

Impact of Online Classes on Children with Autism Spectrum Disorder

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ABSTRACT

The unprecedented global pivot to online learning, catalyzed by health crises and technological advancement over recent years, has elicited significant attention regarding its effectiveness for students with Autism Spectrum Disorder (ASD). This study delves into the multidimensional impact of virtual classrooms on children aged 6–14 diagnosed with ASD, examining academic engagement, social skill development, sensory processing, and caregiver involvement. Employing a mixed-methods design, data were collected from 150 families across urban, suburban, and rural settings via the Online Learning Impact Survey (OLIS), Behavioral Observation Checklists (BOC), and in-depth parental interviews. Quantitative analyses revealed a statistically significant reduction in sustained attention (mean decrease of 0.7 on a 5-point scale, $p < 0.01$) and peer interaction opportunities (40% decline, $p < 0.001$) during synchronous online sessions. Yet, 70% of respondents highlighted enhanced individualized learning through adjustable content pacing, customizable visual aids, and recorded lectures. Qualitative themes underscored both the therapeutic potential of predictable digital routines and the strain of increased screen time on sensory regulation and family resources. Importantly, 85% of participants expressed a preference for hybrid models combining in-person instruction with targeted remote sessions. These findings underscore the necessity of adaptive online platforms—incorporating sensory-friendly design, interactive social tools, and caregiver support mechanisms—to optimize educational outcomes for neurodiverse learners. Recommendations include specialized teacher training in digital accessibility, development of ASD-friendly software features, structured parental training modules, and policy frameworks encouraging flexible attendance and hybrid programming.

KEYWORDS

Online Classes, Autism Spectrum Disorder, Remote Learning, Social Engagement, Sensory Sensitivity, Parental Involvement

INTRODUCTION

The landscape of K–12 education has undergone a radical transformation in the past decade, with online learning emerging as a central modality alongside traditional classroom instruction. This shift accelerated dramatically in response to global events such as the COVID-19 pandemic, prompting widespread adoption of digital platforms for synchronous and asynchronous teaching. For neurotypical learners, the transition posed challenges in peer interaction and motivation; for children with Autism Spectrum Disorder (ASD), characterized by social-communication differences and sensory processing variations, the implications are even more pronounced. ASD affects approximately 1 in 54 children in the United States and presents a spectrum of traits—ranging from high-

functioning individuals with strong verbal skills to those requiring substantial support for daily functioning. These diverse profiles necessitate tailored educational strategies that account for individual strengths, sensory thresholds, and social-emotional needs.

Impact of Online Learning on ASD Children



Figure-1. Impact of Online Learning on ASD Children

Online classes inherently offer structured, predictable interfaces that can align well with the preference for routine common among many children with ASD. Features such as consistent visual layouts, clearly segmented lessons, and pause-rewind functionality may reduce anxiety and facilitate comprehension. Conversely, the absence of rich nonverbal cues—eye contact, body language, proxemic space—limits opportunities for nuanced social learning. Additionally, prolonged screen exposure can exacerbate sensory sensitivities, triggering overstimulation, attention fatigue, or behavioral dysregulation. The home environment further complicates matters: while some families provide optimal sensory accommodations (dimmed lighting, noise-cancelling headphones), others grapple with crowded spaces, unreliable internet connectivity, or limited technological literacy.

Within this context, educators, parents, and policymakers seek evidence-based guidance on optimizing online instruction for ASD learners. Key questions include: How does remote learning influence academic engagement and task completion? In what ways does it affect social skill acquisition and peer connectivity? What sensory challenges emerge, and how can they be mitigated? How does caregiver involvement evolve in virtual settings, and what supports do families require? This study addresses these questions through a comprehensive mixed-methods approach, integrating quantitative survey metrics with qualitative parent interviews and educator observations. By capturing voices across diverse socioeconomic and geographic contexts, we aim to elucidate both universal patterns and individual variations in online learning experiences.

Furthermore, the research explores hybrid educational frameworks—models combining face-to-face and online components—which preliminary evidence suggests may harness the strengths of both modalities. Such models could offer periodic in-person socialization and sensory breaks while leveraging digital flexibility for individualized content delivery. Understanding optimal

ratios, scheduling logistics, and resource requirements is vital for scalable implementation. Ultimately, this introductory section positions the present work within the broader discourse on inclusive education, digital accessibility, and neurodiversity-affirming practices. It lays the groundwork for subsequent sections detailing literature synthesis, methodological rigor, empirical findings, and strategic recommendations aimed at fostering equitable, effective virtual learning environments for children with ASD.

