Impact of AI on the inclusion of Learners with Special needs: Public Policy Perspective in Contemporary Scenario

1. **Dr. Muhammad Umar Riaz Abbasi,** Ph.D. Islamic Thought and Culture, Department of Islamic Thought and Culture, National University of Modern Languages Islamabad Pakistan, VFM, Air University, Islamabad, Pakistan
Author of Five Books and Forty-seven Research Publications, Columnist, Daily Pakistan Observer
Best Paper Presenter Award Globetz International Conference Turkey, November 2021
Chairman, Global Reconciliation Institute for Peace (GRIP), Corresponding & Principal Author
Email: drumarabbasi101@gmail.com
ORCID: http://orcid.org/0000-0001-6977-9516
2. **Anum Zulfiqar**, Mphil Scholar, Mass Communication, National University of Modern Languages, Islamabad, Pakistan
3. **Muhammad Shoaib Rasool**, MPhil Scholar, Department of Political Science and International Relations, DPIR, University of Sargodha, Pakistan
4. **Dr. Syed Shameel Ahmed Quadri**, Assistant Professor, Department of Political Science, University of Karachi, Pakistan

Abstract: *Artificial intelligence possesses the capacity to profoundly transform how teachers engage with students who possess exceptional requirements. The influence of AI and other technologies has extended far across various industries, including academia. These advancements have significantly facilitated the learning process for students with disabilities such as sensory, motor, cognitive, and others. European nations are progressively dedicated to upholding human rights and promoting inclusive education. Nevertheless, the enduring disparities in education and social opportunities suggest an inconsistent application of inclusive education. The utilization of artificial intelligence (AI) has had a dual effect, not only on learners with special needs but also on educational institutions by facilitating the development of inclusive teaching methods. This study is a working paper that aims to analyze the impact of AI on education for learners with special needs. The data collection was accomplished through qualitative research, including focused interviews with teachers and students who have special needs. The data was additionally gathered from academic databases such as Scopus and Science Direct, as well as from newspapers, journals, and blogs. The gathered responses were analyzed using content analysis. The study specifically examined whether the literature addressed the issue of assessing the influence of AI on special education for students with special needs, the utilization of artificial intelligence to promote inclusive education, and the use of AI to assist teachers in advancing special education. The study also attempted to provide a framework, based on focused interviews, for inclusive special needs education in the future.*

Keywords: *Artificial Intelligence, Inclusive education, special educational needs, special learners, learning*

disabilities

Introduction:

Background of role of AI in inclusive education

Artificial intelligence (AI) refers to the replication of human intelligence in computers, which are specifically designed to imitate human thinking and behaviour. Cognitive abilities encompass several mental processes such as learning, thinking, problem-solving, vision, and language understanding.

Artificial Intelligence is a technique used to empower a computer, computer-controlled robot, or software with the ability to think intelligently, similar to the human mind. AI is achieved by the examination of the human brain's patterns and the analysis of cognitive processes. The research yield the creation of sophisticated software and systems.

Artificial intelligence (AI) is more than simply a trending term. This technology possesses significant capabilities that are fundamentally transforming multiple industries on a global scale. The domain of education, namely special education, is not exempt from this.

The core of special education lies in implementing a customised and personalised approach. Artificial intelligence, with its sophisticated capacities, has the potential to introduce unparalleled customisation to the process of learning. Adaptive learning technologies, supported by advanced AI algorithms, provide distinct learning routes to accommodate the varied requirements of children in special education. These AI systems evaluate and comprehend the unique learning style, speed, and level of understanding of each student. Assume that a student's preferred method of learning is primarily based on visual comprehension. Under those circumstances, the AI system has the ability to adjust and display information in a visually-oriented manner, which enhances the student's involvement and comprehension.

Moreover, AI technologies facilitate the overcoming of communication obstacles that frequently hinder the educational progress of pupils with special needs. Advanced AI capabilities, such as recognition of voice and text-to-speech technologies, enable students with speech or physical limitations to communicate effortlessly. Google's Voice Access enables voice-based device control, Microsoft's Immersive Reader enhances comprehension while reading, and AssistiveWare's Proloquo2Go facilitates symbol-based communication. These technologies utilise artificial intelligence (AI) to provide crucial support for special education pupils, enabling them to properly express themselves and actively participate in instructional material.

The domain of AI-driven assistive robots is rapidly expanding and presents a promising opportunity for special education. These robots function as interactive companions, aiding students, especially those with autism and other developmental disabilities, in improving their social skills, identifying and comprehending emotions,

and nurturing their enthusiasm for learning. Robots such as Milo and NAO are effectively teaching children to recognise social signals and reactions in a secure and reassuring setting by utilising interactive courses and games.

AI plays a clear role in directly engaging with students and enhancing their learning, but it is also a useful tool for educators. AI offers a vast amount of data that illuminates the learning process of each pupil. This data enables instructors to effectively track progress, refine teaching tactics, and promptly identify potential obstacles to learning. The knowledge obtained from AI allows for an anticipatory strategy for improving the effectiveness of instruction and the overall experience of learning.

