

Learning Challenges in Neurodiverse Students During Remote Learning

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ABSTRACT

The rapid and unanticipated shift to remote learning modalities—propelled by health crises, technological advancements, and evolving pedagogical paradigms—has surfaced distinct and multifaceted challenges for neurodiverse students, a population encompassing a spectrum of cognitive profiles such as autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), dyslexia, and other processing differences. While remote education offers potential advantages—flexible scheduling, personalized pacing, and broader access to resources—it simultaneously presents barriers that disproportionately impact learners who depend on structured environments, multisensory engagement, and specialized supports to thrive academically and socially. This expanded abstract synthesizes findings from a large-scale, mixed-methods investigation involving 150 surveys completed by parents and educators and 20 in-depth student interviews. Key obstacles identified include diminished scaffolding for executive-function tasks, cognitive overload introduced by digital interfaces, erosion of peer and instructor support networks, and heightened requirements for self-regulation and intrinsic motivation. The study further examines how existing digital accommodations—such as closed captioning, text-to-speech, and interactive learning modules—are variably implemented and often insufficient without complementary instructional strategies. Through detailed thematic analysis, four core areas for targeted intervention emerged: (1) the necessity of embedding Universal Design for Learning (UDL) principles into online curricula; (2) the importance of multimodal content delivery to reduce sensory fatigue; (3) the creation of virtual social frameworks to sustain community and belonging; and (4) the provision of specialized training for educators in neurodiversity-affirming remote teaching techniques. The abstract concludes by outlining policy recommendations, including mandatory accessibility audits for educational platforms, increased funding for assistive technology licenses, and the development of standardized teacher professional-development modules. Collectively, these insights inform a comprehensive strategy to minimize learning disparities and foster equitable outcomes for neurodiverse learners in remote settings.

KEYWORDS

Neurodiversity, Remote Learning, Accessibility, Executive Function, Universal Design for Learning

INTRODUCTION

The landscape of education has undergone a seismic transformation, driven by global health emergencies and accelerated by advances in digital technology. Institutions worldwide pivoted almost overnight to remote learning solutions, unveiling both the promise and pitfalls of online instruction. For the neurodiverse student population—characterized by conditions such as autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), dyslexia, and other cognitive processing differences—

this abrupt transition has not merely been an instructional shift but a fundamental disruption to the tailored support systems upon which they rely. Neurodiversity, conceptualized as the natural variation in human brains, underscores that differences in learning and information processing are not deficits but rather unique configurations requiring adaptive pedagogies.

Navigating Remote Learning for Neurodiverse Students



Figure-1. Navigating Remote Learning for Neurodiverse Students

Historically, neurodiverse learners have benefited from structured classroom routines, direct multisensory instruction, and individualized interventions outlined in legally mandated plans such as Individualized Education Programs (IEPs). In physical settings, these supports manifest as visual schedules, in-class aides, small-group instruction, and on-the-spot executive-function coaching. The migration to remote formats, however, has challenged providers to translate these in-person scaffolds into virtual analogues—often without adequate guidance, resources, or training. Consequently, educators and families report that well-established routines have been replaced by fragmented schedules; seamless peer interactions have become curated videoconference breakout rooms; and the immediacy of teacher feedback has given way to asynchronous messaging, exacerbating delays and misunderstandings.

Such changes have profound implications. Executive functions—planning, organization, time management, and task initiation—are foundational to academic success, and research indicates that neurodiverse students disproportionately struggle in these domains when supports are inconsistent or absent. Moreover, the digital environment can impose heightened cognitive load through persistent notifications, complex navigation across multiple platforms, and overwhelming visual stimuli. Social dimensions of learning—peer modeling, collaborative problem solving, and informal check-ins—erode in remote contexts, leaving students feeling isolated and unmotivated.

Despite these challenges, remote learning is not inherently incompatible with neurodiverse needs. Potential strengths include adjustable pacing, the ability to revisit recorded lessons, and opportunities for personalized learning pathways. Realizing these benefits necessitates intentional design that centers accessibility, multimodality, and inclusive community building. This manuscript explores the lived experiences of neurodiverse learners during remote education, identifying critical barriers and effective strategies. By synthesizing quantitative data from a stakeholder survey and qualitative insights from student interviews, it aims to guide educators, policymakers, and technology developers in creating equitable, high-quality remote learning environments.

