NAVIGATING OPEN AND DISTANCE E-LEARNING SYSTEMS FOR INCLUSIVE EDUCATION IN NIIGERIA: CHALLENGES AND SUPPORT STRATEGIES FOR STUDENTS WITH AUTISM SPECTRUM DISORDER

Amos Iliya, PhD
National Open University of Nigeria

Abstract
The shift toward online learning environments has brought to light the unique challenges faced by students with Autism Spectrum Disorder (ASD) and underscores the need for effective strategies to ensure inclusive education. ASD is characterized by a range of social, communicative, and behavioral differences that can be exacerbated in virtual settings. These challenges include difficulties with social interaction, sensory sensitivities, and the need for predictable routines, which can make it difficult for students with ASD to thrive in online learning environments. The paper adopts a qualitative research approach using a case study design. An open-ended Key Informant Interview (KII) was conducted with stakeholders, including 10 students with ASD and their parents or guardians, as well as 20 online educators from National Open University of Nigeria, Abuja and Abmadu Bello University, Zaria. The interviews and observations elicited detailed, context-rich data while allowing for flexibility to explore emerging themes. This paper explores the use of Universal Design for Learning (UDL), Assistive Technology (AT), and Teacher Training and Support as well as clear communication, visual supports, such as diagrams, videos, and interactive tools, provide the routine that many students with ASD require. The paper recommends the integration of UDL principles into their online curricula to ensure that educational materials and activities are accessible to all students, including those with ASD. And the provision of access to assistive technologies tailored to the needs of students with ASD, such as communication apps, text-to-speech software, and visual schedules.

Key words: Open and Distance E-Learning Systems, Challenges and Strategies, Autism Spectrum Disorder

Introduction

The rapid evolution of digital technology has reshaped the educational space, notably with the expansion of online learning platforms. While this shift offers new opportunities, it also presents challenges for students with diverse learning needs, such as those with Autism Spectrum Disorder (ASD). ASD is a developmental disorder characterized by difficulties with social communication, repetitive behaviors, and often, sensory sensitivities (American Psychiatric Association, 2013). The unique learning profiles of students with ASD necessitate specialized strategies to ensure their successful participation and achievement in online education. As online learning becomes increasingly prevalent, especially in the wake of global events such as the COVID-19 pandemic, there is a growing imperative to develop and implement effective strategies that support the inclusion of students with ASD in these environments.

Inclusive education, which emphasizes the full participation of all students, regardless of their abilities, is a critical goal in modern educational practices (UNESCO, 2020). However, achieving this goal in online learning environments poses distinct challenges for students with

ASD. The traditional educational strategies used in physical classrooms may not directly translate to online platforms, where the lack of face-to-face interaction, unpredictable routines, and potential sensory overload can exacerbate the difficulties experienced by these students (Ashburner, Vickerstaff, & Howells, 2019). Therefore, educators and institutions must adapt their teaching methods and the online learning environment to better accommodate the specific needs of students with ASD. Research indicates that students with ASD often benefit from structured environments, clear communication, and predictable routines (Hedges, Kirby, & Sutherland, 2014). These elements can be integrated into online learning through the use of visual supports, social stories, and individualized learning plans. Additionally, the flexibility of online platforms offers opportunities to customize learning experiences, providing students with ASD the chance to learn at their own pace and in ways that align with their sensory preferences. For instance, the use of assistive technologies, such as speech-to-text applications and screen readers, can further enhance accessibility and engagement for these students (Guldberg, 2017).

Despite these potential advantages, there are significant barriers to the successful integration of students with ASD into online learning environments. These include the digital divide, which disproportionately affects students with disabilities, and the need for training educators to effectively use technology to support inclusive education (Khalil, 2021). Moreover, the lack of social interaction in online learning can hinder the development of social skills, which is a critical area of development for students with ASD (Bozkurt et al., 2020). Addressing these challenges requires a comprehensive approach that involves not only adapting the technological infrastructure but also fostering a culture of inclusivity within educational institutions. Given these challenges, there is a pressing need to develop and implement effective strategies that can support students with ASD in online learning environments. Such strategies should be informed by a deep understanding of the unique needs of these students and should involve the adaptation of existing online educational tools to make them more inclusive. Moreover, there must be a concerted effort to provide educators with the training and resources necessary to support the learning and development of students with ASD effectively. In the context of Nigeria, these efforts must also address the broader infrastructural challenges and ensure that all students, regardless of their abilities, have access to quality education. The failure to address these issues could result in significant long-term consequences for students with ASD, including increased educational disparities and reduced opportunities for social and economic participation. Therefore, the teething questions this paper responded to include: What are the primary challenges faced by students with Autism ASD in online learning environments? What strategies and practices are currently being implemented to support students with ASD in online learning environments? What role does assistive technology play in supporting students with ASD in online learning environments?