While we appreciate the remarkable capabilities of AI and its ongoing improvements to special education, it is equally important to analyse and confront the ethical implications it presents. Ethical issues such as privacy concerns, potential bias, and the risk of unfair treatment require careful and thorough consideration. The utilisation of AI in special education necessitates the establishment of a robust ethical framework, which should be formulated through the collective efforts of policymakers, educators, and AI experts. The primary focus of this framework should be to give utmost importance to the well-being and protection of students, safeguard their privacy, and ensure that artificial intelligence plays a role in promoting equitable opportunities for all learners.

Another crucial factor to consider is the digital divide. Ensuring equal access to these advanced tools is of utmost importance as AI becomes increasingly widespread in special education. The expense associated with these technologies, together with the required infrastructure such as high-speed internet, may unintentionally exacerbate the educational inequalities among students.

AI's involvement in special education is expected to expand in the future. Professional growth and thorough teacher training are necessary, nevertheless, in order to fully reap its benefits. Teachers must possess a sense of ease and confidence in utilising these technologies, effortlessly incorporating them into their instructional approaches. With the advancement of AI technology, the demand for continuous professional growth in this domain will persistently increase.

The indisputable potential of AI in revolutionising special education is evident. The level of customisation it offers, together with its capability to overcome communication obstacles, and its potential to offer profound insights to educators, renders it a transformative innovation. Nevertheless, fully unlocking the capabilities of AI requires tackling ethical concerns, guaranteeing equitable availability, and empowering educators through professional growth. As we progress along this journey, we can anticipate a future in which AI assumes a crucial role in empowering every special learner to achieve their maximum capabilities.

Recent advancements in technology have helped learners with special needs take advantage of novel modes of connection. In the period between 2001 and 2010, artificially intelligent innovations have achieved notable success. AI methodologies are regarded as a means to enhance the quality of life for learners with special educational needs.

Rationale for studying the impact of AI on learners with special needs

Advancements in technology, specifically in Artificial Intelligence (AI), have notably impacted different parts of society, including education, in recent years. Although the use of technology in educational environments is prevalent, it is essential to explicitly examine the influence of artificial intelligence on students with disabilities. This reasoning provides a concise and logical explanation for the necessity of conducting research in this specific field.

Ensuring equal opportunities and fairness:

Despite the advancements in educational inclusion, learners with special needs persistently encounter distinct obstacles. Artificial intelligence (AI) can tackle these difficulties by offering customized solutions that specifically adapt to the unique learning needs of individuals. Analyzing its influence can provide methods to improve inclusiveness and advance educational fairness.

Customized educational experiences:

AI technology can customize and tailor learning experiences to each student's requirements and capabilities. Gaining insight into how artificial intelligence can customize educational content and procedures for students with special needs is essential for creating an inclusive learning environment that accommodates many learning preferences.

Improved Academic Achievements:

Initial research indicates that artificial intelligence (AI) tools can potentially enhance educational outcomes for individuals with special needs. Further exploration can yield valuable insights into the potential advantages, including heightened academic accomplishments, enhanced involvement, and improved skill acquisition, contributing to these learners' overall success.

Enhancing Competence in Technology and Developing Proficiency:

The utilization of AI technology can enhance the acquisition of technological literacy in learners with special needs. Studying how these kids engage with and get advantages from AI tools might provide valuable insights to educators and policymakers regarding the essential competencies required for achievement in a society progressively reliant on technology.

Identification and intervention:

AI can aid in the early detection of learning difficulties and motivate the implementation of intervention techniques. By examining its influence, we can discern efficient methods in which AI technologies can facilitate prompt interventions, thus mitigating learning challenges before they escalate into substantial impediments.

Professional development for teachers:

Educators are crucial in effectively incorporating AI tools into the classroom. Studying the influence of artificial intelligence on children with special needs yields useful knowledge on the necessary training and professional growth that teachers must undergo to efficiently utilize new technologies, thereby guaranteeing the best possible assistance for their pupils.

Concerns about ethics and safeguards:

With the increasing use of AI in education, examining the possible ethical consequences and protective measures is essential, especially when working with vulnerable groups like students with special needs. Exploration in this field has the potential to aid in the creation of protocols and regulations that promote conscientious and moral utilization of artificial intelligence in the context of special education.

Contribution to the field of educational theory and practice:

Gaining a thorough comprehension of how AI affects students with special needs helps enhance educational theory and practice. This knowledge can be used to build evidence-based strategies, instructional techniques, and policies focused on this group of students' specific needs and skills.

Purpose of the research

- The primary objective of this research is to thoroughly investigate and comprehend the diverse effects of Artificial Intelligence (AI) on students with special needs in educational environments. The study aims to clarify how AI technology can be utilised to improve the learning experiences, academic accomplishments, and general welfare of kids with special needs. The research seeks to accomplish the following substantial objectives through a thorough investigation:

- Explore and define the ways in which AI technologies can be efficiently employed to customise learning strategies that cater to the distinct cognitive, sensory, and physical requirements of learners with special needs. This entails comprehending how AI may modify instructional content, delivery methods, and evaluations to cultivate an inclusive and helpful learning environment.

