized learning where the unique needs of each student are met via personalized learning pathways, resources, and real-time feedback. Again, the recent Generative AI technologies can automatically generate a variety of accessible educational materials, such as simplified texts, audio narrations, and visual aids, which cater to learners with visual, auditory, and cognitive disabilities and suit individual abilities and preferences. It can enhance engagement by creating adaptive learning environments with the use of AI tools that benefit learners with learning disabilities. This chapter explores how AI and related technologies can support adaptive education and improve motivation, engagement, cognitive skills, and overall learning experiences.

Keywords: Adaptive Learning, Learning Disabilities, Artificial Intelligence, Generative AI, Assistive technologies, AI-based Tools, Metaverse

INTRODUCTION

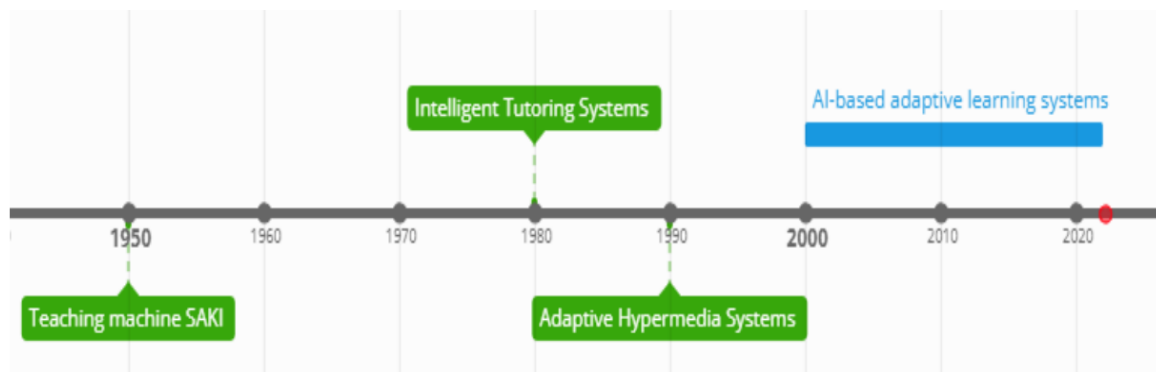
Adaptivity is one of the inherent abilities of human beings that allows them to analyze each of the different situations in their regular lives and act correctly. This ability varies in different degrees from one person to another, depending on their knowledge, experiences, habits and perceptions. Adaptivity in human learning encourages the ability to design a student learning model that represents the beliefs, preferences and needs of individual students and aims to provide, for example, learning materials,

learning sequences, feedback, tutoring, interface and presentation adapted to this model (Chou et al., 2015).

Artificial intelligence (AI) has widely established itself in the education field. The term, AI-based adaptation in the field of education emerged with the evolution of teaching-learning platforms and applications. New advancements in adaptive learning have occurred over time as technology has advanced and changed. These include intelligent tutoring systems in the 1980s and adaptable hypermedia in the 1990s (Psotka et al., 1988; Wilson & Scott, 2017). With the further development of artificial intelligence technologies, a new approach to education known as AI-based adaptive learning emerged in the 2000s. The evolution of adaptive learning environments is illustrated in Figure 1 (Ezzaim et al., 2023). This approach involves using powerful artificial intelligence algorithms to create customized content and pedagogical paths based on personalized needs, responses, learning paces and styles, preferences, and other factors (El-Sabagh & Hassan, 2021). Moreover, the overwhelming potential of AI has been well established by the recent developments of Generative AI. However, the potential benefits of AI come with challenges and risks. There needs to be ethical considerations for using AI in education, particularly considering data privacy and bias. Sometimes, Generative AI models give responses that are either factually incorrect, nonsensical, or even harmful, commonly known as LLM hallucinations. In other cases, generative AI models can be biased, resulting in unfairness and discrimination. Data privacy is another critical concern in AI-powered education systems as AI can collect large amounts of student data, including personal information, academic records, and learning preferences. AI-powered education platforms should implement robust security measures to protect user data, maintain privacy, and ensure system integrity.

A few important terms are introduced in the next section to provide the necessary introductory backgrounds for better understanding the subsequent sections on AI-based adaptive education for disabled learners.

Figure 1. The timeline of adaptive learning development



Key Terms and Definitions

Learning Disabilities

The term “learning disability” refers to a group of disorders that affect a broad range of academic and functional skills including the ability to speak, listen, read, write, spell, reason, organize information, and do mathematical calculations. Disability results from the interaction between health conditions and/or impairments that a person experiences, such as dementia, blindness or spinal cord injury. The most common treatment for learning disabilities is special education. The common types of learning disabilities can be:

Sensory Impairments - A sensory impairment refers to the impairment of one or more of our body’s sensory functions. This can lead to challenges in perceiving or processing sensory information. Some examples of sensory impairments include visual impairment like blindness or hearing impairment like deafness.

