

AI and VR Enabled Modern LMS for Students with Special Needs

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Abstract: The reauthorization of the Individuals with Disabilities Education Act (IDEA) guarantees all children with disabilities accessible and adequate public education. However, understanding the psyche of these people throughout the world in order to teach them effectively is never easy. Children with special need account for various challenges or disabilities, including intellectual and compilation disabilities. Special needs children have various special cases which demand personalized care, such as segregation and co-teaching mode of learning for such students. Technological advancement has shaped modern forms of learning, as exemplified by the introduction of artificial intelligence (AI) and natural language processing (NLP) in advancing special learning. The technology features various concepts, such as metaverse, which has shaped the virtual reality and 3D imaging necessary for online learning. Distance learning has enabled personalized care alongside sentimental analysis from the Q and A using natural language processing. AI-based learning management systems (LMS) have spearheaded personalized learning, nurturing distance learning and replacing traditional classroom learning for special-needs students.

Keywords: AI, Natural Language Processing (NLP), Metaverse, Virtual reality, AI-based learning management systems (AI-LMS), Distance learning, Ed Tech

Introduction

Educational Psychology is essential for students with special needs. Along with parents, children go under tremendous pressure to understand and act like regular students in social and public places like educational institutes. When it comes to educating pupils with impairments, there is no one size fits all solution. Using the different insights discovered by educational psychologists, instructors diversify teaching so that every student, regardless of ability, has an opportunity to learn. Differentiated education promotes group work and a challenging work environment for student centered ideas, flexibility, continual evaluation, and cooperation.

Children living with disability in the educational sector account for an increasing number across the globe. Children with special needs account for the disabilities, which leads to challenges in learning, understanding, behaviors, and infirmity, which escalates the inability of most individuals to learn compared to their counterparts. Intellectual disability accounts for the prevailing challenge among these children with low average intelligence and mental disability alongside the lack of skills in undertaking normal basic activities (Fernandez-Villardón et al., 2020). The children experience challenges in undertaking their assigned schoolwork, communication skills, and behavioral patterns. Although children with intellectual disabilities can learn new skills, they usually have a slow learning ability depending on the level of intellectual disability. Some children demonstrate the signs of intellectual disability in infancy, as exemplified by talking late or having trouble talking, slow mastery of various skills such as feeding and dressing, and experiencing a challenge in remembering the various activities learned alongside the challenges in problem solving. Intellectual disability arises from various factors exemplified by genetic conditions, pregnancy complications accrued from drug abuse, premature births, and illness, as exemplified by meningitis, whooping cough, and measles causing a severe head injury. However, despite the various factors and slow learning process, artificial intelligence (AI) and natural language processing (NLP) can substantially aid in nurturing children with special needs in learning globally through personalized attention and breaking the physical barriers to accessing education remotely (Dash, 2022).

Case Presentation

Special Education for Special Needs

Approximately children attending special curricula in the United States has increased over the past years. More than 7 million students attend special education services in the United States (Nazaretsky et al., 2021; Park et al., 2022). Approximately the number of children studying under the disabilities education act has accrued to approximately 7.2 million, with approximately 15% of students enrolled in public education (Park et al., 2022). New York accounts for the state with the most significant number of disabled students in the United States, with 19.2%, followed by Pennsylvania (18.6%). Texas accounts for the lowest population of disabled children at 9.2%. Nevada accounts for the highest increase in the number of disabled children, currently standing at 58% over the last years, as compared to Rhode Island, which accounts for a 23% decline (Ouyang & Jiao, 2021; Park et al., 2022).

Children with special needs require various special education, commonly referred to as aided education or alternative supervision. Special education entails educating children in various modes that accommodate particular individual disparities, disabilities, and special needs. The roll out of the education incorporates the individualized planning and systematic monitoring arrangement of the various teaching procedures, the adapted equipment and materials utilization, and the access settings that suit the particular

student (Fernandez-Villardón et al., 2020). The application of special needs helps nurture the particular students to achieve basic self-sufficiency, assuring their success in school and community. These services supplement the typical classroom education, which does not meet the special needs of the children with special needs.

Special education facilitates providing accommodated education for individuals with special education, as exemplified by learning disabilities, learning difficulties, and communication disorders. Special needs educations also include emotional and behavioral disorders. Modern facilities and technology have boosted the quality of special needs education as offered through the various specialized teaching areas, resource rooms, and separate rooms (Billingsley et al., 2019). The various developed countries, as denoted in the United States and the United Kingdom, have modified the teaching methods to incorporate special needs children within the general environments, reducing the social stigma and improving academic achievement across many children.

