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Artificial Intelligence in Special Education: A Literature Review

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Abstract

New avenues for communication with students who have Special Educational Needs (SEN) have begun to open up because of innovative educational technology. The most successful strategies over the past 20 years (2001–2020) have been those that utilize Artificial Intelligence (AI) techniques. The quality of life for SEN students is thought to be improved by the efficient use of AI techniques. Therefore, it becomes necessary to implement A.I. approaches to design procedures for both diagnosis and intervention. In addition, the study focuses on Assistive Technology (AT) and provides information on the most pertinent research conducted over the previous 20 years for the earlier objectives. This paper also discusses the limitations of current AI use in special education, including the scarcity of intervention tools and the lack of standardized diagnostic methods. Furthermore, the review explores the unique challenges in developing countries in implementing AI-based solutions for special education. This review study advances the available research by reviewing the role of Large Language Models (LLMs) as an AT while building on existing research that has acknowledged the much earlier potential of AI technologies to empower special education.

Keywords: Artificial intelligence; Assistive technology; Special educational needs; LLMs.

1 | Introduction

The world has changed dramatically in the previous 10 years as a result of the quick development of technology, which has also led to a decrease in computer capacity in all areas of daily life [1]. Understanding human mind in all its forms was the aim of computing science. A significant amount of research has been conducted on Artificial Intelligence (AI) within the last fifty years. AI is a complicated topic in terms of how it is used, configured, and developed. Many scholars have different definitions for it. One of the pioneers of AI, John McCarthy, claimed in 1955 that the goal of the field was to create robots that behaved like sentient beings [2].

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On the other hand [3], characterize the human brain as thinking, interpreting, and learning circumstances through the use of programming methods and application to problem solving. It may also refer to the study and creation of intelligence operatives with the ability to see their environment and act in ways that increase their chances of success [4]. AI, according to this definition, is the quality that makes an entity able to function correctly and consistently. Sen [5] defined AI as the process of converting human intellect into computer software through simplification, highlighting that the concept was motivated by the ways in which the human brain operates to support social and economic interactions.

Despite varying definitions, AI is generally understood to refer to the ability of computers running AI software to act intelligently based on data already in existence [6]. Therefore, there is a relationship between education and AI. Scholars and researchers seem to support the idea that AI technology might help education [7]. Lately, there has been an increase in the significance of educating every kid and fulfilling their educational needs as adults and adolescents. This research has bolstered the case for leveraging technology to overcome educational barriers. It has long been known that AI has educational benefits. AI approaches have long been used in the field of special education.

Early research initiatives mostly employed "Expert Systems," whose main function was to emulate the behavior of a human expert, to finish intellectual activity [8]. According to Gupta and Nagpal [9], an expert system is a computer software that mimics the decision-making and behavior of a person with extensive training and expertise in a certain subject. Expert systems do, in fact, comprise a knowledge base with accumulated experiences and rules dictating how to use that knowledge base in each particular scenario. It is comprised of a knowledge base editor that allows experts and information specialists to interchange data with the data system and an explanation facility that provides an explanation to the user [6].

Intelligence agent is a term used in [10] definition. It can also refer to systems that use a range of AI techniques to make decisions autonomously based on the current circumstances. It can also be defined as software that performs tasks for users or programs after detecting the environment [11]. In general, a system that can analyze data to generate outputs from inputs is referred to as an agent [2]. An architecture containing sensors and actuators (a computer, a robotic car, etc.) and an agent program make up an intelligent agent [12]. After processing different environmental impressions or data with machine learning algorithms, intelligent agents can operate in a pre-programmed or taught manner.

We would go into further depth on the many components of comprehending AI. Among these are machine learning algorithms, which are a group of algorithms that learn from recorded data and use that data to do various tasks:

I. Predict the future;

II. Optimize a particular utility function under uncertainty;

III. Extract hidden structures from data;

IV. Classify data [13].

Rather than providing the computer with instructions directly, the concept of imparting the essential abilities through learnable instances enabled the computer to become intelligent [14].

Additionally, deep learning is a unique method that uses hierarchical designs created by expanding the number of hidden layers in basic Artificial Neural Networks (ANN) to attempt learning high-level abstractions [15]. Numerous tasks, including speech recognition, image processing, language processing, and signal processing, include deep learning.