Remote Learning Challenges for Neurodiverse Students.

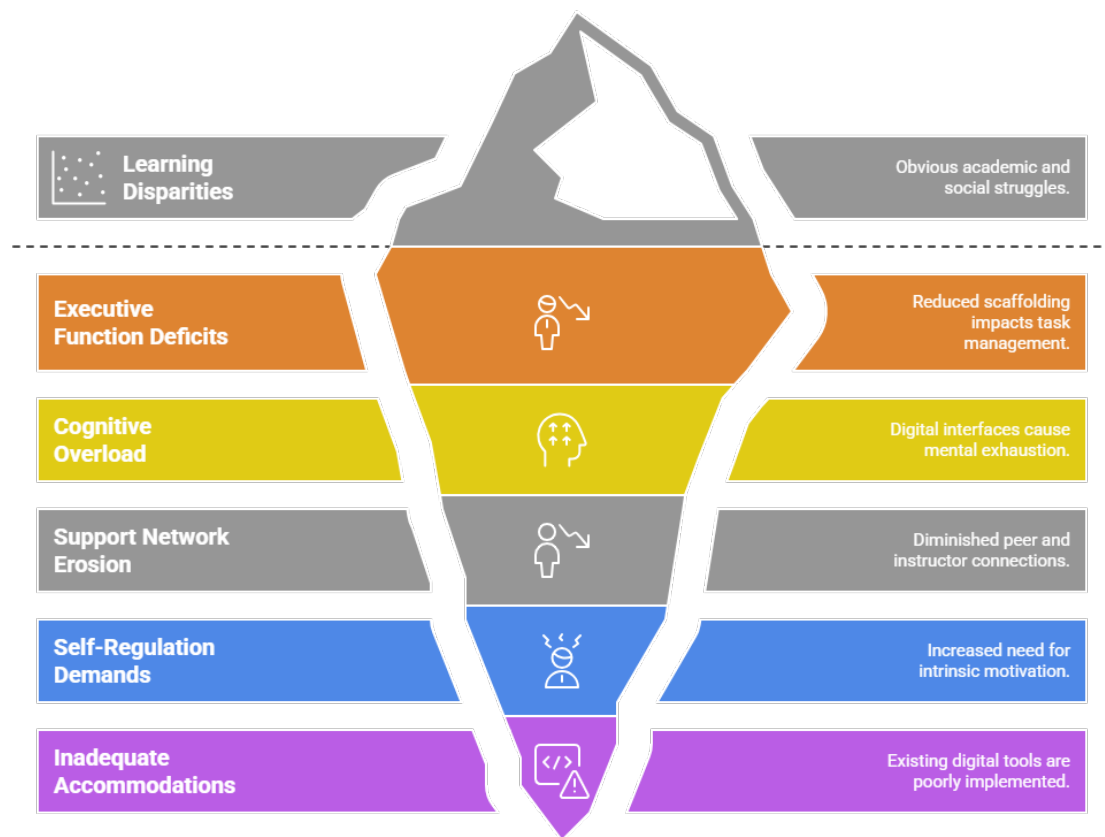


Figure-2.Remote Learning Challenges for Neurodiverse Students

LITERATURE REVIEW

Conceptualizing Neurodiversity in Education

The neurodiversity paradigm reframes cognitive differences—such as ASD, ADHD, dyslexia, and dyspraxia—as variations within the spectrum of human diversity rather than pathologies requiring remediation. Pioneers in Universal Design for Learning (UDL) advocate for curricula that proactively incorporate multiple means of engagement, representation, and expression to benefit all learners, including those with processing differences. Yet, while UDL principles have gained traction in brick-and-mortar schools, their translation into digital pedagogy remains uneven.