The mode of delivery of special education for individuals with special needs differs in the community. Some utilized modes include inclusion, mainstreaming, segregation, and co-teaching. The inclusion approach includes intermixing children with both special needs and with special needs in the classroom all day long (Billingsley et al., 2019). The various schools have modified the school curriculum to include students with special needs in the community, especially in regions with registered children with mild to moderate disabilities. Depending on the service, the schools offer specialized resources and education within confined regions with the freedom for the students to leave the educational facility at will (Kolchenko, 2018). The facilities have various specialized equipment to facilitate learning, such as speech and language therapy, physical therapy, and rehabilitation counseling for learners. The students may leave the standard classes for regular engagement with the counselors.

Special needs education also features the mainstreaming special need program. The program entails educating children with special needs on their skills within specific periods. Special education delivery, however, calls for segregating the students into various classrooms exclusively for the children with special needs for the rest of the day (Harris, 2019). The segregation mode of special needs education targets children with special needs who do not attend schools where regular learning occurs with non-disabled children. This mode of education delivery involves segregated students who may attend the same school with which the educational center offers traditional education but spend the entire instructional period within the various separated classrooms designed exclusively for disabled children. When the children attend their special class within the school with the ordinary students, the disabled children enjoy an integration opportunity with regular students in various aspects, as exemplified by sharing meals (Billingsley et al., 2019). In typical cases, the children with the requirement

for special needs attend special schools whose location could occur within a hospital or housebound. However, the various students who fall victim to school suspensions or expel do not fall into the children with special needs category.

Co-teaching approach in the delivery of health education entails placement of the students within the general classroom to enable joint learning of disabled and non-disabled peers. In this context of special needs education, the available education teacher, alongside the special education instructor, work together as a team (Ouyang & Jiao, 2021). The various existing modes of co-teaching include one teaching-one help, within which one instructor issues learning instructions to the learners as the other teacher circulates within the class for evaluation and offers assistance. Parallel teaching, as embraced within this learning mode, entails the teachers providing similar content to the two distinct groups of students simultaneously. In comparison, station teaching encompasses the two instructors delivering divergent content to the two groups simultaneously, and the student consequently rotates through each station (Bone & Smith, 2021). Alternative teaching, in contrast, as employed in special needs education, comprises one instructor working with a smaller group while the other instructor works with most of the class.

AI and NLP Shaping E-Learning

Computer programs and AI-LMS are predictable and logical and may give youngsters with specific hobbies an intellectual outlet. It is hoped that children with special needs may be better able to interact socially with others through developing relationships with AI and social robots. Some use cases for modern technological developments are discussed below, which can be used for the unique education system.

Metaverse

The pandemic's onset revolutionized the operation mode in the overall community, as exemplified in remote working, training, and onboarding. The metaverse has the potential to fuel the transformation in remote training. Neal Stephenson coined the term "metaverse" in the sci-fi novel Snow Crash, whose imagination was lifelike avatars' interaction in realistic 3D buildings and virtual reality. Several companies, such as Google and Microsoft, have invested in the technology whose description entails the online environment fueled with augmented reality (AR) and virtual reality (VR) coexistence (Lau, 2015). The technology application in the evolving digital world allows collaboration, problem solving, and practice within the interactive engagement method. Metaverse facilitates faster learning, information retention, and management of own learning experiences. Hence, the environment stimulates the physical world by incorporating digital tools, facilitating learners' interaction with avatars (Moretti & Schlemmer, 2012). Therefore, the metaverse replaces real world experiences while promoting the development of nurtured experiences within the present realms (**Figure 1**).



Figure 1. 3D and Virtual reality in learning, Note. Adapted from (Harris, 2019)

Virtual reality implies that the 3D and computer generated virtual environment represents the natural world and creates an illusion. The technology fosters the potential in the immersive and engaged learning experience hence the viability of e-learning as it allows learning beyond the classroom setting. This new learning mode fosters learning while reducing physical challenges and learning experiences (Krsak & Kello, 2020). Augmented reality, in contrast, has blended object creation with enhanced text, graphics, and audio alongside virtual within the real-time experience. The technology facilitates the digital learning experience through virtual space and natural environment combination, fostering interaction. In addition, augmented reality benefits special needs by facilitating quick reference within technical information for repairs and machinery usage (Krsak & Kello, 2020). In addition, the technology limits distractions, capturing learners' attention demonstrated by the physical engagement with the digital content.