In the context of Nigeria, where the adoption of online learning is rapidly growing, particularly in urban areas, there is a pressing need to explore and implement strategies that ensure students with ASD are not left behind. The Nigerian educational system, which is already grappling with issues of inclusivity and access, must now confront the additional challenge of making

online learning environments accessible to all students, including those with ASD (Afolabi, 2020). This paper seeks to identify effective strategies for supporting students with ASD in online learning environments, with a focus on promoting inclusive education in the Nigerian context. By examining current practices, challenges, and potential solutions, this study aims to contribute to the broader discourse on how to create more equitable and accessible educational opportunities for all students.

Conceptual Clarification

Autism Spectrum Disorder: ASD is a neurodevelopmental condition characterized by a range of difficulties in social communication, interaction, and repetitive or restrictive patterns of behavior (American Psychiatric Association, 2013). The spectrum nature of autism means that it manifests in varying degrees of severity, affecting individuals differently. In Nigeria, awareness and understanding of autism are gradually improving, but there are still significant gaps in diagnosis, intervention, and educational support (Bakare et al., 2011). Autism often goes unrecognized or misdiagnosed, particularly in rural areas, due to cultural stigmas and limited access to specialized healthcare. Nevertheless, the Nigerian government and non-governmental organizations (NGOs) have taken steps to increase awareness, with campaigns like the Autism Awareness Month being observed annually (Ihenacho et al., 2021). Despite these efforts, Nigeria's education system remains largely unprepared to support students with ASD, especially in online learning environments where additional challenges may arise.

Students with ASD often face unique challenges in online learning environments. One significant issue is the lack of face-to-face interaction, which can make it difficult for students to navigate social cues and engage in meaningful communication (Jeste et al., 2020). Online platforms can also exacerbate sensory sensitivities due to an overwhelming number of stimuli such as screen brightness, sound notifications, and background visuals (Bergmann, 2020). Additionally, students with autism may struggle with executive functioning skills, including time management, task organization, and self-regulation, which are critical for success in online education (Meadan et al., 2021).

Inclusive Education in Nigeria: Inclusive education is rooted in the belief that all children, regardless of their physical, cognitive, social, or emotional differences, should be included in regular educational settings. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2020), inclusive education is about embracing diversity and creating a learning environment where all children feel valued and supported. This model contrasts with traditional segregated education, where children with disabilities or special needs are often placed in separate schools or classrooms. Inclusive education is not only a moral imperative but also a legal requirement under international frameworks such as the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), which Nigeria has ratified (United Nations, 2006). However, despite these commitments, there are still significant gaps in Nigeria's educational policies regarding the inclusion of students with ASD and other disabilities in mainstream schools. Online learning presents an opportunity to bridge these gaps by making education more accessible to students with special needs, but it

requires a concerted effort from the government, educators, and stakeholders to develop inclusive policies that cater to diverse learners.

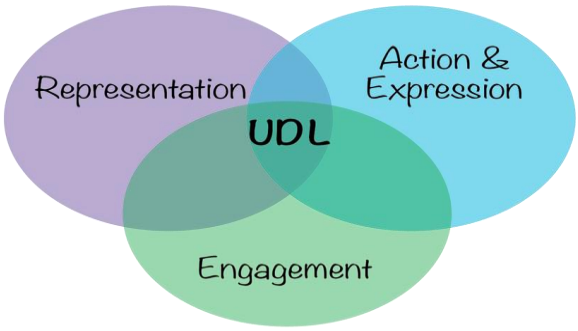
Inclusive education is a transformative approach that seeks to ensure that all learners, irrespective of their abilities or disabilities, receive equitable opportunities to participate in the same learning environments. In the Nigerian context, inclusive education involves integrating children with special educational needs (SEN) into mainstream schools and classrooms. This includes children with physical disabilities, sensory impairments, intellectual disabilities, autism spectrum disorder (ASD), and learning difficulties, among others. Despite international commitments, such as the United Nations Convention on the Rights of Persons with Disabilities (CRPD) and the Sustainable Development Goals (SDG 4), which call for inclusive and equitable quality education for all, Nigeria faces significant challenges in implementing inclusive education policies effectively.

Theoretical Framework

The theoretical framework for supporting students with ASD in online learning environments is grounded in several key educational theories and models that emphasize inclusive education, differentiation, and the use of technology to enhance learning outcomes. This framework draws on Universal Design for Learning (UDL), Social Constructivism, and Assistive Technology models to provide a comprehensive approach to creating inclusive online learning environments that effectively meet the needs of students with ASD.

Universal Design for Learning (UDL) Framework: The Universal Design for Learning (UDL) framework is a foundational theory for supporting students with ASD in online learning environments. UDL is based on the idea that educational environments should be designed to be flexible and accommodate the diverse needs of all learners, rather than attempting to retrofit solutions for individual students (Meyer, Rose, & Gordon, 2014).