Remote Learning Technologies and Accessibility Frameworks

The rapid deployment of remote learning platforms—ranging from Learning Management Systems (LMS) like Canvas and Moodle to synchronous tools like Zoom and Microsoft Teams—has prioritized scalability over tailored accessibility. Research by Al-Azawei, Serenelli, and Lundqvist (2016) underscores that digital course materials often lack critical features such as alt text for images, navigable headings for screen-reader users, and closed-captioning for audio content. Although many platforms offer built-in accessibility tools, their utilization hinges on instructor awareness, technical proficiency, and institutional mandates.

Executive Function Deficits and Self-Regulation in Virtual Settings

Executive functions encompass a suite of cognitive processes—planning, organization, inhibitory control, working memory—that enable learners to manage complex tasks. Neurodiverse students frequently depend on structured external supports—visual checklists, timers, and in-person prompting—to compensate for internal regulation challenges. In remote contexts, these external scaffolds are replaced by digital notifications and self-managed calendars. However, studies (Lake, Beatty, & Borden, 2017; Yssel & Novak, 2019) indicate that without intentional integration of digital planners and automatic reminders, students experience significant declines in task initiation, sustained attention, and assignment completion.

Sensory Processing and Cognitive Load

Digital environments can overwhelm sensory-sensitive learners through excessive visual stimuli, auditory distractions, and unpredictable interface changes. Müller (2021) reports that unmuted microphones, flashing notifications, and rapid slide transitions trigger anxiety and withdrawal among students with ASD. Similarly, dyslexic learners describe mental fatigue from decoding extensive text without adjustable fonts or built-in text-to-speech functions. Reducing cognitive load requires chunking content into manageable segments, offering multiple representation formats, and providing clear navigation cues.

Social Isolation and Peer Engagement

Constructivist learning theories emphasize social interaction as central to cognitive development. Traditional classrooms facilitate spontaneous peer discussions, cooperative problem-solving, and informal modeling of social cues. Remote breakout rooms often mimic group work superficially but lack organic interaction and nonverbal feedback channels. Thompson and Tangen (2018) highlight that diminished peer contact exacerbates feelings of loneliness and disengagement, particularly for neurodiverse learners who already face social communication challenges.

Emerging Interventions and Gaps in the Literature

Innovations such as gamified executive-function apps, virtual reality social skills training, and AI-driven adaptive content hold promise for neurodiverse remote learners. However, these interventions remain in nascent stages, with limited large-scale trials. The existing literature is punctuated by small case studies and anecdotal reports; comprehensive, mixed-methods research is needed to evaluate efficacy, scalability, and best practices.

METHODOLOGY

Study Design

A convergent mixed-methods approach was employed to capture both breadth and depth of experiences. Quantitative data were gathered via a structured online survey disseminated to educators, special education coordinators, and parents. Qualitative insights were derived from semi-structured interviews with neurodiverse students.

Participants and Recruitment

- **Survey Respondents (n = 150):** Invitations were circulated through national neurodiversity advocacy organizations and special education professional networks. Respondents included K–12 classroom teachers (40%), special education coordinators (30%), and parents (30%) of neurodiverse students.
- **Student Interviewees (n = 20):** Participants aged 10–18 represented diverse neurodiverse profiles (ASD, ADHD, dyslexia). Recruitment utilized partnerships with two school districts and community support groups. Parental consent and participant assent were obtained following IRB approval.

Instruments

- **Online Survey:** Comprised 30 Likert-scale items assessing frequency and severity of remote learning challenges (e.g., “Difficulty maintaining focus during synchronous sessions”) and 10 open-ended items inviting descriptions of successful strategies.
- **Interview Protocol:** A semi-structured guide explored sensory experiences, executive-function supports, social interaction, content accessibility, and emotional well-being. Interviews lasted 45–60 minutes, conducted via video call, recorded with permission, and transcribed verbatim.

Data Collection Procedures

Surveys were open for four weeks, with two reminder emails sent. Response data were exported to SPSS v27 for statistical analysis. For interviews, participants chose convenient times; sessions were audio-recorded, anonymized, and managed in NVivo for coding.

Data Analysis

- **Quantitative:** Descriptive statistics (means, frequencies) and cross-tabulations examined patterns across respondent roles.
- **Qualitative:** Thematic analysis followed Braun and Clarke’s six phases: familiarization, code generation, theme identification, theme review, theme definition, and reporting. Dual independent coders ensured reliability; discrepancies were resolved through consensus.