Metaverse has ultimate benefits in various industries, which enhances training programs. The technology offers extensive learning environments that foster a learner-centered experience through the emotional and cognitive effect achievable through creating authentic immersions. Improvisation of technology in special needs education has improved remote training as the learners can remotely access the training material and learn irrespective of the physical environment of every learner (Kolchenko, 2018). Utilizing metaverse with correspondence in learning and development enables learners to eliminate the physical limitations with new modest learning experiences. In addition, metaverse through e-learning has reduced the time required to acquire new skills and significantly increased learning quality and information retention (Kolchenko, 2018). Besides, the metaverse has facilitated avatar based simulations to achieve collaborative and interactive learning.

Metaverse accelerates interactive and engaging learning experiences. The learners using the metaverse in learning gain experience and exposure as it supports a linkage to the immersive content and storytelling methodologies, which allow the expression of learning in various new and exciting models. The 3D technology, as improvised in the

learning model alongside the interactive modules, VR and AR, facilitates meaningful learning (Zhong & Zheng, 2022). Learners using the metaverse in education have the opportunity to relate to the context of the practical stories incorporated, hence facilitating memory (Kolchenko, 2018). Besides, the metaverse in e-learning has broken the burden of time limitation in the accessory of learning materials. The active interaction between learners and the platform alongside trainers in real time stimulates an effective learning environment that improves learning outcomes. E-learning embedded in the metaverse helps enhance better decision making as the learning analytics highlight the progressing nature of the learners in achieving the set goals (Zhong & Zheng, 2022). The highlights help educators determine the best approach to improve education delivery.

Student Sentiment Analysis Using NLP

Quantitative and qualitative feedback mechanisms utilized in the education settings help assess the learners learning experience in terms of percentages and grades alongside assessment tasks and audio files. The advancement in technology, as denoted in education, helps in the correlation of the dataset pattern in the prediction of item occurrence. For instance, machine learning utilizes various methods to identify the learner's interaction with the various special needs programs offered online, gauging the learner's processing ability (Dake & Gyimah, 2022). The classification and clustering, as utilized in the improvisation of machine learning in Association Rule Mining (ARM), facilitates the analysis of the student responses to the various online tasks. Frequency and pattern identification of keywords in the straightforward interpretation within a qualitative feedback system helps gauge intelligence level in learning (Dake & Gyimah, 2022). Hence, this highlights to the trainer the various aspects on which the particular students demand extensive attention. In addition, deploying various ML algorithms on the dataset helps measure the item support as provided by the student in response to the presented questions and the confidence level for the real time analytics (Nazaretsky, 2021; Dash, 2021a). The analysis will thus help in gauging the learning ability and retention alongside the improvements.

Sentiment analysis constitutes a form of natural language processing for determining the summarized view and opinion within a text or feedback given by a student. The sentiment analysis has a keyword through which it filters the information, facilitating an analysis of the findings. The filtered work and research form a framework for predicting the learning program effectiveness as uniquely identifiable from each student's feedback (Nazaretsky, 2021; Dash & Ansari, 2022). The various institutions have registered an increase in online teaching platforms through which educators provide learners with open ended questions, which they must analyze and provide feedback on depending on their understanding of the subject and question. Besides, the new online learning platforms have embedded a new practice of student reflection on the subject against real world practices, providing a new model for analysis of the student learning progress

and understanding. The learners express their subjective feelings, opinions, and frustration in tackling the assigned tasks (Checa et al., 2021). The instructor extensively understands the student's challenges through natural language processing, highlighting the student's various concerns. Besides, the open ended discussion questions have an extensive understanding of the student insights compared to the question and answer approach with limited answer choices.

Virtual Reality

Virtual reality entails new technology embraced in the modern learning environment in which students experience various world destinations while confined in the classroom. The technology facilitates students in the exploration of the diversified community within the comfort of their desks. As embraced in learning, the technology provides the learner with interactive content, usually videos or images, through which they explore the entire 360 degrees of the particular scene through 3D technology (Abdullah, 2019; Dash, 2021). Virtual reality videos accrue from capturing the actual image in real world locations using cameras by a specialist before editing the material in the studio to suit the student demands within the classroom. The students view the edited video on VR headsets or projected onto walls through the immersive classroom. The new mode of technology has thus facilitated learning as it has a unique ability to inspire and engage students in education, improving the e-learning and memory of students with intellectual inability. Besides, teachers monitor the students closely and gauge interaction, especially when offered within the school's confines.