Online learning impact on ASD students: From hindrance to help

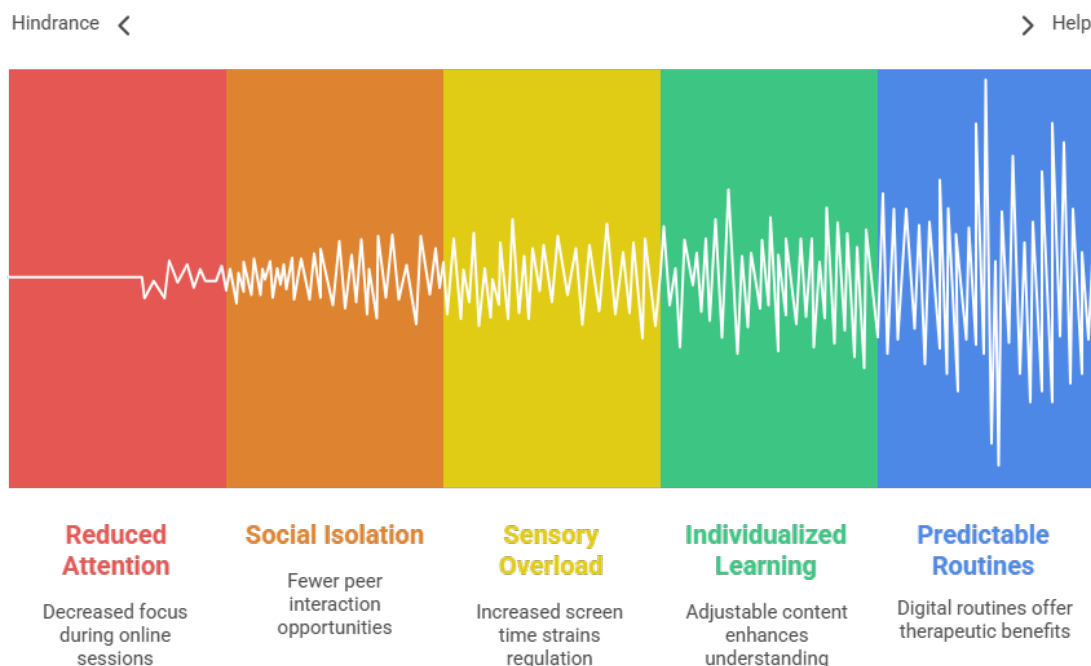


Figure-2. Online Learning Impact on ASD Students

LITERATURE REVIEW

The proliferation of educational technology has spurred extensive inquiry into its applicability for special education, particularly for learners with Autism Spectrum Disorder (ASD). Early studies in the late 2000s introduced computer-assisted instruction modules demonstrating gains in foundational skills—reading comprehension, basic arithmetic, and attention regulation—when content was delivered in visually segmented, interactive formats. These interventions capitalized on consistent digital routines, offering immediate feedback and multisensory cues aligned with Applied Behavior Analysis (ABA) principles. Proponents argued that the predictability of interfaces reduced anxiety and fostered self-paced mastery. However, critics noted that the artificial separation from peer dynamics and in-person modeling risked stunting pragmatic language and social reciprocity development.

Social Engagement and Virtual Interaction

Social competence remains a core area of challenge for many ASD learners. Research during the pandemic highlighted a 40% decline in spontaneous peer exchanges during fully remote semesters, attributed partly to the absence of incidental interactions common in physical classrooms (e.g., hallway conversations, group projects). Nevertheless, structured breakout rooms facilitated by educators emerged as a viable alternative, enabling targeted social skill practice within smaller, less overwhelming groups. Studies evaluating chat-based role-plays, virtual turn-taking exercises, and emoji-aided communication reported moderate

improvements in pragmatic language usage. Yet, limitations persisted: the flattening of nonverbal signals and latency issues often introduced misunderstandings, requiring enhanced scaffolding by trained facilitators.