Figure 1: Chart representation of UDL



Source: CAST (2018)

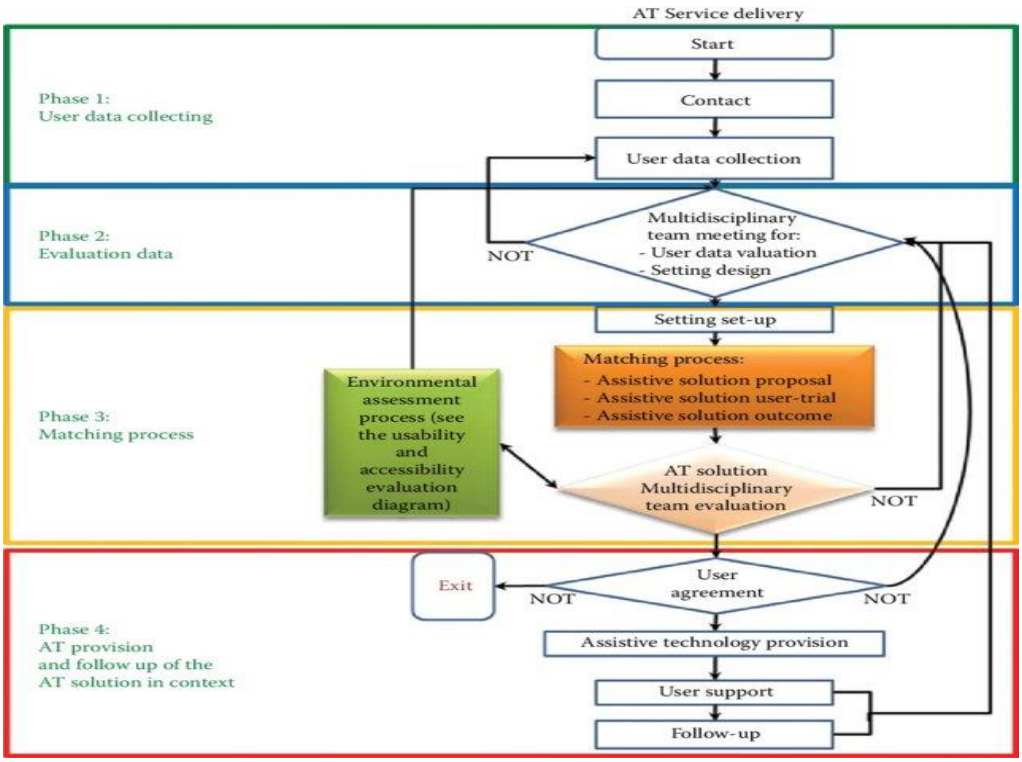
The UDL framework emphasizes three key principles: providing multiple means of representation, multiple means of action and expression, and multiple means of engagement (CAST, 2018). In the context of online learning, UDL can be applied by designing digital

content that is accessible to students with ASD, such as using visual supports, providing text-to-speech options, and offering alternative ways to demonstrate learning. By integrating UDL principles into the design of online learning environments, educators can create a more inclusive educational experience that reduces barriers for students with ASD and supports their academic success.

Social Constructivism: Social Constructivism, a theory popularized by Vygotsky (1978), posits that learning is a social process and that students construct knowledge through interactions with others within their environment. This theory is particularly relevant to supporting students with ASD, who may face challenges in social communication and interaction. In online learning environments, it is crucial to create opportunities for collaborative learning and social interaction that are accessible to students with ASD. Educators can leverage the principles of Social Constructivism by incorporating group activities, discussion forums, and peer interactions in ways that accommodate the social communication needs of students with ASD. For example, structured group work with clear roles and responsibilities can help students with ASD engage more comfortably with their peers. Additionally, online platforms can be used to create safe, moderated spaces where students with ASD can practice social skills and interact with their classmates in a supportive environment (Bashir & Murtala, 2020).

Assistive Technology (AT) Model: The Assistive Technology (AT) model is another critical component of the theoretical framework for supporting students with ASD in online learning environments. Assistive technology refers to any device, software, or equipment that helps students with disabilities participate more fully in educational activities (Dell, Newton, & Petroff, 2017). For students with ASD, assistive technology can play a significant role in addressing communication challenges, sensory sensitivities, and organizational difficulties that may arise in online learning. The use of assistive technology in online learning environments can include speech-to-text software, visual organizers, and adaptive communication tools that help students with ASD express themselves and manage their learning tasks. The AT model also emphasizes the importance of training educators and students in the effective use of these technologies to ensure that they are integrated seamlessly into the learning experience (Adebisi, Liman, & Longpoe, 2015).

Figure 2: A Chart Illustration of AT Model



Source: Dell, Newton, & Petroff (2017)

Application of Theories to Inclusive Education for Students with ASD: When combined, UDL, Social Constructivism, and the Assistive Technology model provide a robust theoretical framework for supporting students with ASD in online learning environments. UDL ensures that the online learning environment is accessible and flexible, Social Constructivism encourages meaningful social interaction and collaboration, and the AT model provides the necessary tools to support the unique needs of students with ASD. In the Nigerian context, applying these theories requires consideration of local challenges, such as limited access to technology and the need for culturally relevant training programs for educators (Olumorin, Fakomogbon, & Awoleye, 2018). By leveraging these theories, educators can develop and implement effective strategies that promote inclusive education and improve learning outcomes for students with ASD in online environments.