Dyslexia – It is one of the most researched developmental disorders that impair literacy. It is characterized by difficulty with speaking, reading, writing, or understanding words. This can cause the person's vocabulary to develop at a slower pace and lead to issues with grammar, reading comprehension, and other language skills.

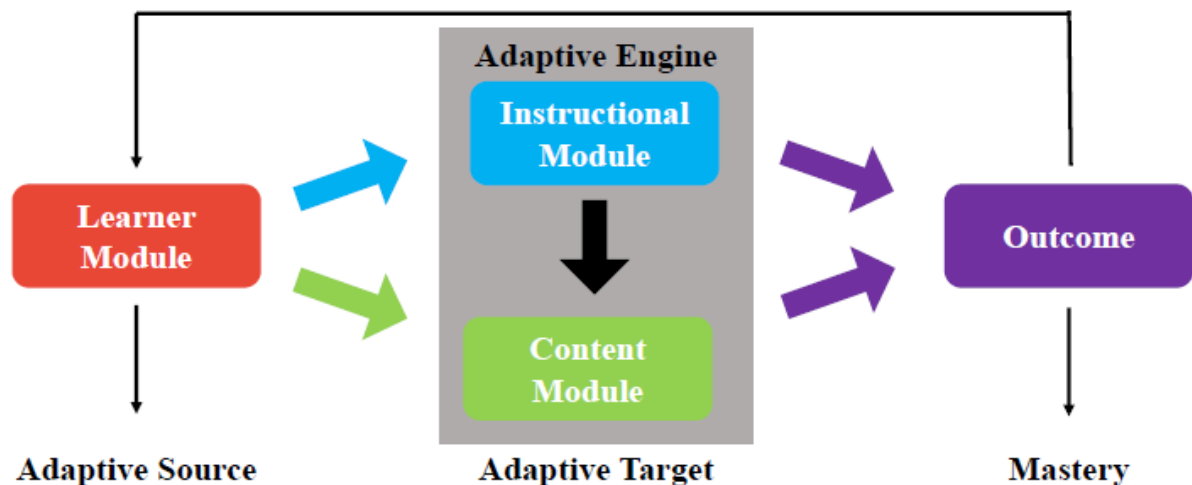
Attention Deficit Hyperactivity Disorder (ADHD) - It is one of the most common childhood neurodevelopmental disorders. Children with ADHD often have difficulty with inattention, hyperactivity and impulsivity.

Autistic Spectrum Disorders (ASD) – ASD constitutes a diverse group of conditions related to the development of the brain. (ASD) are a diverse group of conditions. They are characterized by some degree of difficulty with social interaction and communication. Other characteristics are atypical patterns of activities and behaviours, such as difficulty with the transition from one activity to another, a focus on details and unusual reactions to sensations (World Health Organization, 2024).

Adaptive Learning

Adaptive Learning (AL) is an educational approach that customizes each student's learning experience based on various variables, including cognitive, affective, and demographic background. This approach can be incorporated into conventional classrooms as well as online learning environments using AI and machine learning algorithms (Forsyth et al., 2016). Adaptive learning aims to provide an efficient, effective and customized learning experience for students by dynamically adapting learning content to suit their individual abilities or preferences. A valid AL system (Aleven et al., 2016) usually consists of three components: learner module, content module, and instructor module. An overview of the 3 components is shown in Figure 2 (Li, et al., 2024).

Figure 2. An Adaptive Learning (AL) Model



Learner Module, also known as the student module, refers to the learner characteristics of what a student knows and does.

Content Module, also known as the expert or domain module, refers to the content or knowledge base for the course.

Instructor Module, also known as the pedagogical module, refers to the algorithm that assists in adapting the instruction based on the content and learner module, and defines what, when, and how adaptation can occur.

Artificial intelligence can evaluate a child's concentration, attention span, and language and hearing skills to tailor lessons to individual needs. AI-based adaptive learning uses artificial intelligence to provide training on a wide variety of topics via audio and video tools with individual mentors and tutors in real-world, online, and hybrid contexts. It can adapt lessons to the strengths and weaknesses of individual students. AI-based solutions in education allow students to learn at their own pace. At the same time, it can provide helpful feedback to each student by delaying progression to the next topic until mastery has been established in the current topic. AI-based adaptive learning can overcome various challenges of regular classroom settings for students with disabilities (Sharma, et al., 2023). Hence AI-based adaptive learning is typically a custom learning/teaching approach where the unique needs of each student are met via personalized learning pathways, resources, and real-time feedback. Successful applications of adaptive learning can be adaptive content creation, adaptive assessment and personalized feedback to learners.