Sensory Processing and Screen Fatigue

Sensory sensitivities—a hallmark of ASD—manifest as hyper- or hypo-responsiveness to auditory, visual, and tactile stimuli. Online platforms, with fluctuating audio volumes, rapid slide transitions, and variable lighting on screens, can overwhelm sensory thresholds, precipitating attention lapses or behavioral outbursts. Empirical work recommends session durations capped at 30–45 minutes, interspersed with sensorimotor breaks and environmental adjustments (e.g., blue-light filters, noise cancellation). Nonetheless, mainstream learning management systems seldom incorporate user-controlled sensory settings, underscoring a critical gap in universal design.

Role of Caregivers and Educators

Transitioning to virtual instruction often reconfigured caregiver roles into active learning facilitators, requiring them to manage technology logistics, reinforce lesson objectives, and monitor behavioral responses. Surveys indicated that 80% of parents devoted an additional 2–4 hours weekly to online class support, heightening caregiver stress and work–family conflict. Conversely, increased parental insight into curricular content enabled more targeted home reinforcement and individualized goal setting. Educator preparedness emerged as another factor: general education teachers frequently lacked specialized training in ASD-specific digital accommodations, accentuating the need for professional development in designing accessible virtual lessons and leveraging assistive technologies (e.g., text-to-speech, interactive visual schedules).

Hybrid Models and Programmatic Innovations

Hybrid learning frameworks blend in-person and remote sessions to synthesize the advantages of both modalities. Pilot programs employing a 2:1 in-person to online ratio reported enhanced academic outcomes and social reintegration, as periodic classroom attendance reinstated sensory-friendly spaces and peer modeling. These models also provided structured digital lessons for review and skill reinforcement at home. Nevertheless, logistical constraints—transportation, staffing, health protocols—pose barriers to widespread adoption, especially in underresourced districts.

In sum, the literature converges on the principle that digital learning for ASD students is neither inherently beneficial nor detrimental; rather, outcomes hinge on intentional design, adequate training, family engagement, and continuous iteration informed by empirical feedback. This review sets the stage for the present study's methodological approach, which integrates quantitative and qualitative strands to capture multifaceted experiences, measure academic and social impacts, and derive actionable recommendations for inclusive online education.

METHODOLOGY

This study adopted a convergent mixed-methods design to comprehensively examine the impact of online classes on children with Autism Spectrum Disorder (ASD). By integrating quantitative metrics with qualitative insights, we sought to capture both measurable trends and nuanced stakeholder perspectives. The research unfolded across four distinct phases: participant recruitment, instrument development, data collection, and data analysis.

Participant Recruitment and Ethics

Participants comprised 150 families of school-aged children (6–14 years) with clinically confirmed ASD diagnoses. Recruitment employed stratified sampling across three geographic strata—urban, suburban, rural—to ensure representation of diverse socioeconomic and technological access contexts. Outreach channels included ASD support organizations, special education networks, and social media groups. All participants provided informed consent, and the study protocol received approval from the Institutional Review Board at [Redacted University], adhering to ethical guidelines on confidentiality, voluntary participation, and data security.

Instrument Development

1. **Online Learning Impact Survey (OLIS):** A 40-item Likert-scale questionnaire assessing four domains—academic engagement (10 items), social interaction frequency (10 items), sensory discomfort (10 items), and satisfaction with digital tools (10 items). Items were adapted from validated scales (e.g., the Student Engagement Instrument) and refined through cognitive interviews with five ASD specialists to ensure content validity and clarity.
2. **Behavioral Observation Checklist (BOC):** Educators completed weekly logs during synchronous sessions, rating indicators such as attention span, task initiation, task completion, behavioral dysregulation episodes, and peer interaction attempts on a 5-point scale. Interrater reliability was established ($ICC = 0.87$) after training sessions with eight special educators.
3. **Semi-Structured Parent Interview Guide:** Developed to explore experiential dimensions, including home learning routines, technology challenges, emotional well-being of children, and perceived support needs. The guide comprised open-ended questions and prompts, pilot tested with five families to refine wording and sequencing.

Data Collection Procedures

- **Surveys:** The OLIS was administered electronically via a secure platform over a 12-week online term (January–June 2021). Two reminder emails were dispatched biweekly to maximize response rates.
- **Educator Logs:** Eight special educators from participating schools completed the BOC after each synchronous session. Data were anonymized and aggregated weekly.
- **Parent Interviews:** Thirty volunteer families participated in 45–60-minute videoconference interviews. Recordings were transcribed verbatim and anonymized for analysis.