Fuzzy logic which allows a set to be partially a member of many sets was the AI idea that was employed for this investigation. Similar to traditional reasoning, each entity is a member of a certain set. The set's components are established. An entity can only be a part of a set or it cannot. Fuzzy logic is an exception to this, though. The membership degrees of the set elements in fuzzy sets can have values between 0 and 1 [16].

2 | Literature Review

2.1 | Review on Special Education

The phrase Special Educational Needs (SEN) describes a broad spectrum of challenges that impede learning. Furthermore, SEN is closely related to the historical and cultural advancement of research in many nations. Because the phrase SEN is so broad, we have chosen to utilize the more precise meaning of learning difficulties, which is closer to the IDEA definition of learning disabilities, for this article.

The Individuals with Disabilities Education Act (IDEA) defines learning disability as a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or to do mathematical calculations [8]. The relationship between students with varying needs and talents and AI educational approaches has ushered in new periods and trends that call for the employment of specialized tools and innovative techniques to enhance children's lives in home and school environments.

Over the past ten years, many studies have explored the practical applications of AI computing technologies to enhance the educational experience of children with learning disabilities [17]. The most notable AI methods over the past ten years that have been applied to the identification and treatment of students with SEN will be the subject of this essay. Parents, special educators, and school personnel may all use these helpful resources. This report is divided into two primary categories to aid in the classification of these investigations. Applications for identifying learning disabilities are introduced in the first segment, while intervention-based methods are covered in the second.

2.2 | Review on Assessment and Diagnosis

The application of AI in special education encompasses a broad spectrum of areas which cut across Assessment and diagnosis using AI-powered tools to analyse data from various sources like student performance, eye gaze patterns, and interaction with educational software to identify learning difficulties and potential disabilities. Early and accurate diagnosis is crucial for providing timely intervention and support.

Given the implicit nature of learning challenges, diagnosing these learners using AI techniques has long been a contentious topic [18]. During the evaluation process, several concerns come up, including the type of special educational requirements and their diversity, the co-occurrence of other disorders, and the disparities between boys and girls. A fuzzy cognitive map method was introduced by Georgopoulos et al. [19] for the differential diagnosis of Specific Linguistic Impairment (SLI). A symbolic representation is used by fuzzy cognitive mapping, a soft computing technology, to describe and simulate complicated systems.

Since SLI frequently has symptoms similar to those of other conditions, the purpose of this tool is to help doctors differentiate between SLI dyslexia and autism. Four clinical cases have been evaluated using the system, and the findings are encouraging [19]. Rebolledo-Mendez and Freitas introduced the NeuroSkyMindSet (MS) [19]. This tool combines performance user-generated interaction data to identify attention levels during an evaluation exercise. Three electrodes on a headgear called NeuroSky are placed on the forehead and under the ears. NeuroSky's algorithms employ the electrical impulses read at the areas as inputs to determine the degrees of attentiveness.

Additionally, an AI-driven avatar was created with the ability to converse briefly and ask people questions. It's an inexpensive, non-clinical, and user-friendly gadget for recreation. In the following years, this model was tested on first-year undergraduate students, and the findings showed a good relationship between self-reported and measured attention levels [20, 21]. Arthi and Tamilarasi [22] presented a model that uses the ANN approach to assist in diagnosing autism in youngsters. The original autistic data is transformed by the model into appropriate fuzzy membership values, which are then provided as input to the neural network design.

Additionally, a pseudo-algorithm is developed to use the backpropagation method to forecast autism disorders. In addition to doctors, psychologists, and special educators, this method is suggested as help. In the future, the K-Nearest Neighbour method for comparative study might be used to forecast autism disease [22]. A diagnostic tool for learning difficulties in children's basic education, Sistema Experto de Dificultades para elAprendizaje (SEDA), or Expert System for Learning Difficulties in English was presented by Hernández et al. [22]. The development process employs Expert Systems design methodologies, incorporating a knowledge base with various strategies for evaluating Psychopedagogy. The aim is to establish connections between input variables, such as age, sex, and educational level, and the output systems, such as psychomotor and intellectual aspects.

All of the aforementioned gives users of the expert system the ability to recognize the student's psychological profile. Using an estimation scale of Poor, Moderately Efficient, and Efficient [23], 80% of the evaluators gave the system an E rating [24]. Jain et al. [25] presented a model named Perception Based Learning Disability Detector (PLEDDOR) in the same year. It is an Artificial Neural Network model that uses curriculum-based testing administered by special educators to identify issues with reading (dyslexia), writing (dysgraphia), and mathematics (dyscalculia). This computational diagnostic tool comprises one output unit and one input layer with eleven units that represent various aspects of a traditional test.