Assistive Technology

International Classification of Functioning, Disability, and Health (ICF) defines assistive products and technology as any product, instrument, equipment or technology adapted or specially designed for improving the functioning of a person with a disability (Viner, et al, 2020). Assistive technology has long played a helpful role in improving the quality of life for people with disabilities. It is important to have an appropriate choice of assistive technology device to help students with disabilities succeed in the learning process effectively. Students with disabilities can learn to work around their impairments with the help of appropriate assistive technology. Assistive technologies can address many types of learning difficulties and can improve certain skill deficits like reading, writing, spelling, comprehension and calculation. A student who has difficulty writing can compose a school report by dictating it and having it converted to text by special software. A child who struggles with math can use a hand-held calculator to keep score while playing a game with a friend. Students with dyslexia might benefit from

software that reads text aloud or highlights essential information, making reading assignments more accessible. The developments of AI and Generative AI are taking the technology to the next level.

Generative AI

Generative AI (Generative AI) refers to artificial intelligence models that generate new content, including text, images, audio, and video, based on the patterns and information they have learned from the given training data. While the traditional Machine Learning (ML) algorithms of AI focus on analyzing and interpreting data, Generative AI is designed to create new, original outputs and thus able to solve more challenging problems (Cao et al., 2023; Li, et al., 2024). Moreover, the advanced capabilities of Generative AI like reasoning can help to perform more complicated AL tasks, such as dynamic learning path planning.

The recent multi-modal Generative AI models have achieved promising results in directions like audio (speech)-to-text, text-to-audio(speech), image-to-speech(audio) that can help to create digital accessibility solutions. It can further assist in designing and creating interfaces involving adaptive texts, fonts and colours benefiting reading, visual or cognitive impairments. Generative AI technologies can automatically generate a variety of accessible educational materials, such as simplified texts, audio narrations, and visual aids that provide good support and motivation for learners with visual, auditory, and cognitive disabilities and suit individual abilities and preferences. This can help in summarization of texts, proofreading, interactive support and class engagement. As Generative AI continues to develop, there exist more promising scopes for the development of exciting applications to elevate human capacity through assistive technology.

Metaverse

Metaverse is an immersive virtual ecosystem that combines the physical and virtual world and is facilitated by Artificial Intelligence, Extended Reality and the Internet. A virtual world is a persistent, computer-generated environment where the users meet and communicate with each other just as they would in a shared space. The Metaverse is based on technologies that enable multisensory interactions with virtual environments, digital objects, or digital twins and physical entities. Metaverse supports

three-dimensional (3D) immersive technologies that can help to create truly immersive and engaging adaptive content for disabled learners.

Motivation

In recent years, AI has provided solutions that can accommodate a wide range of student needs. Some pioneering works have been done on AI-based adaptive learning. Although, AI and related technologies have a major impact on the academic world, a significant research gap exists on the application of Generative AI in adaptive education for disabled learners. The current chapter aims to provide some remedial solutions with practical applications of Generative AI for disabled learners. Moreover, the current work can be extended in future for exploring Generative AI with Metaverse to enhance engagement through the creation of more interactive, and immersive learning environments and providing hands-on experiences and simulations that benefit the disabled learners. Some earlier research on the applications of Generative AI and Metaverse in blended education and assistance for the well-being of elderly people by the sole author of this chapter can be useful references (Mitra, 2023a; Mitra, 2023b). The main contributions in the current chapter for further educational development are:

- Importance of AI-based adaptive education for disabled learners
- AI-based and Generative AI-based tools that can help disabled learners with adaptive learning
- How the promising potentials of Generative AI techniques can be utilized in adaptive education for disabled learners with use-cases of applications
- Future research directions for further development using Generative AI and Metaverse

These introductory backgrounds and the contribution areas help organize various subsequent sections of the chapter.

Organization of the Chapter

The contributions mentioned in the motivation subsection have been discussed individually in the subsequent sections. The titles of the Main Sections are marked with capital letters and the subsequent Subsections are in bold mixed letters and italics respectively as per hierarchy. Appendices at the end of the sections help in understanding practical applications of AI-based technologies. Appendix-1 provides a list of AI-based tools with their individual applications as remedial solutions for various learning

disabilities discussed in this chapter. Appendix-2 illustrates two applications of Generative AI with popular chatbot, ChatGPT 4o for teaching and helping a student having Dyslexia and ADHD.

RELATED WORKS

AI in Adaptive Education

Adaptive education was increasingly recognized as a significant and promising direction for the future of education (Park & Lee, 2013). A chapter by (Sharma, et al., 2023), analysed how AI has influenced special education in the classroom. The analysis focused mainly on AI's impact on Special Educational Needs (SEN) education and AI's impact on SEN education through its positive effects on SEN educators. The chapter also explores how special education supported by AI could personalize lessons for each student and encourage greater involvement on their behalf. Again, a systematic mapping of the literature on AI-based adaptive learning has been presented in (Ezzaim et al., 2023). The examination of 93 articles published between 2000 and 2022 made it possible to draw several conclusions, including the number of adaptive learning environments based on AI, the types of AI algorithms used, the objectives targeted by these systems as well as factors related to adaptation.