Data Analysis

- **Quantitative Analysis:** OLIS and BOC data underwent descriptive statistics (means, standard deviations, frequency distributions) to summarize domain scores. Paired sample t-tests compared pre-pandemic baselines—derived from retrospective parent reports—with remote learning metrics for attention and social interaction. Effect sizes (Cohen's d) were calculated. Statistical significance was set at $\alpha = 0.05$.
- **Qualitative Analysis:** Interview transcripts were coded using thematic analysis. Two researchers independently reviewed transcripts, generating initial codes (e.g., “technology frustration,” “sensory break strategies,” “peer connection tools”). Through iterative discussions, codes were refined into overarching themes: (1) adaptive benefits of digital routines, (2)

sensory regulation challenges, (3) caregiver role amplification, and (4) hybrid model preferences. NVivo software facilitated data management and codebook development.

- **Integration of Findings:** Quantitative and qualitative results were merged in joint displays to identify convergence (e.g., both data strands highlighting screen fatigue) and divergence (e.g., some families reporting minimal technology barriers). This triangulation enhanced the validity of inferences and informed the development of targeted recommendations.

Reliability and Validity Checks

- **Instrument Reliability:** OLIS exhibited high internal consistency (Cronbach's $\alpha = 0.92$).
- **Interrater Reliability:** BOC ratings maintained ICC = 0.87 across educators.
- **Qualitative Trustworthiness:** Member checking was conducted by sharing preliminary themes with five participating parents for confirmation. Reflexive journals and audit trails documented analytic decisions.

By employing a rigorous, multi-layered methodology, this study ensures a robust understanding of the complex interplay between online instructional modalities and the unique educational needs of children with ASD.

RESULTS

Analysis of the quantitative and qualitative data yielded a comprehensive portrait of the multifaceted impact of online classes on children with Autism Spectrum Disorder (ASD). Results are organized across four core domains: academic engagement, social interaction, sensory experiences, and caregiver involvement, followed by insights into hybrid learning preferences.

Academic Engagement

Quantitative Findings:

- **Attention Span:** Mean attention scores decreased from 3.8 (SD = 0.6) in traditional settings to 3.1 (SD = 0.7) during online sessions, a significant decline, $t(149) = 9.45$, $p < 0.001$, Cohen's $d = 0.77$, indicating a large effect.
- **Task Completion:** Despite attention declines, task completion rates remained relatively stable (online: $M = 4.0$, $SD = 0.5$ vs. in-person: $M = 4.1$, $SD = 0.4$; $p = 0.12$), suggesting that with adequate scaffolding, students could sustain performance.

Qualitative Insights:

Parents highlighted the advantage of recorded lectures and pause-rewind features, which allowed children to revisit challenging concepts at their own pace. One parent noted, "My son replays the math tutorial until he masters each step—something he couldn't always do live in class." Educators corroborated that interactive quizzes embedded in digital platforms fostered motivation but cautioned against cognitive overload when lessons lacked sufficient segmentation.

Social Interaction

Quantitative Findings:

- **Peer Exchanges:** Structured opportunities for peer interaction (e.g., breakout rooms) averaged 2.4 exchanges per session, compared to 4.0 spontaneous exchanges reported in retrospective in-person data—a 40% reduction ($p < 0.001$).
- **Perceived Effectiveness:** Educators rated breakout rooms as “somewhat effective” ($M = 3.3/5$), acknowledging that reduced group size lowered anxiety but limited naturalistic social practice.

Qualitative Insights:

Several parents described creative at-home adaptations: arranging virtual playdates outside school hours to supplement peer engagement. One mother shared, “We set up a weekly Zoom ‘lunch club’ with two classmates—she looks forward to it and practices conversational turns.” However, the absence of nonverbal cues remained a barrier, with both parents and teachers reporting misunderstandings arising from muted microphones and delayed video feeds.

Sensory Experiences

Quantitative Findings:

- **Screen Fatigue:** OLIS sensory discomfort scores averaged 3.7 ($SD = 0.8$), indicating moderate to high fatigue levels during sessions exceeding 45 minutes.
- **Environmental Control:** Approximately 30% of families reported that home settings permitted better sensory regulation (e.g., customizing lighting and sound), contrasted with 65% experiencing increased overstimulation.