Methodology

The paper adopts a qualitative research approach using a case study design. This approach is chosen to provide a comprehensive and contextual understanding of how online learning environments impact students with ASD and to identify effective strategies for supporting these students. Case studies are effective in exploring real-life contexts and can provide detailed insights into the specific challenges and strategies observed in different settings (Yin, 2018). An open-ended Key Informant Interview (KII) was conducted with stakeholders, including 10 students with ASD and their parents or guardians, as well as 20 online educators from National Open University of Nigeria, Abuja and Abmadu Bello University, Zaria. Interview questions focused on experiences with online learning platforms, perceived barriers, and effective strategies for support. The interviews elicited detailed, context-rich data while allowing for

flexibility to explore emerging themes. Observational method was used to examine online learning sessions involving students with ASD. This included reviewing recorded sessions and noting interactions, engagement levels, and the use of assistive technologies. The session provides direct insights into the dynamics of online learning environments and the effectiveness of implemented strategies. After verbatim transcription of the interviews and the harmonization of data obtained from observation, initial coding was conducted to categorize data into themes related to challenges, strategies, and outcomes. Finally, data were thematically analyzed using unambiguous language stripped of unnecessary padding.

Results

Thematic Analysis of Interviews: Supporting Students with ASD in Online Learning Environments

This thematic analysis presents insights from interviews with educators, parents, and specialists on supporting students with ASD in online learning environments. The findings reveal five overarching themes, Universal Design for Learning (UDL), Assistive Technology (AT), Teacher Training and Support, Structured and Supportive Learning Environments, and Challenges of Online Learning for Students with ASD. Together, these themes illustrate both the potential and constraints of online education in accommodating the unique needs of students with ASD, particularly within the Nigerian context where inclusive education practices are still developing.

Theme 1: Findings from the study underscore the central role of Universal Design for Learning (UDL) in fostering inclusive and equitable online learning experiences for students with ASD. Participants consistently emphasized that UDL principles, multiple means of representation, engagement, and expression, are crucial in addressing the diverse learning needs and sensory sensitivities of students with ASD (CAST, 2018; Meyer, Rose, & Gordon, 2014). This finding aligns with previous research suggesting that UDL enhances accessibility by promoting flexible instructional designs that accommodate learner variability (Al-Azawei, Serenelli, & Lundqvist, 2016).

Educators in the study reported that many students with ASD struggle with processing complex information, sustaining attention, and managing cognitive overload during online instruction. Consistent with Rao, Ok, and Bryant (2014), the teachers observed that applying UDL strategies such as using multimodal materials (text, audio, and video), visual supports, and simplified instructions, improved comprehension, attention span, and retention. Similarly, Hall, Strangman, and Meyer (2019) noted that visual and interactive supports promote active engagement and reduce anxiety among neurodiverse learners.

Flexibility in assessment was another significant outcome, as participants explained that allowing students to demonstrate understanding through oral presentations, projects, or written tasks enhanced inclusion and learner autonomy. This resonates with the work of Dell, Dell, and Blackwell (2015), who found that assessment diversity fosters motivation and self-regulation among learners with disabilities. However, educators also identified systemic barriers, limited institutional awareness, inadequate digital infrastructure, and weak policy frameworks that restrict UDL implementation in Nigeria. These findings echo UNESCO (2020), which emphasizes that digital inclusion policies in the Global South must integrate UDL to prevent marginalization of students with special learning needs in online education systems.

Theme 2: The findings reveal that Assistive Technology (AT) plays a crucial role in promoting accessibility, engagement, and inclusion for students with ASD in online and blended learning environments. Participants emphasized that AT tools, from speech-to-text software and visual schedules to communication applications, enhance participation for learners experiencing communication and sensory challenges. This supports previous research indicating that AT empowers students with ASD to engage more actively in learning by compensating for social and communicative limitations (Al-Azawei, Parslow, & Lundqvist, 2017; Mechling, 2011).

Teachers in the study highlighted that tools such as Speech-Generating Devices (SGDs) and Augmentative and Alternative Communication (AAC) apps enabled non-verbal students to communicate, participate in group activities, and collaborate effectively in virtual classrooms. Similar to findings by Alnahdi (2020), parents reported that sensory regulation tools, including noise-canceling headphones, visual planners, and timers, helped their children manage overstimulation and sustain attention during lessons. Additionally, AT supporting executive functioning, such as digital planners and task management apps, was seen as instrumental in fostering organization and self-regulation (Pennington, 2010).

However, the study identified significant challenges to AT adoption in Nigeria. High costs, inadequate funding, and limited teacher awareness constrained effective utilization. These barriers mirror global trends observed in low- and middle-income countries, where AT availability remains uneven and often donor-dependent (UNESCO, 2020). Participants agreed that teacher and caregiver training is essential for effective adaptation and use. Without this, AT devices often remain underutilized. Overall, AT was perceived as a powerful catalyst for inclusive education, but one requiring stronger policy frameworks, investment, and institutional support to achieve sustainability and equitable access.