Machine Learning techniques have been widely used in the AI-based adaptive learning framework to support the analysis of large volumes of learner behaviour data and assist in developing personalized learning paths (Gheibi et al., 2021). Again, Deep Learning (DL) can solve problems for disabled learners that are difficult with traditional machine learning techniques, such as image and speech recognition. One of the applications offered by ML in education is personalized learning and adaptive systems. Adaptive learning systems continuously analyse individual student progress. Advanced algorithms assess correct and incorrect answers and the steps taken to arrive at solutions (Ayanwale, M.A. et al., 2024). Artificial intelligence approaches have been used in personalized adaptive education systems to detect Learning Styles (*LS*) automatically (Essa et al., 2023). The automatic detection of LSs to classify students according to their personal learning preferences is beneficial. Learning styles detected by the automatic approaches are dynamic and can be changed according to the students' behaviors, while in the traditional approaches, the LSs are static (Aissaoui, et

al., 2019). These approaches utilize algorithms from the field of Machine Learning to tackle the challenge of personalizing e-learning by mapping students' behaviour attributes to a particular LS automatically and dynamically to optimize the individual learning process. To determine LSs, well-known and used *Learning Style Theory Models (LSMs)* have been suggested to identify the initial LSs of learners. In the area of the automatic detection of LSs, the LS model plays a vital role in directing researchers during that process (Feldman et al., 2015). Felder and Silverman Learning Style Model (FSLSM) is regarded as one of the best models to use in adaptive systems to identify learners' LSs in *e-learning* environments (Essa et al., 2023). The widespread success of ML algorithms like reinforcement learning, active learning, meta-learning and deep learning in adaptive education has encouraged the exploration of Generative Artificial Intelligence (Generative AI) for further development of adaptive education.

Generative AI in Adaptive Education

The promising potential of Generative AI in different domains including education has inspired (Li et al., 2024) to bring Generative AI to Adaptive Learning. The paper aims to shed light on the intersectional studies of these two methods, which combine Generative AI with adaptive learning concepts. Again, the area where Generative AI and adaptive learning meet is changing quickly and offers both huge possibilities and difficulties. The research paper (Guettala et al., 2024) investigates the impact of incorporating Generative AI into adaptive and personalized learning environments, with a focus on tracing the evolution from conventional artificial intelligence methods to Generative AI and identifying its diverse applications in education. A recent paper (Zhao et al., 2024) surveyed use of Generative AI for disabled students. It mainly focused on students with writing disabilities and used Generative AI chatbots like ChatGPT, Gemini, Copilot and Claude as the main AI tool. Among all the Generative AI tools, chatbots were the most common choices for use by students. ChatGPT was found to be the most popular chatbot. (Tamdjidi et al., 2023) have conducted a study to investigate whether AI-driven chatbot, ChatGPT can assist individuals with Attention Deficit Hyperactivity Disorder (ADHD) in better comprehending and recalling written text. The widespread use and benefits of Generative AI for

students across different countries have been presented in Chegg's *Global Student Survey Report* 2023 (Cheggs., 2024).

Educators and institutions can face several challenges in implementing AI in adaptive education including AI adoption cost, the need for technical expertise and the skill gap, students' data privacy concerns and training teachers. AI adoption cost can be high as it requires considerable investments in infrastructure and development activities like investing in educator training on AI and privacy and incorporating data literacy into the curriculum. Technical expertise is required for implementing artificial intelligence algorithms to automate tasks and provide personalized learning. Students' data can be on their academic performance, weaknesses, strengths and private data for each student. Training teachers for AI can be challenging on many fronts. Teachers need to be conversant with the AI-based tools related to disabled learning. The first and most significant challenge will be change management. When introducing new technologies, there is always resistance to change within any organization. It should be ensured that teachers understand the usage of AI-based tools and processes. One possible solution to this challenge is gradually introducing technology within the organization.

Detailed discussions on the related works with special emphasis on the recent works will give sufficient background and understanding of the next sections.

AI-BASED AL FOR DISABLED LEARNERS

The global number of persons with disabilities has increased substantially in the past decade for various reasons. According to the WHO *Global Report on Health Equity for persons with disabilities*, an estimated 1.3 billion people experience significant disability. This represents 16% of the world's population or 1 in 6. (World Health Organization, 2024). Learning disability is a common issue that affects a significant number of students all over the world. Statistics on learning disabilities is provided in Table 1 to illustrate the magnitude of learning disabilities.