After being tested on 240 kids gathered from Indian hospitals and schools, the approach was shown to be straightforward and reproducible in large quantities, but it also yields findings that are similar when using recognized detection metrics [25]. Kohli et al. [26] presented a methodical technique that uses ANN to detect dyslexia in children at an early developmental stage. This method is one of the first to employ ANN to overcome dyslexia detection issues. It also sets itself apart from other platforms because it is built using test data that spans the evaluation outcomes of prospective dyslexic students from 2003 to 2007. These test results make the system's input data, and the output results divide the pupils into two groups (dyslexic and non-dyslexic).

The process that connects college performance to the fundamental features is called error back-propagation. According to Kohli and Prasad [26], the preliminary test data findings were quite accurate and indicate that this platform may also be used with actual data. A platform for a quicker and more precise diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) was created by Anuradha et al. [27]. They employed the Support Vector Machines (SVM) algorithm, a well-known AI method. The authors claim that this is the first time the SVM algorithm has been used to detect ADHD. SVMs are supervised learning methods that work well for regression and classification.

The SVM module was given a data set that included answers to a questionnaire used by the clinicians to identify the disease and was validated by a medical professional. The data set was then added and subsequently brought back to the SVM module, which is what ultimately gives us the diagnostic. The ability to regulate the diagnostic process's complexity is the primary benefit of using the SVM algorithm. Children aged six to eleven were used to test this procedure, and the findings showed an 88,674% success rate in diagnosis [27].

2.3 | Review on Intervention

Obtaining a trustworthy and accurate diagnosis is the first step toward assisting a youngster in overcoming challenges. The intervention procedure is the second phase. The application of AI systems in the teaching of kids with learning disabilities is presently the attention of many researchers. ActiveMath is a web-based intelligent math teaching system that was launched by Melis et al. [28]. Through the use of ActiveMath, an Intelligence Tutoring System (ITS), students may learn whenever it is most convenient for them in the comfort of their own homes. To provide adaptive course development, student modelling, feedback, interactive exercises, and a knowledge representation suitable for the semantic Web, it employs a variety of AI approaches.

The user creates their student model in ActiveMath by first evaluating their degree of topic mastery. They then select learning objectives and scenarios, such as being prepared for an exam. Both the recommendation method and the course creation process adjust to the student's ability. Additionally, a poor man's eye tracker that can precisely measure a child's attention span and reading time has been developed. Numerous studies conducted in the years that have followed have indicated numerous beneficial effects from this application, all of which support the impact of this ITS throughout the learning process [28, 29].

To assist students with speech impairments, Schipor et al. [30] developed a fuzzy expert system-based Computer Based Speech Therapy (CBST) system. They created the traditional architecture of the upgraded CBST system, LogopedicsMonitor (LOGOMON), using a fuzzy expert system. This method seeks to recommend the best course of action for each student based on the information that has been chosen. According to the system's evaluation, the learner benefits from greater treatment time, predictability, and result explanation when employing an expert system [30].

A platform created by Riedl et al. [31] can help teenagers with High Functioning Autism Spectrum Disorders (HFASD) practice and acquire social skills with less assistance from caregivers, educators, and therapists. Presenting a social scenario game, such as visiting a movie theatre, forces students with HFASD to role-play and finish activities involving social circumstances. The organizations receive assistance from AI in creating customized social settings. When analyzing the causal form of the narrative plan, an AI system looks for places where a student's activities might break a causal link.

An additional branch designed to address the contingency of the learner's activity is the alternate narrative scenario. This specific platform's AI tool lessens the workload associated with manual authoring, freeing up professionals to tackle the implementation of intervention tactics. The assessment of this social scenario intervention strategy is complete, and the findings thus far are encouraging [31]. The Dedalos initiative, introduced by [31] focuses on teaching English as a second language to hearing-impaired individuals whose first language is Greek sign language.

The process of creating educational e-content tailored to each user's needs involves auditing and evaluating the language proficiency of the e-learners. The system makes use of an intelligence taxonomy system that was created for student evaluation and instructional material organization. The strategy opens the door for integrating Greek students with hearing impairments and supports a comprehensive support system for their education [32]. To facilitate students' individualized feedback, Gonzalez et al. [33] created an automated platform for the identification and analysis of mistakes in mathematical tasks.