Theme 3: Findings from the study revealed that teacher preparedness remains a pivotal factor in achieving inclusive and effective online learning for students with ASD. Participants emphasized that teachers are the central mediators of inclusion; however, many lack the specialized training required to address the sensory, communication, and behavioral challenges associated with ASD in virtual classrooms. This aligns with earlier research indicating that limited teacher training is a significant barrier to the successful implementation of inclusive education, especially in low-resource contexts (Lindsay et al., 2014; Obiyo & Eze, 2020).

Four key areas emerged as critical for professional development: understanding ASD learning profiles, designing individualized learning plans, integrating assistive technologies, and fostering inclusive communication. Educators who had prior exposure to autism-focused workshops or professional learning reported higher confidence in differentiating instruction and using digital tools effectively, findings consistent with those of Symes and Humphrey (2011), who argue that teacher competence in autism pedagogy directly influences student engagement and achievement.

Participants also called for institutionalized professional development programs that combine theory with practice. Many recommended online training modules and mentorship networks to offer scalable, continuous learning opportunities, an approach supported by UNESCO (2021), which advocates for blended professional development models in digital education. However, the study noted persistent challenges: fragmented training structures, inadequate funding, and limited access to internet connectivity in rural schools. Collaborative peer learning communities were identified as a promising avenue for sustaining motivation and sharing best practices. Overall, the findings underscore that meaningful inclusion of students with ASD in online education depends not only on technology but on teachers' capacity, empathy, and

pedagogical adaptability, key ingredients for designing responsive and equitable learning environments.

Theme 4: A consistent finding across interviews was the importance of structure, predictability, and clear communication in creating effective online learning environments for students with ASD. Participants agreed that students with ASD perform best when routines are clearly defined and expectations are explicit, an observation supported by research showing that predictability reduces anxiety and supports engagement in learners with ASD (Koenig et al., 2009; Knight et al., 2019). Teachers reported that using visual timetables, consistent schedules, and daily checklists helped students transition smoothly between tasks and remain focused. Learning platforms such as Google Classroom and Moodle were valued for their ability to organize content, provide automated reminders, and facilitate structured interaction, echoing findings by Al-Azawei et al. (2017) that flexible and accessible design enhances online participation for neurodiverse learners.

Educators emphasized that online communication must be clear, simplified, and multimodal. Breaking tasks into sequential steps and reinforcing them with visuals or auditory cues enhanced comprehension and independence. Providing instructions in multiple formats, text, voice notes, or short video demonstrations, helped accommodate varying processing styles, consistent with Universal Design for Learning (UDL) principles (CAST, 2018).

Beyond cognitive support, participants underscored the need for social and emotional scaffolding. The isolation of online learning can exacerbate social challenges for students with ASD (Williamson et al., 2019). Teachers responded by organizing small-group discussions, peer mentoring, and emotional check-ins. Parental collaboration was highlighted as crucial, especially in Nigeria where specialized support staff are scarce. Guiding caregivers to establish quiet, predictable learning spaces at home enhanced student engagement and continuity. Collectively, these findings affirm that structure and support are not merely pedagogical choices but essential conditions for inclusive online education.

Theme 5: While participants acknowledged the potential of online learning to expand educational access, they unanimously identified significant challenges faced by students with ASD in virtual settings. One of the most recurring concerns was the loss of social interaction. Students with ASD often depend on structured face-to-face cues, such as gestures, tone, and facial expressions, to interpret meaning and engage socially (Williamson, Carnahan, & Jacobs, 2019). In online environments, these cues are diminished, leading to reduced motivation, isolation, and withdrawal. Teachers in this study observed that students became disengaged without opportunities for structured peer interaction or teacher-led socialization sessions, aligning with prior research emphasizing that social connectedness is crucial for emotional regulation and learning among students with ASD (Koenig et al., 2009; Parsons et al., 2017).

Participants also reported that sensory overload was a major challenge. Bright screens, inconsistent audio quality, and frequent notifications triggered anxiety and distraction. Sensory sensitivities, a core feature of ASD, make these digital stimuli overwhelming (Ashburner, Ziviani, & Rodger, 2010). Teachers mitigated these effects by adjusting brightness, reducing background noise, and scheduling sensory breaks. Despite these efforts, the lack of sensory-friendly online interfaces remains a persistent barrier to inclusion.

Another key finding was difficulty with self-regulation and time management in online settings. Without the structured physical routines of classrooms, many students struggled to stay organized or complete assignments independently. Visual planners, reminders, and consistent routines were found essential to maintaining engagement, a finding consistent with

studies showing that predictable schedules enhance task completion and reduce anxiety among learners with ASD (Knight, Sartini, & Spriggs, 2019).

The issue of technological inequality was particularly pronounced in Nigeria. Many families lack access to reliable internet or suitable devices, and teachers in rural areas faced unstable connectivity that disrupted instruction. These infrastructural barriers echo findings across the Global South, where digital divides continue to limit inclusive education (UNESCO, 2023; Olaye & Adegboyega, 2021). Participants noted that assistive technologies (AT) such as communication apps or visual planners were often inaccessible due to high costs and limited availability.