Table 1. Learning Disability Statistics

Disability Narration	Data
Number of Children with Learning Disabilities	15% of the global population 1 in 5 children in the U.S. have learning disabilities.
Dyslexia	Between 10 to 20 % of the global population.
Attention Deficit Hyperactivity Disorder (ADHD)	ADHD in children and adolescents is estimated at around 8%.
Dysgraphia	Estimated to affect 7 to 15% of school-aged children.

Inclusivity in education goes beyond simply providing access but also involves creating an environment where all students feel valued and supported. Inclusive education involves designing curricula, pedagogies, materials, and classroom environments that support and engage all students regardless of their background, abilities, or learning preferences. Persons with disabilities often experience health inequities due to avoidable, unjust and unfair conditions. AI-enabled adaptive learning can help create a more inclusive and equitable education system. Adaptive teaching-learning, a growing concept that understands students' unique learning styles and paces, has emerged in response. Adaptive learning technologies personalize educational experiences based on individual student needs. AI technologies play a crucial role in fostering an inclusive atmosphere by addressing the diverse needs of students and ensuring that everyone has an equal opportunity to succeed. The creation of accessible digital content is crucial for ensuring that all students can engage with learning materials. This includes providing content in multiple formats, such as audio, video, and text, and ensuring that it is compatible with assistive technologies. For students with disabilities, technology can take on multiple forms, including personal, instructional, and assistive. Although there are number of positive aspects of AI-based adaptive learning there are certain limitations and challenges as discussed in the next section.

Limitations and Challenges

There are certain technology limitations of Generative AI on adaptive education that can have impact on disabled students. Firstly, there may accessibility issues where disabled students might struggle to

access it effectively. For example, visually impaired students may have difficulties to interact with text-based chatbots (Tlili et al., 2023). Secondly, some of the outputs of Generative AI may increase the stresses of students with learning disabilities (Botchu et al., 2023). Thirdly, overly simplified information processing of Generative AI may negatively affect students with ADHD by further reducing their attention spans (Chen et. al., 2023).

AI-based AL Tools

Adaptive learning is an innovative technique historically used in remedial education through highly integrated and advanced technical tools. The availability of AI tools to aid and support disabled students is one of the most exciting breakthroughs in recent years. The state of the art in AI tools is improving rapidly. These tools can play an important role in supporting students with disabilities and learning differences, enabling them to access educational content, participate actively in the learning process, and reach their full potential. Some tools on AI-based special education have been discussed in (Sharma, et al., 2023). According to (Vinar, et al., 2020) there exists a vast array of educational software that can be utilized for the enhancement of reading skills for learners with autism, who are both deaf and blind and those with traumatic brain injury. Several AI tools based on assistive technology have been discussed in the paper. A list of AI-based AL tools including Generative AI-based tools for various learning disabilities is provided in Appendix -1.

Generative Learning Techniques

Generative AI models are algorithms designed to identify patterns and rules in their training data and generate new observations that adhere to similar rules. Large Language Models (LLM) such as the Generative Pre-trained Transformer (GPT), LLama or Claude are deep learning models that are trained on vast amounts of data, mainly text and whose deployment revolves around generating new data from a prompt. Recent studies have shown that the LLMs' capabilities for teaching and assessing are the key factors that reveal their potential to create personalized learning experiences. LLMs can generate and provide explanations on various questions including programming allows learners to obtain personalized feedback. Feedback from an LLM tends to be positively received and contributes to the development of learners receiving it. Regarding lesson creation, LLMs make it possible to create

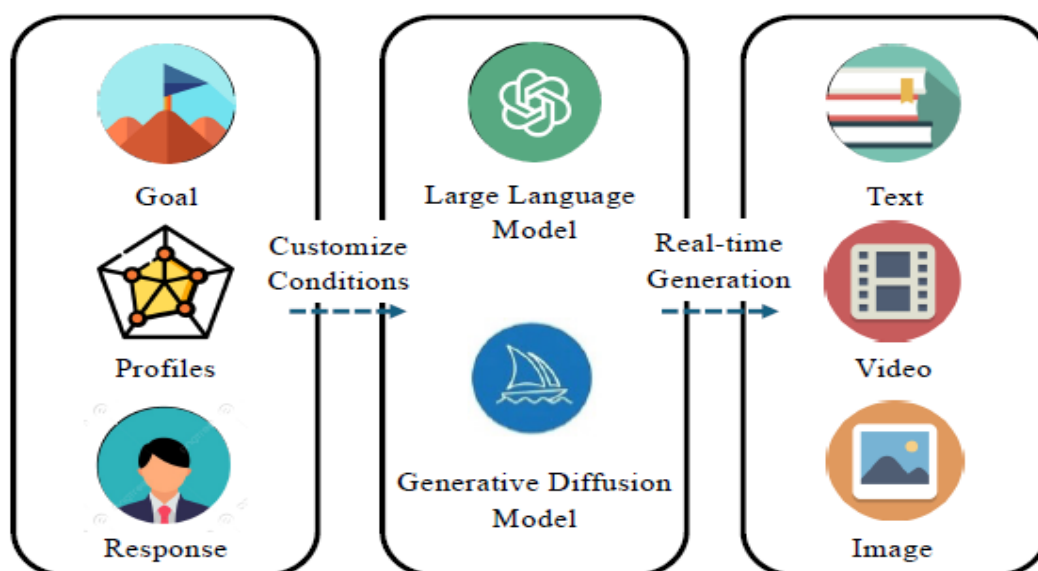
different variants of the same lesson to cater to the knowledge of different categories of students. Customizable lesson creation can help to deliver the materials in a more engaging way (Pesovski, 2024).