- Evaluate the influence of artificial intelligence on the academic performance, acquisition of skills, and overall educational accomplishments of students with disabilities. The research seeks to measure and

assess the enhancements in learning outcomes enabled by AI tools, taking into account various learning styles and personalised educational strategies.

- Examine the impact of artificial intelligence (AI) on addressing the social and emotional requirements of learners with special needs. This involves investigating the ways in which AI technologies can enhance the growth of social skills, self-esteem, and emotional well-being, therefore promoting a favourable and all-encompassing school atmosphere.
- Enumerate prospective obstacles and moral deliberations linked to the amalgamation of artificial intelligence in the realm of special education. This entails a meticulous analysis of concerns such as data privacy, algorithmic prejudice, and the ethical consequences of depending on technology for tailored learning experiences for susceptible groups.
- Offer empirically supported insights to guide the formulation of inclusive education policies that use artificial intelligence technologies. The project seeks to provide pragmatic suggestions for policymakers, educators, and stakeholders to utilise AI in a manner that fosters fairness, inclusivity, and the complete engagement of students with special needs in regular educational environments.
- Contribute to the progress of teacher professional development by identifying the requisite skills, training, and support needed for educators to integrate AI tools into their teaching proficiently practises. The project seeks to equip educators with the expertise and materials necessary to navigate the ever-changing field of artificial intelligence in special education.
- Examine how artificial intelligence (AI) might enhance cooperation among different parties, such as educators, parents, and technology developers, in order to establish a comprehensive and supportive environment for students with special needs. The project aims to discover efficient methods of collaboration that optimise the advantages of AI integration.
- Create a strong basis for future research efforts in the field where artificial intelligence and special education cross. The study seeks to encourage additional investigation, creativity, and improvement of AI technologies in order to address the changing requirements of learners with special needs more effectively, hence ensuring continuous advancement in inclusive education practises.

Research questions

- What are the potential roles of Artificial Intelligence in inclusive education?

- What are the methods for incorporating AI technology into current educational frameworks to guarantee that learners with special needs are included and have access to the resources they need?

Significance of the study

This study has multiple dimensions of importance and has ramifications for various stakeholders in the education sector, technology development, policymaking, and society as a whole. Here are some crucial elements of importance:

- This study has the capacity to enhance inclusive education by determining how AI technology can be utilised to develop learning environments that are more accessible and customised for students with special needs.
- Gaining insight into the influence of artificial intelligence (AI) on students with special needs can result in the creation of focused interventions and resources that enhance academic performance and learning outcomes for this particular group.
- This study can provide insights into how AI can enhance computer literacy and skill development in students with special needs, equipping them for a society that is more reliant on technology.
- Gaining insight into the role of AI in enhancing the social and emotional well-being of students with special needs can facilitate the creation of interventions that cultivate a favourable and all-encompassing school atmosphere, hence fostering a sense of belonging and self-assurance among these learners.
- The research underscores the significance of cooperation among educators, parents, and technology developers, cultivating a collaborative educational environment that optimises the advantages of AI for learners with special needs.
- The study can establish a basis for future research and innovation in the convergence of AI and special education, stimulating additional investigation and enhancement of AI technologies to address the changing requirements of learners with special needs more effectively.
- The study aims to analyse the enduring effects of AI on students with special needs, offering valuable information on how to enhance their readiness for forthcoming technological breakthroughs and facilitate their integration into society.

Methodology:

Using a qualitative research approach, this study seeks to fill gaps in knowledge. Focused interviews have been employed to perform the research. Participants included both general education instructors and students

with impairments. Individuals with disabilities and educators working with pupils who have special needs made up the focus group participants. This sample was selected to gain insight into institutional support and teacher practices for creating an inclusive classroom. By utilising Content Analysis on the collected responses, we were able to propose a more inclusive pedagogy and approach to instruction in order to advance special education.

Research Instruments:

The target groups' answers were gathered via focused interviews. The interview was mostly conducted in two stages: The initial phase involved conducting interviews with teachers who specialise in educating students with special needs. The purpose of these interviews was to get insight into their teaching methods and the level of institutional support provided to foster inclusive pedagogy. During the second phase, an interview was carried out with students who have disabilities to get insight into the challenges encountered by learners with special needs and to determine whether these challenges are being handled by the institution or the teacher. The questions posed to the respondents during the focused interview are presented in the Table below:

Questions	
From teachers:	**From learners with special needs:**
What is your current approach to incorporating technology into your learning process, and do you encounter any particular difficulties in your studies?	How has the incorporation of AI affected the personalised learning programmes for children with special needs, based on your expertise?
How might artificial intelligence strengthen or amplify your learning experience, in your view?	Which AI tools or technologies have you discovered to be the most efficient in assisting learners with special needs, and what are the reasons for their effectiveness?
Have you utilised any tools or programmes in your schooling that are powered by artificial intelligence? If so, how did you find them?	How can one effectively integrate AI alongside traditional teaching approaches to cater to the unique requirements of learners with special needs?
Do you believe that AI technologies have the potential to enhance your ability to communicate	What are the problems and concerns associated with using AI for learners with special needs,

with both teachers and peers? If yes, how exactly?	according to your perspective, and how may these issues be resolved?