All children are recommended to use this strategy, but individuals with special needs-like those with Down syndrome-struggle with addition and subtraction as math operations are especially important to them. An error detection algorithm was created that can analyze the information obtained from the student's interactions with the platform. Teachers can then use the error's output to tailor their instruction to the student's individual needs and identify areas of difficulty.

Additionally, to help students learn from their mistakes, they created a model that returns the set of mistakes made by the students in the rectified activities. A group of students with Down syndrome tested the system, and the findings show that the module functions as intended [33]. All pupils who struggle with spelling can use the adaptive spelling instruction technique that Baschera and Gross established the same year. The inference technique that powers this platform is intended to handle information that has not been classed and has various faults characterized by separate mal-rules.

Based on the observed error behaviour, the inference process is based on a Poisson regression with linear link functions and calculates the student's difficulties with each specific mal-rule. Using this knowledge representation, a student model for spelling instruction was created, complete with lessons for specific word mal-rules and pupil-adjusted repetition of misspelt words. When this system was tested in two extensive user tests, the learner's performance significantly improved due to the student-adapted training activities [34].

2.4 | Assistive Technology

Assistive technologies range from hardware and software tools such as mobility aids, braille machines, visual alert systems, hearing aids, calculators, and spelling programs, all of which contribute to the ease and efficiency of daily tasks [13]. The benefits that one can achieve from the use of such technologies are the reason for advocacy among parents, teachers and educational institutions alike. This advocacy serves as a means to offer compensatory benefits, address academic issues, foster personal independence, and provide specialized support, from spelling-checking techniques to sophisticated speech recognition systems [13].

Although the use of AT may vary to several ages, the elderly with chronic illnesses, and those who are disabled are the highest [31]. One in ten people who are disabled are kids for whom the use of AT can be extremely beneficial. To engage in family, and community and live a fulfilled personal and professional educational life, people with special needs should have access to resources such as Assistive technologies that can help them lead more fulfilled lives. Unfortunately, due to problems such as lack of affordability, unavailability of resources and nonacceptance; accessing AT can be challenging for low-income nations such as Nigeria. Moreover, barriers such as lack of training and resources, poverty, poor management of resources and funds, and lack of family involvement contribute to the problems that hinder special needs individuals from fully utilizing AT for the betterment of their lives.

2.4.1 | Exploring assistive technology in the modern era

AT has played a vital role in increased inclusion in special education. Because of its ever-evolving nature, there is always a need for research to improve adaptability for students and teachers alike. In the Nigerian context, there is a need to understand that every day there are a significant number of children with disabilities, that face challenges in accessing education. This is evident in many countries of the world [35, 36], because of this very reason, the integration of AT holds immense potential for breaking the barriers to inclusive education.

Assistance is making the task easier to perform in a better way. A gadget gives the human partner the facility during the human-robot contact. In general, all machines and robots are created with certain objectives in mind, including some form of help. However, in the context of human-computer interaction and human-robot interaction in particular, the support perspective mostly relates to enhancing human capacities [36, 37]. Regardless of the application domain, this viewpoint may be expanded to describe the unique trade-offs and patterns that are present in such assistive frameworks are socially helpful robots.

2.4.2 | Large language models as a modern-day assistive technology

Large Language Models (LLMs) are types of AI trained on massive amounts of text data. They can generate text, translate languages, write different kinds of creative content, and answer your questions in an informative way. Simply put, they're like superpowered chatbots that have learned to understand and respond to human language with remarkable sophistication. It is a type of AI trained on massive amounts of text data. These powerful models can generate text, translate languages, write different kinds of creative content, and answer your questions in an informative way [38].

2.4.2.1 | LLMs application in special education

In the realm of special education, LLMs have the potential to become game changers. Students with diverse learning needs often require individualized approaches, something that can be overwhelming for even the most dedicated teachers with limited resources. LLMs can bridge this gap by offering a suite of tools designed to empower educators and unlock the potential of every student.

AI algorithms can create individualized learning plans tailored to a student's specific needs and learning pace. This includes adapting the difficulty level of materials, recommending appropriate resources, and suggesting alternative teaching methods. Large Language Models (LLMs) are doing this by bringing the exact level of personalized support and instruction they need to thrive. LLMs are a type of AI trained on massive amounts of text data. They can generate text, translate languages, write different kinds of creative content, and answer your questions in an informative way. Simply put, they are like superpowered chatbots that have learned to understand and respond to human language with remarkable sophistication [39].