Virtual reality can help students with special needs in learning in various ways. For instance, VR offers an outdoor experience through which the learners develop an accessible mode of remembering multiple activities, which differs from the traditional method of reading and writing. The outdoor experience helps students learn better as the student relate learning with the various scenario encounters in the virtual world (Checa et al., 2021). VR also offers an opportunity to see the various extraordinary scenarios in society within the confines of the classroom, hence nurturing the inspiration among the students to the diverse world class and diversified experiences. The VR mode of images circulating among the students within the school allows for the flourishing of the imagination ability among the learners, forming a confine to the upgrade of the memory among the various special needs children (Abdullah, 2019; Katambur, 2022). While promoting the usage of VR in the classroom, teachers encourage peer interaction among the learners as the students have anxiety about sharing their thoughts and experiences in various virtual reality contexts. As the student shares their experiences, it helps nurture the memory ability among the needy children and develop the ability to conclude the numerous subjects, facilitating learning.

Modern classrooms have witnessed students developing boredom efficiently within the classroom setting. VR has fostered e-learning through the learners' engagement with the

outside world as the student engages with the various external learning contexts that capture their attention (Abdullah, 2019). In addition, the learners develop an interactive session amongst themselves as they enjoy an outdoor, breaking the continuous monotony of dependence on books and literature materials, which accounted for students disengaging from the classroom due to boredom. Besides, the children quickly grasp the learning materials provided in a virtual environment (Checa et al., 2021). The children break social and physical barriers to the various scenarios they could have experienced in the outside world but have a substantial benefit in their education.

Personalized Attention Using AI

In today's educational environments, students like social robots. Additionally, social robots are being designed to gather and monitor each student's progress on particular tasks. Online progress tracking for students allows teachers and therapists to create specialized courses for different focus areas per students' strengths and weaknesses. For students with autism, research employing the social robot "Romibo" has been quite successful in the USA (Bone & Smith, 2021).

AI offers an opportunity for personalized learning as it focuses on the development of training, which focuses on the achievement of the unique needs of the learners hence helping in the development of e-learning. Personalized training with social robots, as defined by the customization of the learning experience, helps in tailoring the individuals of each student with the various specials, primarily through e-learning.

Artificial intelligence helps measure the learning process of each learner, hence facilitating the accessibility of the learning materials for each student based on their perceived processing and understanding (Lau, 2015). Besides, AI helps predict the various learning outcomes, allowing the production of content that suits the respective learner goals based on the previous personalized learning history.

As integrated into the AI, machine learning algorithms help predict results based on the previous learning scores, tailoring each learner's objectives and goals. For instance, learners using online learning platforms articulate specific gaps within their understanding process; hence the AI offers recommendations to help the learner fill the identified gaps in the learning process more personalized for each student (Moretti & Schlemmer, 2012). The system can also recognize the different nature of student behavior in skipping some modules while undertaking the extensive and less sequential learning journey compared to students lacking fundamental skills (**Figure 2**).



Figure 2. AI and ML for Special education

Personalized learning using AI helps in the proper allocation of resources alongside offering mentorship to the learners in e-learning. For instance, learners have access to the various online tools necessary for filling the various analyzed gaps in e-learning based on historical progress (Atif et al., 2021). This mode helps save time as the learners have access to only those essential skills or knowledge identified in the gaps. The instructors and teachers also spend less time analyzing student progress in the e-learning modules (Nazaretsky, 2021). Hence, this helps in less time consumption while processing quality learning material for the various students. Alongside the customized learning materials as per the gaps, the learners have access to mentorship programs through which they can ask frequent questions about the various ambiguous topics that require an immediate response, irrespective of the multiple locations (Shi et al., 2022). Besides, AI provides accurate responses based on the content and the machine learning algorithms.

Utilizing personalized learning through AI in learning allows the learners to influence their learning process and development activities, especially in the e-learning process in which the students access education in various locations. The learner gains more influence over the learning process than the pre-determined frameworks (Tan et al., 2022). The collection of the learners' accessibility to the learning material facilitates the development of learning ability, hence defining the various steps to follow within the learning process (Origin Learning, 2018). Personalized learning improves the e-learning platform by opening the multiple modes onto which it intelligently responds to learners' experiences by adapting to continually changing abilities.

Results and Discussion

AI-Based Learning Management System

The Modern-day Learning management standards (LMS) govern the application of Artificial intelligence as it demands manual labor to demonstrate the student learning

and teacher. However, both parties interconnect through the various technologies, which foster student-teacher and student-student inter-communication. The new mode of learning has incorporated diverse students, full-time workers, military personnel, and non-residents with challenges in the accessibility of classroom lectures (Wu & Ma, 2022). Learning institutions have benefitted from this new mode, which has increasingly advanced in demand through the recruitment of more learners into the learning institutions with limited costs on infrastructural costs, as they no longer need more classrooms despite the growing number (Cope et al., 2021). The home schooled students have also gained access to the centralized instructions for the various institutions as the multiple institutions control the virtual learning models with Education Technology Innovation (Ed Tech).