Literature Review:

Insights into artificial intelligence and its input in education

Recent advancements in technology have helped learners with special needs take advantage of novel modes of connection. In the period between 2001 and 2010, artificially intelligent innovations have achieved notable success. AI methodologies are regarded as a means to enhance the quality of life for learners with special educational needs. According to numerous media publications, we currently see an AI revolution, particularly in the field of machine learning. These systems, capable of being trained on extensive datasets to carry out specific tasks, are currently being seen as potentially causing major disruptions in various sectors such as business, finance, healthcare, and public sector institutions. Education is unequivocally included in the list of topics that will be affected. Currently, AI is being utilised in education through software platforms that provide 'adaptive' or 'personalised' learning. These systems usually utilise machine learning methods to suggest specific resources or tests by analysing the behaviours of individuals and groups inside the platform software. Some notable examples include the ALEKS platform, which was initially created at the University of California, Irvine, and later acquired by McGraw Hill Education, a publishing company focused on education. Another example is Century, a UK-based company that provides platform services using artificial intelligence and neuroscience research. Squirrel AI, a Chinese company, also offers an adaptive learning engine and has formed research and development partnerships with various educational organisations and financiers in the US. These platforms, which personalise educational experiences, are currently one of the most common applications of AI in education. They expose certain fundamental assumptions about education that differ from the previously described principles of inclusiveness. Nevertheless, it is crucial to emphasise that they are commonly pushed based on their capacity to enhance educational accessibility. As an illustration, Century asserts that their goal is to provide intelligent tools to every teacher and learner, enabling them to achieve success. This statement clearly emphasises technology's perceived capacity to surpass the capabilities of human teachers and educational institutions. In a similar vein, Squirrel AI asserts that their platform effectively tackles the pressing issues in education today, including the deficiency of individualised instruction in conventional classrooms and the unfair allocation of educational resources (Squirrel AI 2018). Their AI system is explicitly presented as a substitute for perceived shortcomings in education, including both the quality of instruction and the availability of education. AI is portrayed as a tool to enhance education by increasing

access to possibilities for a larger number of students and by tailoring educational offerings to meet individual requirements.

Today, advancements in technology such as work automation, the Internet of Things (IOT), artificial intelligence (AI), machine learning, augmented reality (AR), and virtual reality (VR) are causing significant changes in the workplace. These changes are particularly impacting individuals with disabilities and requiring organisations to be more adaptable in order to quickly embrace changes in work methods and culture and to construct inclusive and accessible environments. In numerous developing countries across Asia and the Pacific, individuals with disabilities often find themselves caught in a distressing cycle of being excluded from society, unable to participate in employment opportunities, and marginalised from mainstream development programmes.The World Report on Disabilities, published by the World Health Organisation (WHO) [1] and Laabidi [2], reveals that over one billion individuals worldwide experience various forms of disability. These individuals are deprived of access to healthcare, education, and employment prospects [3]. Without accessible assistive technologies, individuals frequently lack the resources necessary to participate in education and achieve a self-sufficient and improved quality of life. According to a calculation made by the World Health Organisation (WHO), there are over 1 billion individuals who could benefit from one or many assistive devices or goods. Microsoft's Annual Report [4] (shareholder letter) highlights the profound influence of technology on many facets of life, work, and society as a whole. There is a global demand for reliable and dependable technology that may bring advantages to individuals and society as a whole. Technological infrastructure and instruments have the capacity to facilitate creativity in individuals, regardless of whether they have impairments or not. Technological progress has facilitated Microsoft's ability to empower individuals with disabilities. For instance, the company has developed educational resources that have proven beneficial for youngsters with dyslexia, enhancing their learning capabilities. This has expanded the range of AI and machine learning. Artificial intelligence (AI) technology has been designed to facilitate high-computing jobs using computer tools, enhancing human efficiency [5]. While machines cannot fully replace human beings, they can certainly aid them in improving work arrangements. Advancements in artificial intelligence have the potential to enhance education and learning for those with special needs.

Learners with special needs

A child is considered to have special educational needs if they possess a learning difficulty or impairment that hinders their learning process more significantly than the majority of children in their age group. They may have difficulties in academic performance, interpersonal communication, or behavioural conduct. Specialists, instructors, and voluntary organisations can aid and guidance to parents.