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LLMs can analyse a student's performance data, learning style preferences, and areas of difficulty. By leveraging this data, LLMs can create customized learning paths tailored to each student's needs [40]. LLM can identify a student struggling with fractions. Instead of a one-size-fits-all approach, the LLM could curate a series of interactive exercises, and explanations tailored to the student's specific knowledge gaps, and even generate personalized practice problems that cater to their learning style. This adaptability ensures that students are neither bored nor overwhelmed, keeping them engaged and motivated throughout the learning process [33].

LLMs also offer targeted support for students with specific learning challenges. For example, an LLM could provide real-time text-to-speech conversion for students with dyslexia, allowing them to access written materials without the burden of decoding them. Similarly, LLMs could offer alternative representations of complex concepts for students with visual processing difficulties, such as converting text descriptions into interactive diagrams or offering audio narration alongside visual information [19]. This kind of personalized assistance can empower students with disabilities to access and engage with learning materials in a meaningful way.

Beyond these core functionalities, LLMs offer exciting possibilities for fostering communication and social-emotional learning among students with SEN. For students who struggle with verbal communication, such as those with Autism Spectrum Disorder (ASD), LLMs offer alternative communication pathways. It acts as a virtual assistant, helping students translate their thoughts into spoken words or vice versa.

2.4.3 | Assistive technology in Nigeria

Globally, special education has been given immense attention which has caused increased spending on research and development allowing for newer innovations to help Students with Disabilities. However, Nigeria, because of its lack of resources and awareness still faces huge challenges when it comes to technology of any sort, let alone AT [1]. When it comes to special education, Pakistan faces a challenge in enrolling such children in schools. AT, because of its adaptable nature, has been a transformative force for kids with special needs. One segment of this diverse community is children with hearing disabilities. In the Pakistani context, however, children with hearing disabilities find it hard to access education resources, and the integration of AT, particularly speech-to-text applications, holds great promise.

3 | Educational Assistive Technologies

The use of speech-to-text applications and videos with subtitles are types of educational assistive technologies that are designed to improve communication in classrooms and empower students with hearing disabilities to engage actively in learning activities. Speech-to-text applications, for example, convert spoken language into written text, offering a valuable tool for students with hearing impairments to comprehend and interact with the learning material effectively [13].

Examples of such applications include real-time transcription services, captioning tools, and speech recognition software. The importance of speech-to-text applications in educating students with hearing disabilities lies in their ability to provide real-time access to spoken content. This allows these students to participate in classroom discussions, understand lectures and engage with educational content equally with their peers.

The use of such technology not only facilitates communication but also promotes inclusivity in educational environments. While there are increased benefits of using AT (such as speech-to-text applications), the literature within the Nigerian context remains limited and has studied the impact of these technologies on academic performance and the overall development of students with hearing disabilities. This study seeks to address this gap by exploring the integration of speech-to-text applications in the educational curriculum for children with hearing impairments in Nigeria.

3.1|Assistive Technology in Existing Syllabus for Kids with Special Needs

Students with impairments encounter several obstacles in the educational system that hinder their ability to learn and perform well in various classroom activities. These kids must receive the same opportunity as their classmates to engage in society. Digital technologies are used in this situation to access the curriculum. Evidence in this regard demonstrates how digital technology (computers, laptops, and mobile devices) has altered the lives of several kids [1]. Despite these educational improvements, little focus has been placed on how students with disabilities use technology daily.

This is not unexpected considering that there are little developed research children on children with impairment and that general research frequently leaves out this segment of the student population [12]. Ensuring equitable access to and profit from digital technology may be difficult in light of this. Students who are visually impaired are most in need of tools, followed by those who are hearing-impaired and those who are physically challenged [26]. Thus, it can be said that using AT successfully and effectively is essential to ensuring that students with special needs are included in the classroom. Even though using AT in the class has many advantages for all students, some difficulties and barriers must be overcome.

Modern technology has completely changed how we do business, communicate, wage war, cultivate our crops, and treat our patients during the past ten years. Teaching is also undergoing a technological revolution, and no area has seen this change more drastically or successfully than the education of kids with disabilities. Although the benefits of technology for students with disabilities are already well known [34], future benefits are probably going to be even greater and more pervasive than current practices would lead us to believe that children should use assistive technologies to enrich their own lives.