The Generative AI's generative characteristics and its power of multimodal capabilities can provide novel directions for AL studies. Two such directions Content Creation and AI Agents as discussed here are quite useful for engaging students in personalized learning and providing good support to students as well as teachers/instructors.

Content Creation

The great potential of Generative AI with its multimodal power and instructional tuning can be well harnessed for the dynamic creation of quality content necessary for disabled learners. The dynamically created learning contents by Generative AI in AL provide learners with a more precise way in receiving knowledge. This dynamic or real-time generation feature can empower AL systems to dynamically make content adjustments based on the changes in users' knowledge proficiency during the learning process. Generative AI is opening up new and creative ways to create content for adaptive education and its usage for the AL system. Figure 3 (Li, et al., 2024) illustrates the process of content creation in AL using Generative AI.

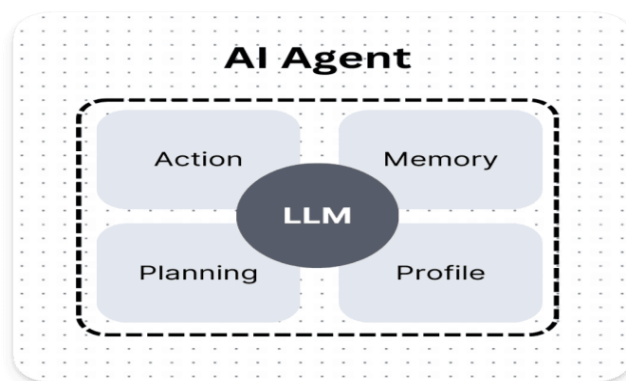
Figure 3. Generative AI for Content Creation in AL.



AI Agent

An AI agent is a system designed to reason through complex problems, create actionable plans, and execute these plans using a suite of tools. LLMs' task planning potential to solve complicated real-world problems through its initiative elaborations with external resources such as computer programs, search engines and other toolkits have empowered LLM to serve as the brain of an AI agent. An AI agent usually consists of 5 parts: An LLM with general-purpose capabilities that serve as the main brain or **coordinator**, and four sub-modules: a **planning module** to divide the task into smaller steps, an **action module** that enables the agent to use external tools, a **memory module** to store and recall past interactions and a **profile module**, to describe the behavior of the agent (Maierhofer, 2024). The key modules of an AI Agent are illustrated in Figure 4.

Figure 4. Key Modules of an AI Agent.



Recently, LLMs as planning modules of autonomous agents have attracted more attention (Huang, 2024). LLM-Agents can be a good personal learning assistant who can provide real-time support to students during their studies. Agent-based framework can also be a powerful toolkit for instructors in adaptive learning. It can help the teachers/instructors to overcome the tedious regular feedback jobs by automating the process for different question formats. Agentic workflows provide the adaptive structure that enables AI agents to achieve their goals. AI agents operate within agentic workflows. Personalized agentic workflows are gaining popularity and will be the future.

Use Case Examples

Two Use Case examples of real-life applications of Generative AI are provided in Appendix - 2. The input prompt and the ChatGPT 4o response are provided for each example. The first example is an

adaptive learning example for a disabled learner suffering from dyslexia is provided here as an adaptive learning example. A multimodal LLM, ChatGPT 4o is instructed to become a teaching agent and generate an attractive image and text to explain a simple object to a disabled learner. The second adaptive learning example shows how to help a disabled student with Attention Deficit Hyperactivity Disorder (ADHD) comprehend complex ideas in a sample document through summarization and identification of key concepts.

AI-BASED TOOL USAGE DATA ANALYSIS

AI-based adaptive Learning tools described in the previous section of ‘AI-based AL Tools’ have shown promising potential in supporting disabled learners. A study on the usage of these tools by disabled learners has been done and the corresponding data is provided in Table 2.