Learners with exceptional educational needs encounter challenges due to any of the following factors, either alone or in combination:

Challenges related to behaviour and interpersonal abilities	Encompasses self-control, interpersonal skills, and other related abilities.
Speech or linguistic impairments	Either pertaining to the ability to receive or convey information (e.g., in the context of the autism spectrum).
Impaired focus and attention	Either attention deficit hyperactivity disorder (ADHD) or attention deficit disorder (ADD) can be present.
Higher cognitive processes	Encompasses challenges in comprehension, strategizing, and coordinating.
Auditory defects	Encompasses both auditory impairment and complete hearing loss, which can be present from birth or acquired as a result of sickness or accident.
Challenges related to reading and writing skills and communication barriers.	Impacts the cognitive acquisition in one or many domains, such as reading, spelling, and writing (e.g., dyslexia and dysgraphia).
Mathematical challenges	Refers to those who may encounter difficulties in performing tasks involving numeracy and mathematical proficiency, such as dyscalculia.
Psychological disorders	Encompasses conditions such as depression, anxiety, and others, and can vary in intensity from moderate to severe. Individuals may potentially have multiple mental health disorders simultaneously.
Physical or neurological disabilities	Cerebral palsy can manifest as either congenital or acquired, such as in cases of

	muscular dystrophy or traumatic brain injury, and its severity can vary. Neurological disability may not be apparent.
Vision impairments	used to explain the outcome of an illness or ailment affecting the eyes. There are several levels of impairment, from minor to severe.

Evolution of inclusive education

Implementing the tenets of inclusive education in higher education can provide difficulties. The concept of inclusive education was initially formulated for younger learners before being implemented in higher education. Nevertheless, with the increasing number of students with disabilities who are effectively finishing their early education, there is a growing necessity to transition towards inclusive methodologies in higher education.

The Salamanca Statement, recognised by UNESCO in 1994, is considered a significant milestone in promoting inclusive education, as stated by Vislie in 2003. The intention was to replace special needs education with inclusive education, which means avoiding segregated educational approaches and promoting diversity in the mainstream classroom.

European nations are progressively dedicated to upholding human rights and promoting inclusive education. Nevertheless, the presence of ongoing educational and socioeconomic disparities suggests that the actualization of inclusive education is not consistent across all areas.

Inclusion is a multifaceted and disputed notion: scholars, policymakers, and professionals engage in discussions over the nature of inclusive education, its imperative, and the methods for its execution. Various global organisations advocate for inclusive education as a fundamental entitlement for all students.

Goal 4 of the UN 2030 Agenda for Sustainable Development, as well as the latest UNESCO recommendations, endorse the human rights viewpoint by recognising inclusion and equity as fundamental values that should govern all educational policies and practices. Inclusive education is emphasised in significant European texts, such as those from the Council of the European Union (2018a, 2018b), the Council of Europe Commissioner for Human Rights (2017), and the European Union Agency for Fundamental Rights (2020). Considering the historical exclusion of learners with disabilities from educational institutions, other key policy texts emphasise their entitlement to inclusive education. Article 24 of the Convention on the Rights of Persons with Disabilities (United Nations 2006) specifically defines inclusive education as the provision of

accessible, high-quality, and cost-free primary and secondary education to individuals with disabilities, ensuring equal opportunities and preventing discrimination and exclusion based on disability. Within academic literature, inclusive education is portrayed as an ideology that directs the implementation of practices aimed at upholding the entitlement of all learners to receive education of high quality. According to Booth (2009), inclusive education aims to enhance the involvement of all learners, establish systems that treat all individuals equally, and foster fairness, empathy, human rights, and respect. Other important elements of this include more integration into regular classrooms, ensuring equal opportunity for academic and social success, adopting inclusive teaching methods, and fostering inclusive educational environments. Throughout history, inclusive education has firmly established itself as a moral and legal necessity.

Stance of THE UNITED NATIONS on inclusive Education; deep insight into SDGs

Significant advancements have been made in attaining the goal of providing primary education to all individuals since the year 2000. In 2015, the percentage of students enrolled in developing countries reached 91 percent, while the global number of children not attending school has decreased by about 50 percent. Additionally, there has been a significant surge in literacy rates, with a notable rise in the number of girls attending school compared to previous years. All of these achievements are extraordinary.

Progress in certain emerging regions has been hindered by prevalent poverty, armed conflicts, and other calamities. The ongoing armed war in Western Asia and North Africa has resulted in a rise in the number of youngsters who are not attending school. This is a concerning pattern. Sub-Saharan Africa had the most significant advancement in primary school enrollment compared to other emerging regions. The enrollment rate increased from 52 percent in 1990 to 78 percent in 2012. However, substantial gaps still persist. The likelihood of out-of-school children from the impoverished households is as much as four times that of children from the wealthiest households. Rural-urban disparities are still rather significant.

Ensuring that education is accessible to everyone and of high quality reinforces the understanding that education is a highly effective and well-established means of promoting long-lasting development. This objective guarantees that every female and male student successfully finish their elementary and secondary education without any cost by the year 2030. Additionally, its objective is to ensure equitable availability of cost-effective vocational education, eradicate gender and socioeconomic inequalities, and attain widespread accessibility to high-quality tertiary education.

The United Nations has established a target: By 2030, guarantee that every girl and boy receives a comprehensive, fair, and high-quality primary and secondary education that results in meaningful and successful learning outcomes, in line with Goal 4.

The goals of UN in Quality Education are listed below:

By 2030, guarantee universal access to high-quality early childhood development, care, and preprimary education to ensure the preparedness of all girls and boys for primary school.

By 2030, offer equitable access for both genders to cheap and high-quality technical, vocational, and higher education, including university.