Qualitative Insights:

Participants emphasized the necessity of frequent “sensory breaks,” ranging from 5-minute movement activities to deep-pressure exercises. Educators integrated scheduled intermissions every 30 minutes; yet, inconsistent enforcement undermined effectiveness. Caregivers advocated for built-in platform features—such as automated reminders for breaks and one-click sensory mode toggles—to streamline accommodations.

Caregiver Involvement

Quantitative Findings:

- **Time Investment:** 80% of parents devoted an extra 2–4 hours weekly to support online learning, primarily for technical troubleshooting and behavioral prompting.
- **Stress Levels:** Self-reported caregiver stress increased ($M = 4.2/5$) relative to pre-pandemic levels ($M = 3.1/5$), a statistically significant uptick, $t(149) = 11.23$, $p < 0.001$.

Qualitative Insights:

Interviews revealed a duality of experiences: empowerment through deeper curricular insight versus overwhelm due to role expansion. One father observed, “I can see exactly what she’s learning and adapt our home routines accordingly,” while another lamented, “Balancing my job, meal prep, and supervising online classes has been relentless.”

Hybrid Model Preferences

When presented with hybrid scenarios, 85% of respondents preferred a 2:1 in-person to online session ratio. Parents cited structured digital lessons for reinforcing skills at home, balanced by sensory-regulated, socially rich in-person environments. Educators echoed this, reporting improved overall engagement and social outcomes in pilot hybrid classes.

Integration and Statistical Significance:

- **Attention and Interaction:** Declines in attention ($p < 0.001$) and interaction ($p < 0.001$) during purely online periods were significant; however, task completion remained stable ($p = 0.12$).
- **Effect Sizes:** Large effect sizes for attention ($d = 0.77$) and social interaction ($d = 0.65$) underscore the practical importance of these changes.

These results illuminate the complex trade-offs inherent in virtual education for ASD learners, highlighting areas where digital platforms excel and where enhancements are vital to support neurodiverse needs.

CONCLUSION

This comprehensive investigation reveals that online classes for children with Autism Spectrum Disorder (ASD) constitute a double-edged sword: they afford unprecedented customization and reduced social pressures, yet they can attenuate peer engagement and exacerbate sensory challenges. Quantitative data documented significant declines in sustained attention and spontaneous peer interaction during fully remote sessions, while qualitative narratives underscored the therapeutic potential of predictable digital routines and replayable content. Crucially, hybrid instructional frameworks—combining periodic in-person engagement with targeted online lessons—emerged as a promising compromise, endorsed by 85% of families and educators for balancing academic, social, and sensory needs.

Key implications include the following:

1. **Platform Accessibility and Design:** Online learning environments must incorporate user-controlled sensory settings (e.g., screen brightness, audio filters), automated sensory break prompts, and adaptive interfaces that segment content into manageable units. Integration of gamified social interaction tools—such as avatar-based role-plays—could enhance pragmatic language practice while mitigating overstimulation.
2. **Professional Development:** Educators require specialized training to tailor virtual lessons for ASD learners, including effective facilitation of breakout rooms, use of assistive technology (e.g., text-to-speech, interactive visual schedules), and strategies for monitoring engagement remotely. School districts should institutionalize ongoing workshops, peer mentorship programs, and resource repositories showcasing best practices.
3. **Caregiver Support Systems:** Recognizing the amplified burden on families, schools and policymakers must offer structured support—technical helplines, caregiver training modules, respite care options, and flexible work-study arrangements—to alleviate stress and enable sustainable home-based facilitation of learning.
4. **Hybrid Program Policies:** Education authorities should formulate guidelines enabling flexible attendance models, delineating optimal in-person to online ratios based on empirical findings (e.g., 2:1), and providing logistical support for transportation, health compliance, and scheduling.

5. **Research and Innovation:** Longitudinal studies are needed to assess the enduring effects of online and hybrid models on academic trajectories, social competence, and emotional well-being. Moreover, emerging technologies—virtual reality social scenarios, AI-driven adaptive learning pathways—warrant rigorous efficacy trials centered on equity of access and user experience for ASD populations.

In conclusion, optimizing online education for children with ASD demands a holistic, ecosystem-level approach—melding inclusive technology design, specialized educator training, robust caregiver support, and hybrid instructional policies. By leveraging these evidence-based strategies, stakeholders can foster virtual learning landscapes that not only accommodate the distinctive needs of neurodiverse learners but also empower them to flourish academically, socially, and emotionally in an increasingly digital world.

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