Table 2. AI-based AL Tool Usage Statistics

AI-based Tool	Number of Users
Be My Eyes	Over 669,000
Seeing AI	Over 3,000 million
Microsoft Lens	Over 10 million
Otter.ai	Over 14 million
Dyslexia Font	Over 1 million
Prologue2go	300,000
Notability	Over 5 million

The credibility of these AI-based tools has been well-established across the globe. These tools are well-accepted for an effective AI-based adaptive education and aim to bring about a sense of equality among disabled people and help them to live independently.

CONCLUSION AND FUTURE DIRECTIONS

Artificial Intelligence (AI) have a major impact on the academic world, making learning easier for students with sensory, motor, cognitive, and other forms of impairments. There is a growing focus on promoting inclusive education using AI-powered assistive technology that have widespread impact on disabled learners. Artificial intelligence (AI) based learning tools and methods are being adopted that make it easier for these learners to carry out tasks that might otherwise be challenging for them. The

integration of AI, specially Generative AI with adaptive education brings new directions in adaptive learning through the dynamic and diverse output capabilities of Generative AI.

This chapter may inspire future research areas like the application of Metaverse in adaptive education. Generative AI has the huge potential to empower Metaverse (Mitra, 2023b). Metaverse is an immersive virtual ecosystem that combines physical and virtual world and is facilitated by the convergence between the Artificial Intelligence, Internet, Web and Extended Reality (XR) that covers Mixed Reality (MR), Augmented Reality (AR) and Virtual Reality (VR). Metaverse in adaptive education has several advantages like better personalized learning experiences through creation of more engaging and immersive contents under virtual environments. It makes the education more accessible, personalized, engaging, and globally connected (Mitra, 2023a). The paper, (Lin, et al., 2023) on Metaverse is a comprehensive survey of the Metaverse in education, with a focus on current technologies, challenges, opportunities, and future directions. It aims to provide a systematic literature review of Metaverse in education.

AUTHOR NOTE

This chapter is the personal work product of the author and has not been reviewed, approved or endorsed by AI Forum.

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APPENDIX - 1

AI-based AL Tools by Disability Types

Sensory Impairments

Vision Impairment

Be My Eyes – It is a digital visual assistant powered by Open AI's GPT-4 model for the blind or people with low vision. It contains a dynamic image-to-text and text-to-speech generator. Users can send images via the app to an AI-powered Virtual Volunteer, which will answer any question about that image and provide instantaneous visual assistance for a wide variety of tasks.

Seeing AI - Seeing AI is a Microsoft app for visually impaired people that narrates the world around them. It brings together the power of the cloud and AI to identify products, recognize and describe people around and their facial expressions, as well as describe scenes around using the power of AI.

Microsoft Lens - Microsoft Lens (formerly "Office Lens") from Microsoft is a great way to capture information from documents, whiteboards, business cards, receipts, menus, signs, handwritten memos, or anything else containing text that can be imported without the need of any manually type out. The text can be further converted to speech for the visually impaired using text-to-speech generator of GenerativeAI.

Talking Calculator - A talking calculator has a built-in speech synthesizer that reads aloud each number, symbol, or operation key a user presses. It also vocalizes the answer to the problem. This auditory feedback may help an individual with visual perception limitations check the accuracy of the keys as they are pressed and verify the answer before he/she transfers it to paper.

Audio Impairment

Generative AI powers real-time captioning services that provide immediate text representation of spoken words during live events, lectures, and video calls. This technology ensures that individuals who are deaf or hard of hearing can participate fully in conversations and access auditory content without delay. Tools like Google's Live Caption can automatically generate captions on the devices while

Otter.ai can convert speech to text from audio or video.

Dyslexia

Dyslexie Font - Dyslexie Font is aimed at improving the reading for individuals with dyslexia. A unique typeface is created with a specific focus on addressing the challenges faced by those with dyslexia. The design elements contribute to a more distinct visual contrast between letters, ultimately reducing the risk of confusion for dyslexic readers.

Ghotit - Ghotit Real Writer & Reader software includes advanced writing and reading assistive technologies tailor-made for people with dyslexia and dysgraphia. It is a comprehensive literacy software that helps children and adults with dyslexia/dysgraphia to read, write, and correct misused or confused texts. Ghotit's writing and reading assistive technology including word prediction, context and phonetic spell checking, grammar and punctuation checking, text-to-speech including dual highlighting is tailor-made or personalized for their needs.

Talkitt – It is an innovative solution that enables people who have motor, speech, and language disorders to easily communicate using their own voice.

Voiceitt – It is a speech-to-text Assistive Technology that allows people with non-standard speech, to use their voice for communication with others or with technology. Talkitt recognizes the user's vocal patterns and "speaks" their words in an understandable language, allowing them to communicate clearly and easily.

ASD

Proloquo2go – It is an Augmented Alternative Communication (AAC) tool that enables non-speaking children and adults to express themselves confidently and initiate conversations. Proloquo2Go is available on iPad, iPhone, Apple Watch, and, as a separate app on Mac.