By 2030, aim to significantly augment the quantity of young individuals and adults equipped with pertinent expertise, including technical and professional proficiencies, to facilitate their employability, secure respectable work, and foster entrepreneurial endeavours.

By 2030, the goal is to eradicate gender inequalities in education and guarantee equitable opportunities for all individuals, including those with disabilities, indigenous populations, and children in precarious circumstances, to access education and vocational training at all levels.

By 2030, promote universal reading and numeracy among kids and a significant number of adults, encompassing both genders.

By 2030, ensure universal acquisition of knowledge and skills necessary for advancing sustainable development. This includes education for sustainable development, sustainable lifestyles, human rights, gender equality, promotion of peace and non-violence, global citizenship, and recognition of cultural diversity and its role in sustainable development.

Construct and enhance educational infrastructure that prioritises the needs of children, those with disabilities, and different genders, while ensuring secure, nonviolent, inclusive, and efficient learning environments for everyone.

By 2030, significantly increase the availability of scholarships worldwide for students from developing countries, especially those from least developed countries, small island developing States, and African countries. These scholarships will be for higher education, including vocational training, information and communications technology, technical, engineering, and scientific programmes. The scholarships will be offered by developed countries as well as other developing countries.

By 2030, aim to significantly augment the availability of proficient educators, primarily in developing nations, particularly in the least developed countries and small island developing states, by means of international collaboration for teacher education.

Application of artificial intelligence in special education

Artificial Intelligence has been a subject of intense research for the past 50 years. It is the examination and advancement of 'intelligent agents' capable of seeing their surroundings and making decisions to enhance their

chances of achieving desired outcomes. Intelligence agents can exist either as physical entities, such as humanoid robots, or as software entities with intellectual capabilities, like virtual avatars. Artificial intelligence (AI) technology has been progressively employed to enhance the quality of life for those with special needs, addressing a wide range of challenges that impede learning, cognition, communication, behaviour, emotion, and sensory and physical development. The code of practice (2001 SEN) emphasises that children do not all develop at the same pace and that each child possesses unique abilities and needs. Therefore, it is crucial to comprehend the various aspects of the environment in which AI will be deployed, such as its accessibility, training requirements, and necessity. Variations may occur across various social contexts. Indeed, artificial intelligence is facilitating the creation of a cooperative and participatory setting. The advancements in AI technology are generating novel opportunities irrespective of an individual's mode of listening, speaking, or writing. AI-driven text messaging platforms are aiding young individuals by giving mental health interventions. The utilisation of AI tools in teaching and learning facilitates the integration of students with learning impairments or disabilities. AI provides efficient assistance for online education by offering personalised learning for students, automating lessons, handling regular activities, and enabling adaptive assessments. Robotics integrated with artificial intelligence can be employed to provide support, assistance, and enhancement to teaching professionals. Effective assistive technology allows students with disabilities to overcome specific limitations. This specialised technology enhances self-reliance and reduces reliance on external assistance. Artificial intelligence has the potential to significantly enhance the productivity and effectiveness of our workplaces, while also complementing and enhancing the capabilities of human workers. Artificial intelligence assists educators in identifying pupils with learning challenges and intervening at a young age. AI tools and inventories play a crucial role in education, particularly for learners with special needs, as they enable the integration of student autonomy with enhanced control and guiding. AI is primarily utilised by teachers and parents for the purpose of instructing pupils, rather than for identifying their specific needs.

Special AI tools at the rescue of Learners with special needs

Attention deficit hyperactivity disorder (ADHD): It encompasses a broad spectrum of challenges that become evident during the period of growth and maturation, distinguished by a collection of behavioural issues involving inattention, hyperactivity, impulsivity, or a combination thereof. Artificial intelligence has provided enhanced diagnostic and therapeutic methods for addressing certain behavioural challenges. Rebolledo-Mendez and Freitas introduced the neuro-sky mentality, a system capable of detecting levels of attention during an assessment activity. The Neurosky system comprises a headset equipped with three electrodes that

are positioned behind the ears and on the forehead. The electrical impulses obtained from the aforementioned places serve as input for Neurosky algorithms to evaluate the levels of attention. A conversational AI avatar was also created to ask questions and engage in limited interaction with people. This instrument is affordable, non-medical, and user-friendly, specifically designed for recreational use. Aguillar et.al 2006 developed a model teacher module within an intelligent tutorial system (ITS), which is an interactive educational approach used for assessing ADHD.

Autistic Spectrum Disorder (ASD) or Autism: Learners diagnosed with Autism Spectrum Disorder (ASD) display deficiencies in social skills, language, and communication abilities, as well as a proclivity for repeating patterns of interest and behaviour. Artificial intelligence approaches can assist in early intervention and provide specialists with powerful tools that accurately indicate the individual's level of Autism Spectrum Disorder (ASD). The researchers Sebe et.al in 2006 developed a computerised technique for recognising emotions. This technology uses both visual and aural inputs. This human-computer interaction application has the capability to identify other affective states such as curiosity, boredom, bewilderment, and irritation, in addition to the six universal emotions (happy, surprise, angry, disgust, fear, and sad). This is particularly useful in situations where assessing emotions is challenging. The platform developed by Riedl et.al in 2007 is intended to assist teenagers with high functioning Autistic Spectrum disorder (HFASD) in practicing and acquiring social skills with little assistance from parents, teachers, and therapists. In 2008, Arthi and Tamilarasi developed a model that utilises Artificial Neural Networks (ANN) to diagnose Autism in youngsters. AI applications are also assisting individuals with Down Syndrome and Autism in carrying out their activities and responsibilities in the manufacturing and distribution sectors.