Moreover, educators highlighted that personalized instruction and close monitoring are harder to achieve in online classrooms. Large class sizes and rigid curricula limit teachers' ability to differentiate content or provide one-on-one feedback. This concern supports earlier research emphasizing that individualized instruction is central to effective ASD education (Keen et al., 2022). Compounding these challenges, many teachers admitted they had no formal training in autism-specific strategies, leading to reliance on trial and error. The lack of professional development reflects systemic gaps in teacher education programs and underscores the need for sustained institutional support (Ishola & Madu, 2020).

The findings underscore that supporting students with ASD in online learning environments requires a systemic and inclusive approach encompassing pedagogical flexibility, teacher competency, and infrastructural readiness. Participants envisioned an ideal ecosystem grounded in Universal Design for Learning (UDL) and AT integration, supported by trained educators, affordable technology, and engaged families. However, the Nigerian context still reflects uneven implementation and urban–rural disparities. Strengthening policy frameworks, institutional investments, and teacher capacity-building are critical to achieving equitable digital inclusion for students with ASD.

Conclusion

Supporting students with ASD in online learning environments is a crucial endeavor, especially in the context of Nigeria, where educational accessibility and inclusivity remain key issues. As digital learning becomes increasingly prevalent, ensuring that students with ASD can thrive in online settings is paramount for their educational success and overall well-being. This paper has highlighted several effective strategies for enhancing the online learning experience for students with ASD. Firstly, the application of UDL principles has proven to be a significant factor in creating accessible and engaging online environments. UDL emphasizes the importance of flexible learning approaches that accommodate diverse learning needs, which is essential for students with ASD who may require different modes of instruction and assessment.

Secondly, the integration of assistive technology has been identified as a powerful tool in supporting students with ASD. Assistive technologies such as speech-to-text software, communication apps, and visual aids can help bridge gaps in communication, comprehension, and engagement. However, the effectiveness of these tools is contingent upon their appropriate selection and implementation, tailored to the specific needs of each student (Al-Azawei, Parslow, & Lundqvist, 2017). Moreover, teacher training and support are critical for the successful implementation of these strategies. Educators should be equipped with the skills and knowledge to effectively use online tools and technologies, understand the unique needs of students with ASD, and create an inclusive online learning environment. Professional development programs that focus on ASD awareness, technology integration, and differentiated instruction can greatly enhance educators' ability to support these students.

The perspectives of parents and guardians also play a significant role in shaping effective strategies for online learning. Engaging with families to understand their experiences and expectations can provide valuable insights into how online learning can be tailored to better meet the needs of students with ASD. In Nigeria, addressing the challenges of online learning for students with ASD requires a concerted effort from educators, policymakers, and stakeholders. Investing in training, technology, and inclusive practices will contribute to a more equitable educational landscape where students with ASD can achieve their full potential. Overall, the successful support of students with ASD in online learning environments hinges on a multifaceted approach that combines inclusive design principles, assistive technology, teacher preparedness, and family involvement. By embracing these strategies, Nigeria can advance towards a more inclusive educational system that supports the diverse needs of all learners.

Recommendations

In view of the findings obtained, the paper recommended that, institutions of learning having elearning facilities for students with ASD should consider the following steps in an attempt to foster inclusivity and equality:

1. Integrate UDL principles into their online curricula to ensure that educational materials and activities are accessible to all students, including those with ASD. This includes providing multiple means of representation, expression, and engagement to cater to diverse learning needs.
2. Invest in and provide access to assistive technologies tailored to the needs of students with ASD, such as communication apps, text-to-speech software, and visual schedules. Ensuring that these tools are readily available and supported is crucial for enhancing engagement and learning outcomes.
3. Develop and implement professional development programs focused on equipping educators with skills and knowledge for supporting students with ASD in online learning environments. Training should cover ASD awareness, technology use, and strategies for creating an inclusive virtual classroom.
4. Engage with families to gain insights into the individual needs of students with ASD and collaborate on strategies for supporting their learning. Regular communication between educators and parents can help tailor online learning experiences to better meet the needs of students.
5. Design and evaluate online learning platforms with built-in accessibility features, such as customizable interfaces, alternative text formats, and interactive content that supports varied learning preferences. This approach helps create a more inclusive digital learning environment.
6. Implement systematic methods for monitoring and evaluating the effectiveness of online learning strategies and tools used for students with ASD. Regular assessment and feedback from students, parents, and educators will help refine and improve these strategies.
7. Incorporate opportunities for peer interaction and support within online learning environments to help students with ASD build social skills and feel connected. Virtual group activities and collaborative projects can facilitate social learning and engagement.

References

Adebisi, R. O., Liman, N. A., & Longpoe, P. K. (2015). Using assistive technology in teaching children with learning disabilities in the 21st century. *Journal of Education and Practice*, *6*(24), 14-20.

Afolabi, F. (2020). Inclusivity in Nigeria's education system: Challenges and prospects. *Journal of Education and Practice, 11*(10), 25-33.