Distance has various unique characteristics defining the learning mode. For instance, the learning mode has central control maintained by the respective learning institution, establishing the accreditation and the individual curriculum. Although the institutions may not offer a classroom based learning experience, the learners enjoy the ultimate traditional modes of learning curriculum (Dake & Gyimah, 2022). Distance learning also enables the separation of the students and teachers geographically. They all enjoy the convenience and accessibility benefits of accessing the online learning platform (Wu & Ma, 2022). The well-designed programs have bridged the learners' intellectual, cultural, and social differences. Internet technology has fostered interactive telecommunication between learners and teachers, typically exemplified using Zoom meetings and google meet. Therefore, the advancement of mobile phones and the internet has broken the need for physical proximity among learners and teachers.

The unique feature of distance learning comprises the three-tier community involving the students, the teacher, and the interactive instructional material resources. The material resources utilized in this newest mode of learning include published online books, audio, videos, and graphic displays to provide additional instructional content for the learners (Kolchenko, 2018). The online learning module establishes the community upon which the learners interact, hence reducing the isolation among learners.

Modern distance learning has improvised the web-based course management system, which incorporates digital learning materials, podcasts for facilitating session recordings for the learners, threaded discussion forums for the student-students, and student-teacher interaction alongside the test-tasking functionality. The students can access the system at any specific time (Abashidze, 2021). Unlike the various podcasts' delivery, which requires the students to sign in, distance learning learners have autonomous control of the learning process. The students have the accessibility to shared access to electronic documents and meeting schedules. The improvisation of artificial intelligence and machine learning has enabled personalized learning among the student as the

students have autonomous control of the learning modules (Abashidze, 2021). Besides, the learners' history in the learning process determines the following tasks offered to the learner according to gaps identified in the learning process.

As accrued from technological advancement, distance learning has outshone traditionally embraced classroom learning. However, traditional classroom learning still occurs in various locations where distance learning has yet to be rooted and includes the children attending schools alongside their peer educators (Younes, 2021). Classroom learning offers the opportunity to analyze the various learners' abilities, helping the tutor understand the relevant classroom learning modes. Physical interaction between learners and teachers helps nurture the relationship between learners and students, which can offer an opportunity to fulfil the mentor-mentee relationship for the benefit of the learners (Abashidze, 2021). The interaction among the learners has provided interactive networking among the learners. However, physical learning faces a challenge in the event of the pandemic with the institution of the various restrictions, especially that pandemic with a causative bacteria or virus having social contact as a potential risk. Besides, modern society has involved individuals from across the globe interacting on the internet hence enrolling in various learning institutions while away from the physical education institution.

Future Research and Ed Tech Revolution

The field of educational psychology includes studies on the conceptual development of humans as well as theories of behavior, learning, and teaching (Ouyang & Jiao, 2021). When it comes to children with special needs, we must carefully plan our procedures and technological solutions to ensure that they will help pupils without offending their sensibilities. Even if the use of AI and NLP in education is still in its infancy, these are the future technologies that will reshape our LMS system. The technology advancements benefit not only students but also parents, teachers, and anyone interested in keeping track of their children's growth. This makes it easier to evaluate the requirements and development of each student and organize classes appropriately.

As drawn from the study, AI and NLP have shaped traditional learning by improvising new learning models that suit the various needs of society. However, there exists a niche in the learning models that future researchers can investigate. These gaps include AI's impacts on learning platforms and the likely potential to nurture student learning and interaction with educators. Besides, future research can also focus on the networking impacts accrued from the improvisation of distance learning in learning institutions.

Conclusion

Ultimately, special needs children demand personalized attention and education status, which help nurture the learners and tailor the education to their needs. In some

institutions, the interventions adopted include the segregation of learners. Embracing artificial intelligence has helped nurture e-learning, as the system helps determine the respective tasks for each learner through machine learning. Virtual reality has enabled the learner to experience the various realities within the classroom, fostering distance learning. The sentimental analysis through Q and A offers an opportunity to understand the respective learners' abilities in e-learning. Personalized learning through AI and AI-based LMS will help tailor the special needs demands in acquiring education. Distance learning has continuously replaced classroom based learning due to the attributed demands, although classroom learning with various advanced modes, such as virtual reality, still exists. As detailed above, research gaps exist on the impacts of adopting AI in learning institutions, and the networking issues accrued from distance learning on students still exist.

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