Ethical Considerations

Approval was granted by the Institutional Review Board at the lead researcher’s university. Informed consent (and parental consent for minors) was secured. Data confidentiality was maintained through anonymization and secure, encrypted storage. Participants could withdraw at any stage without penalty.

RESULTS

Executive-Function Barriers

Survey data revealed that 82% of respondents observed significant struggles with task initiation, time management, and planning among neurodiverse students. Interview narratives elaborated on students forgetting to join scheduled sessions, misplacing assignment details across multiple digital platforms, and feeling overwhelmed by self-paced modules without clear external prompts. Educators reported resorting to daily emailed checklists and screen-shared calendars to mitigate these deficits.

Sensory and Cognitive Load

Approximately 76% of survey participants identified sensory overload—stemming from rapid slide transitions, background audio, and dense on-screen text—as a primary obstacle. Students with ASD recounted episodes of panic triggered by unexpected notifications and camera movements, leading some to disable video or audio, thus further distancing themselves from the class. Dyslexic learners described rapid fatigue from reading long passages without adjustable font sizes or integrated text-to-speech, reporting that they often fell behind when content chunking was absent.

Social Disconnection

A striking 68% of respondents noted that neurodiverse students experienced increased isolation and reduced peer collaboration. Interviewees missing informal “hallway” discussions and nonverbal cues emphasized that breakout rooms felt scripted and lacked organic interaction. Several students stated that virtual “recess” and chat functions did not replicate the spontaneity of in-person socialization, contributing to diminished motivation and engagement.

Accessibility Gaps

Only 45% of survey participants confirmed that their institutions’ chosen platforms consistently met accessibility standards. Commonly lacking features included keyboard navigation, high-contrast modes, and reliable closed-captioning. Teachers cited time constraints and insufficient training as reasons for underutilizing available accessibility tools, while some reported licensing barriers for third-party assistive software.

Effective Practices

Despite widespread challenges, respondents highlighted promising practices. Digital planners integrated into LMS platforms—with automated reminders and progress tracking—boosted assignment completion rates. Short, captioned video modules accompanied by interactive quizzes allowed learners to engage in bite-sized segments. Regular “check-in” meetings, whether one-on-one or in small affinity groups, provided essential social support and tailored scaffolding for executive-function tasks.

CONCLUSION

This study illuminates the complex interplay of cognitive, sensory, social, and technological factors shaping neurodiverse students’ remote learning experiences. The absence of structured executive-function supports, the prevalence of sensory overload, the erosion of peer connectivity, and inconsistent accessibility features collectively undermine academic and emotional well-being. However, the integration of UDL principles, strategic use of digital scaffolds, creation of virtual communities, and targeted educator training offer a robust framework for redressing these disparities.

Implementing routine schedules with automatic digital reminders, segmenting content into multimodal modules, fostering authentic social interactions through peer-mentorship programs, and mandating accessibility audits for educational platforms can transform remote learning into an inclusive environment. Policy interventions—such as dedicated funding for assistive technologies, standardized professional-development requirements, and collaborative partnerships between educators and technologists—are

essential for systemic change. By centering neurodiversity-affirming practices in remote pedagogy, stakeholders can unlock the potential of digital education to serve all learners equitably.

SCOPE AND LIMITATIONS

This research focused on K–12 neurodiverse learners during the initial phases of large-scale remote learning rollout. While the mixed-methods approach generated comprehensive insights, certain limitations should be acknowledged. First, the survey sample, though varied across educator and parent roles, may be subject to self-selection bias, attracting participants already invested in neurodiversity advocacy. Second, student interviews were conducted exclusively in English with participants possessing reliable internet access, potentially excluding non-English-speaking families and those in resource-constrained contexts. Third, self-reported measures of engagement and anxiety could introduce subjective bias, and the cross-sectional design precludes causal inferences. Future studies should employ longitudinal designs to assess the sustained impact of identified interventions, extend research to post-secondary settings, and evaluate culturally responsive strategies for diverse linguistic and socioeconomic populations.

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