Al-Azawei, A., Parslow, P., & Lundqvist, K. (2017). Barriers and opportunities of e-learning implementation in Iraq: A case of public universities. *The International Review of Research in Open and Distributed Learning, 18*(6), 234–253.

Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2016). Universal Design for Learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2015. *Journal of the Scholarship of Teaching and Learning, 16*(3), 39–56.

Alnahdi, G. H. (2020). Assistive technology in special education and the universal design for learning. *The Turkish Online Journal of Educational Technology, 19*(2), 90–102.

Mechling, L. C. (2011). Review of twenty-first-century assistive technology for students with autism spectrum disorders. *Journal of Special Education Technology, 26*(4), 41–54.

Pennington, R. C. (2010). Computer-assisted instruction for teaching academic skills to students with autism spectrum disorders: A review of literature. *Focus on Autism and Other Developmental Disabilities, 25*(4), 239–248.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.

Ashburner, J., Vickerstaff, S., & Howells, K. (2019). Supporting students with autism in online learning environments: Challenges and strategies. *Journal of Autism and Developmental Disorders, 49*(4), 1803-1818.

Bakare, M. O., & Munir, K. M. (2011). Autism spectrum disorders in Africa. *African Journal of Psychiatry*, 14(3), 208-210.

Basham, J. D., Gardner, J. E., & Smith, S. J. (2020). The role of Universal Design for Learning (UDL) in creating accessible learning environments for students with disabilities. *Journal of Online Learning Research*, *6*(1), 23-45.

Bashir, L. O., & Murtala, O. G. (2020). Enhancing inclusive education in Nigeria: Strategies for supporting students with autism spectrum disorder. *International Journal of Special Education, 14*(3), 115-129.

Bergmann, S. (2020). Sensory sensitivities in online learning environments. *Journal of Autism and Developmental Disorders*, 50(6), 1981-1988.

Bozkurt, A., et al. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education, 15*(1), 1-126.

CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. Retrieved from http://udlguidelines.cast.org

Dell, A. G., Dell, K. A., & Blackwell, T. L. (2015). *Applying Universal Design for Learning in Online Courses: Pedagogical and Practical Considerations.* Open SUNY Textbooks.

Koenig, K. P., De Los Reyes, A., Cicchetti, D., Scahill, L., & Klin, A. (2009). Group intervention to promote social skills in school-age children with pervasive developmental disorders: Reconsidering efficacy. *Journal of Autism and Developmental Disorders, 39*(8), 1163 1172.

Knight, V. F., Sartini, E. C., & Spriggs, A. D. (2019). Evaluating visual activity schedules to

increase on-task behavior for students with ASD. *Preventing School Failure, 63*(2), 93 102.

Williamson, P., Carnahan, C., & Jacobs, J. (2019). Online learning for students with autism spectrum disorder: A review of the literature. *Journal of Special Education Technology, 34*(1), 26–39.

Dell, A. G., Newton, D. A., & Petroff, J. G. (2017). *Assistive technology in the classroom: Enhancing the school experiences of students with disabilities*. Pearson.

Ezeani, N. A. (2018). Teacher training and support for inclusive education in Nigeria: Challenge and opportunities. *African Journal of Educational Research, 9*(1), 49-63.

Fazendeiro, D. S. (2019). The importance of teacher training in inclusive education: Insights from the field. *European Journal of Special Needs Education, 34*(2), 135-147.

Gillespie-Lynch, K., Kapp, S. K., Shane-Simpson, C., Smith, D. S., & Hutman, T. (2014). Intersections between the autism spectrum and the internet: Perceived benefits and preferred functions of computer-mediated communication. *Intellectual and Developmental Disabilities, 52*(6), 456-469.

Guldberg, K. (2017). Developing inclusive education for children with autism in Nigeria. *International Journal of Inclusive Education, 21*(4), 375-389.

Hall, T., Strangman, N., & Meyer, A. (2019). *UDL Implementation: A Research-based Framework for Educators.* CAST Professional Publishing.

Hedges, S., Kirby, A., & Sutherland, R. (2014). Providing effective education for students with autism in mainstream classrooms: Perspectives from teachers and teaching assistants. *Research in Autism Spectrum Disorders, 8*(5), 622-629.

Ihenacho, I., Obi-Nwosu, H., & Ebigbo, P. O. (2021). Awareness of autism in Nigeria: A review. *Nigerian Journal of Social Sciences,* 17(2), 25-35.

Ishola, A. A., & Madu, C. N. (2020). Challenges of inclusive education in Nigeria: Teacher preparedness and policy implications. *African Journal of Education and Practice, 6*(2), 45–58.

Jeste, S. S., Korb, K., & Zhang, Y. (2020). Navigating online learning for children with autism during COVID-19. *Autism Research,* 13(12), 2164-2169.

Kasari, C., Gulsrud, A., & Locke, J. (2020). Remote learning and social isolation: How can we support children with ASD? *Journal of Autism and Developmental Disorders*, 50(10), 3650-3656.