Cerebral Palsy - Studies have demonstrated that artificial intelligence (AI) systems aid in improving the prediction of outcomes, facilitating the selection of appropriate treatments, and providing therapeutic assistance for learners with CP. Virtual reality can enhance the engagement of children with cerebral palsy in rehabilitation programmes, leading to more rapid improvement in motor abilities. Artificial intelligence (AI) applications have the potential to provide significant advantages for children with cerebral palsy (CP) by offering devices that help regulate their symptoms. For wheelchair users, mobility devices that can adapt navigation, avoid obstructions, and navigate through traffic are highly beneficial. By integrating artificial intelligence with image technologies, it becomes feasible to quantify extensive datasets derived from video footage. This also facilitates the dissemination of medical professionals' observations regarding spontaneous movements linked to CP, so aiding in the diagnosis of their patients. These procedures facilitate the acceleration of diagnosing cerebral palsy in children. Prompt identification of CP is crucial to enable prompt

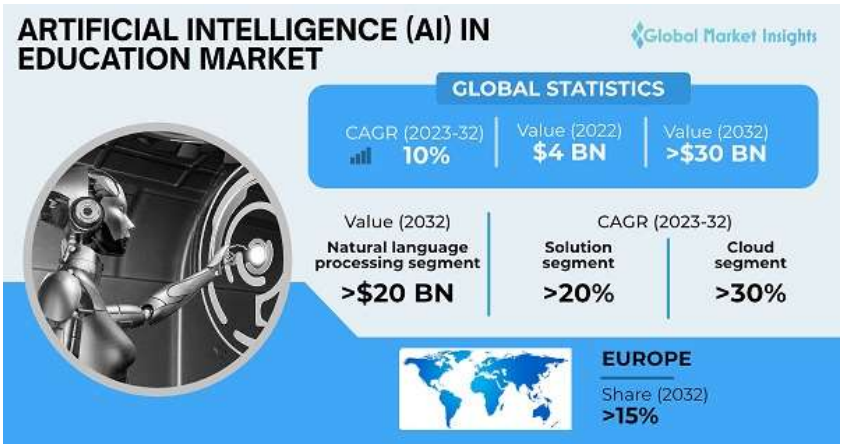
initiation of treatment. Therefore, the development of AI methods to identify cerebral palsy (CP) could greatly enhance the quality of life for children. These systems handle information that is ambiguous, incomplete, or inconsistent and offer some type of reasoning. Diagnoses are determined by the utilisation of experience, intuition, and the discernment of patterns with heightened precision.