The development of ease for children with disabilities is greatly aided by assistive technologies. To make any required modifications based on the child's capacities, the efficacy of AT and the child's capabilities must be regularly assessed. Each kid with special needs will rely on AT to a different extent; some may not be able to function academically without it, while others may merely need it for support, according to Council for Children Centre research from 2005. Children with SLD have unique strengths, needs, interests, and experiences, thus the AT devices that may be utilized with them differ from kid to child. A device that seems appropriate for one child may not be suitable for another [41].

Technology can improve educational results and aid in preparing students with disabilities for life after graduation [42]. It also can make academic experiences for these students more enjoyable and, in some situations, more useful. A qualitative study on the usability and perceived efficacy of an electronic performance support system created for secondary students with minor impairments [13]. Thirty-nine strategy items are included in this program to aid with learning, conduct, and transition in high school and beyond. For one semester, two special education instructors utilized the programmer with their high school kids.

The tools, according to the students, had helped them detect their improper reactions and select the more suitable ones. The need to equip inclusive schools with the proper AT tools and to give teachers the training they need to use and employ such tools in teaching and evaluating is present. There are a variety of AT devices available that are designed and used to address the written language, reading, listening, memory, and mathematics problems of children with SLD. This would maximize the benefits of using AT tools and will result in the technology enhancing and enhancing the teaching-learning process.

The MoE is advised to play a key role in increasing the use of AT in inclusion schools and should: give teachers in general extensive training in how to use AT; increase the number of high-quality AT devices in inclusion schools (for instance, by giving them access to developmentally appropriate literacy software); and most importantly, give teachers working in both private and public kindergartens in-service training programmers The MoE enhances public inclusion schools greater consideration by giving them enough money so that they can have the right AT for instructing students with SLD. It is also advised that colleges review the study plans for special education and teaching majors to ensure that these programs include courses and training on using AT to teach students with disabilities in inclusive classrooms.

4 | Conclusions

Techniques from AI have been effectively used to address issues in the field of special education. Science agrees that AI techniques may combine users' freedom of action and guide them toward personal learning objectives. Some of the most notable publications over the past ten years that presented AI-based diagnosis and therapeutic strategies have been included in this research. These educational resources are designed with the express purpose of supporting educators, parents, therapists, special educators, and kids who struggle with learning.

When children with learning issues are identified by AI tools, we may obtain a reliable diagnostic that will guide our selection of the best intervention strategy. Still, many problems need to be investigated, such as the few available AI intervention tools and the absence of nationally recognized guidelines for AI diagnosis techniques. Furthermore, future research should involve groups of students with other learning disabilities among a wider sample of students. AI research projects hold great promise for improving the lives of Special Education Needs (SEN) children and those in their immediate vicinity.

Students with SEN have shown according to studies to exhibit a diverse range of learning styles, cognitive strengths and weaknesses, and sensory processing differences. Traditional one-size-fits-all approaches to education have also failed to cater to these individual needs, and they strive to create personalized learning environments that cater to each student's strengths and weaknesses. Several studies offered AI as a promising avenue for achieving this goal. Despite the global acknowledgement of AT and the potential it has in the area of special education, Nigeria faces constraints that are marked by limited resources and awareness. Within special education, assistive technologies have always played an integral part in facilitating students with disabilities, allowing them to keep up with their peers. When such technologies exist for the betterment of people, the right application and acceptance can be a source of ease for teachers and students alike. There seems to be a gap, however, in the existing literature which has studied the impact of technological inclusion.

This study bridges gaps by studying the specific challenges associated with student perception and adaptability of AT such as speech-to-text applications in a classroom with hearing disabilities. By doing so, this study contributes to the knowledge base that informs policies and practices, fostering more inclusive and equitable educational opportunities for special needs students.

With no AT in the uses of LLMs, there is more hope in the special education space in developing countries like Nigeria, even as chatbots powered by LLMs already accelerating possibility and widespread. LLMs are making a difference in communication support. For students with ASD who struggle with verbal communication, LLMs can act as virtual assistants. Imagine a student using LLM to translate their thoughts into spoken words or vice versa during classroom discussions. This empowers students to actively participate and express themselves confidently, fostering a more inclusive learning environment.

These are a few early success stories demonstrating the transformative potential of LLMs and generative AI in special education. As these technologies evolve and ethical considerations are addressed, we can expect even more innovative applications that bridge learning gaps, empower students, and unlock their full potential.

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