Scene Speak - Scene Speak is a tool for creating interactive social stories and for use as a communication tool for those with Autism, other developmental disabilities, or anyone wanting to enhance receptive language or visual memory. It provides a framework on the iPad to create Visual Scene Displays and "Interactive" social stories.

ADHD

MindNode- It is a visual tool application that allows students to express themselves in a visual format through concept mapping and brainstorming to create a visual diagram of their thoughts. MindNode helps to capture one's thoughts and create a clear picture of one's idea.

Notability – In Notability, AI generates concise summaries of notes, PDFs, and recordings, making it easy to review key concepts. Notability also turns notes into interactive quizzes, for quick preparation of examinations.

APPENDIX - 2

Example 1

Prompt

Act as a Teacher/Instructor for disabled learners. Teach a student having Dyslexia with a generated impressive colourful 3D image and text to explain any simple object.

ChatGPT 4o Response

ChatGPT said:



Here's a vibrant 3D image of a sunflower to help you visualize and explore its features.

Understanding the Sunflower

- **Big, Round Center:** The dark brown center is packed with tiny seeds, which are food for birds and can be eaten by us, too.
- **Golden Yellow Petals:** The petals are bright and long, arranged around the center like rays from the sun. They make the sunflower look like it's smiling at you.
- **Tall Green Stem:** The stem is strong and straight, allowing the sunflower to stand tall, sometimes as tall as a person!
- **Heart-shaped Leaves:** Large green leaves grow along the stem, each shaped like a heart, giving the plant a friendly, welcoming look.

Special Sunflower Traits

- **Follows the Sun:** Sunflowers turn their heads to follow the sun throughout the day.
- **Attracts Nature:** Bees love sunflowers, and so do birds, making this flower very important for the environment.

This image and description show how amazing sunflowers are, from their shape to their special traits!

Example 2

Prompt

Act as a Teacher/Instructor for disabled learners. Summarize and identify key concepts in a small sample document to help a disabled student with Attention Deficit Hyperactivity Disorder (ADHD) in the comprehension of complex ideas in the sample document.

ChatGPT 4o Response

ChatGPT said:

Certainly! To assist a disabled learner, especially one with ADHD, I'll apply the following techniques while summarizing and identifying key concepts:

1. **Simplification:** Condensing complex ideas into clear and straightforward sentences.
2. **Highlighting Key Points:** Emphasizing the most important information.
3. **Chunking Information:** Breaking down content into smaller, more digestible pieces.
4. **Visual Aid Suggestion:** If helpful, recommending diagrams or charts for clarity.
5. **Encouragement of Focus:** Suggesting strategies like focusing on one section at a time.

Please share the sample document you'd like me to summarize and simplify.

Here's a sample document containing a complex topic for us to summarize and simplify:

Title: The Importance of Renewable Energy

Renewable energy is energy derived from natural sources that are replenished at a faster rate than they are consumed. Examples include solar power, wind energy, and hydropower. Unlike fossil fuels such as coal, oil, and natural gas, renewable energy sources do not deplete over time and generally produce fewer greenhouse gas emissions, which are harmful to the environment.

The adoption of renewable energy is critical for addressing climate change, as it reduces our dependence on carbon-intensive energy sources. Moreover, renewable energy technologies create economic opportunities by generating jobs in manufacturing, installation, and maintenance. For instance, the solar and wind industries have seen rapid growth in employment over the past decade.

However, there are challenges associated with renewable energy. One major challenge is intermittency—solar panels cannot produce energy at night, and wind turbines require sufficient wind speeds to generate electricity. To address this, researchers are working on energy storage solutions like advanced batteries that can store excess power for later use.

In summary, renewable energy offers a sustainable alternative to fossil fuels, providing environmental and economic benefits. Continued innovation and investment are necessary to overcome current challenges and maximize its potential.

I'll now simplify and summarize this for a learner with ADHD.

Simplified Summary for ADHD Learners

Topic: Renewable Energy

1. What is Renewable Energy?

- Renewable energy comes from natural sources like sunlight, wind, and water.
- These sources don't run out and are better for the environment than fossil fuels (coal, oil, gas).

2. Why is Renewable Energy Important?

- It helps fight climate change by producing less pollution.

- It creates jobs (e.g., in making and fixing solar panels and wind turbines).

3. Challenges of Renewable Energy

- **Problem:** Solar panels don't work at night, and wind turbines need enough wind.
- **Solution:** Scientists are making better batteries to store extra energy for later.

4. The Big Picture

- Renewable energy is good for the planet and the economy.
- We need to keep inventing and investing to make it even better.

Tip for Focus:

- Look at one point at a time.
- Think of examples, like using a solar calculator or a windmill in action.

Would you like this in a visual format, or should I go deeper into any section?