Keen, D., Webster, A., & Ridley, G. (2022). How well are educators prepared to teach children with autism spectrum disorder? *Journal of Autism and Developmental Disorders, 52*(7), 2959–2972.

Khalil, H. (2021). Technology and inclusive education: Bridging the gap for students with disabilities. *Education and Information Technologies, 26*(4), 3211-3228.

Knight, V. F., Sartini, E. C., & Spriggs, A. D. (2019). Evaluating visual activity schedules to increase on-task behavior for students with ASD. *Preventing School Failure, 63*(2), 93 102.

Light, J., & McNaughton, D. (2014). Communicative competence for individuals who require augmentative and alternative communication: A new definition for a new era of communication? *Augmentative and Alternative Communication, 30*(1), 1-18.

Lindsay, S., Proulx, M., Thomson, N., & Scott, H. (2014). Educators' challenges of including children with autism spectrum disorder in mainstream classrooms. *International Journal of Disability, Development and Education, 61*(3), 231–242.

Meadan, H., Daczewitz, M. E., & Kaczmarek, L. A. (2021). Supporting executive functioning in students with ASD during remote learning. *Journal of Special Education Technology,* 36(2), 1-15.

Meo, G. (2008). Curriculum planning for all learners: Applying Universal Design for Learning (UDL) to a high school reading comprehension program. *Preventing School Failure: Alternative Education for Children and Youth, 52*(2), 21-30.

Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal Design for Learning: Theory and Practice.* CAST.

Obiyo, N. O., & Eze, U. N. (2020). Teacher preparation for inclusive education in Nigeria: Challenges and prospects. *African Journal of Teacher Education, 9*(1), 85–99.

Symes, W., & Humphrey, N. (2011). School factors that facilitate or hinder the ability of teaching assistants to support pupils with autism spectrum disorders. *Journal of Research in Special Educational Needs, 11*(3), 153–161.

Ogundele, M. O. (2017). Promoting the adoption of assistive technology in Nigeria: The role of government and non-governmental organizations. *Journal of Disability Studies, 5*(2), 120-129.

Okeke, C. O. (2018). Barriers to implementing inclusive education in Nigeria: A review of literature. *International Journal of Special Education, 33*(2), 135-150.

Olawale, K. A., & Owodunni, S. O. (2019). Developing teacher training programs for inclusive education: Lessons from Nigeria. *Journal of Education and Practice, 10*(5), 75-85.

Olaye, F., & Adegboyega, S. (2021). Bridging the digital divide in Nigeria's education system: Lessons from the COVID-19 era. *International Journal of Educational Technology in Africa, 5*(1), 23–34.

Olumorin, C. O., Fakomogbon, M. A., & Awoleye, O. M. (2018). Enhancing special education in Nigeria through assistive technology: Prospects and challenges. *Nigerian Journal of Special Education, 14*(2), 89-102.

Parsons, S., Yuill, N., & Good, J. (2017). Constructing digital environments for social inclusion: Impact for learners with autism spectrum disorders. *Computers & Education, 114*, 1–17.

Ploog, B. O., Scharf, A., Nelson, D., & Brooks, P. J. (2013). Use of computer-assisted technologies (CAT) to enhance social, communicative, and language development in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43*(2), 301-322.

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A review of research on Universal Design Educational Models. *Remedial and Special Education, 35*(3), 153–166.

Rodríguez, M. L., Vicari, M., & Vidal, M. (2020). Visual schedules and ASD: A tool for success in remote learning. *International Journal of Special Education*, 35(2), 45-57.

Salami, A. O. (2018). Enhancing learning among students with disabilities in Nigeria: The role of Universal Design for Learning (UDL). *African Journal of Special Education, 8*(1), 12-24.

Simpson, R. L. (2005). Evidence-based practices and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 20*(3), 140-149.

Smith, T. E. (2020). Supporting students with Autism Spectrum Disorder (ASD) in online learning environments: The role of Universal Design for Learning (UDL). *Journal of Special Education Technology, 35*(3), 123-138.

Sofronoff, K., Kuipers, K., & Lee, N. (2021). Parent involvement in supporting online learning for children with autism. *Autism and Family Journal*, 4(1), 25-38.

UNESCO. (2020). *Global Education Monitoring Report 2020: Inclusion and Education – All Means All.* Paris: UNESCO.

UNESCO. (2021). *The Race Against Time for Smarter Development: UNESCO Science Report.* Paris: UNESCO.

UNESCO. (2023). *Global Education Monitoring Report 2023: Technology in education – A tool on whose terms?* Paris: UNESCO Publishing.

United Nations. (2006). Convention on the Rights of Persons with Disabilities. Retrieved from https://www.un.org/development

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Williamson, P., Carnahan, C., & Jacobs, J. (2019). Online learning for students with autism spectrum disorder: A review of the literature. *Journal of Special Education Technology, 34*(1), 26–39.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.

Ziviani, J., & Rodger, S. (2010). Surviving in the mainstream: Capacity of children with autism spectrum disorders to perform academically and regulate their emotions and behavior at school. *Research in Autism Spectrum Disorders, 4*(1), 18-27.