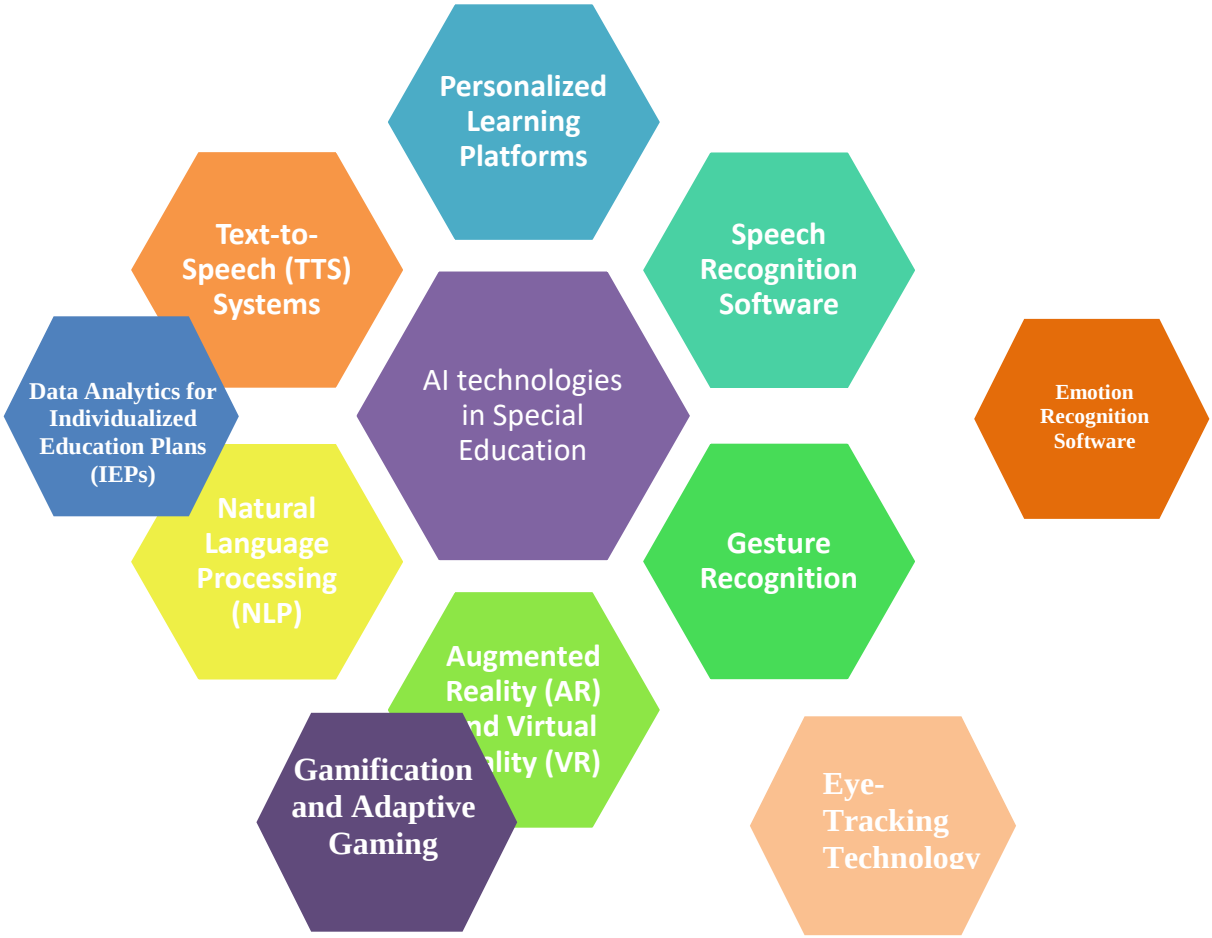
Dyslexia: It is a prevalent neurologically-based developmental delay that results in difficulties with reading, writing, and spelling. It is a lifelong disorder. The diagnosis of this condition is intricate, but artificial intelligence simplifies it. Palacios et al. have introduced a classification method based on rules for diagnosing dyslexia in young children using genetic fuzzy systems. Parents, teachers, and therapists can utilise it to identify those signs. In 2010, Kohli et al. presented a methodical technique to detect dyslexia in its initial stages through the utilisation of artificial neural networks (ANN). Melis et al. (2001) developed ActiveMath, an intelligent tutoring system for mathematics that is accessible on the internet. This system enables students to learn in a personalised and familiar setting. The system employs various artificial intelligence techniques to implement adaptive course development, student modelling, feedback, and interactive activities. Anthony et al. (2008) developed an intelligent tutoring system (ITS) specifically designed to assist students in learning how to solve algebraic equations. The method employs a form of Intelligent Tutoring System (ITS) called 'cognitive tutors', which provide students with real-world situations and prioritise learning by practical application. In 2010, Gonzalez et.al developed an automated platform that detects and analyses faults in mathematical problems. This platform is aimed to provide personalised feedback to students. This approach proved to be particularly beneficial for individuals with Down Syndrome, who experience challenges in doing arithmetic calculations involving addition and subtraction. In their study, Srihari et al. (2008) introduced two computerised techniques for automatically grading handwritten essays in reading comprehension exams. The objective of this system is to allocate a score to each handwritten response that is equivalent to the score given by a human evaluator. The model introduced by Jain et.al in 2009 is named Perception based learning Disability Detector (PLEDDOR). This is a model of artificial neural networks designed to detect specific learning challenges such as dyslexia, dysgraphia, and dyscalculia. It achieves this by analysing curriculum-based tests administered by specialised educators. The SEDA-Expert system, developed by Hernandez et.al in 2009, is designed to address learning challenges in children's primary school. The evaluation involves psychopedagogical assessment to determine the correlation between input factors such as age, sex, educational level, and output systems such as psychomotor aspect, intellectual aspect, and personal aspect.

Sensory/ physical impairment- Georgopoulos et. al (2003) proposed a fuzzy cognitive map method to distinguish and diagnose specific language impairment in individuals with sensory or physical impairments.

Fuzzy cognitive maps are a soft computing technique that employs a symbolic representation to describe and simulate intricate systems for the purpose of distinguishing between specific language impairment (SLI), dyslexia, and autism. In 2003, Schipor et.al tried to develop a computer-based speech therapy system called LOGOMON. This system utilised a fuzzy expert system to assist individuals with speech disorders. Pavlopoulos et.al 2008 utilised a neural network methodology to create a self-assessment system for learners, which was enhanced by the application of genetic programming. The objective was to evaluate the user's responses to both single and several questions in an e-learning setting. The 'Dedalos' initiative, introduced by Drigas et.al in 2008, focuses on teaching English as a second language to children with hearing impairments.

AI Technologies in Special Education:




Personalized Learning Platforms
Text-to-Speech (TTS) Systems
Speech Recognition Software
Data Analytics for Individualized Education Plans (IEPs)
AI technologies in Special Education
Emotion Recognition Software
Natural Language Processing (NLP)
Gesture Recognition
Augmented Reality (AR)
Gamification and Adaptive Gaming
Eye-Tracking Technology