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Harshini Murthy March 22, 2021

Active Engagement in Inclusive Pre-School Classrooms During Distance Learning

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Abstract

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The current study aims to understand the interaction between online learning environments and active social engagement as a measure of effective learning in children with and without Autism Spectrum Disorder (ASD). This was done by observing a sample of 4 preschool-aged students in a research laboratory based inclusive classroom. Parent interviews were also conducted, to investigate the parental perception of distance learning on the child's engagement and development. Parents also discussed the impact of distance learning on family life. Quantitative coding for attention and communication was carried out by analyzing 30-second intervals of WebEx call recordings for eye gaze and verbalizations. The children were observed across three classroom contexts, namely, 1:1, small group and whole group formats for a period of 9 weeks. Parent interviews suggested that the distance learning program had some effective elements, but also had some limitations. Social attention and communication scores indicated discrepancies in how attentive the children were to distance learning. Future directions include incorporating a traditional in-person classroom as a control group and a larger sample size.

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Active Engagement in Inclusive Pre-School Classrooms During Distance Learning

It is known that inclusive early childhood education provides the benefit of increased cognitive, social, communicative, and emotional development while being economically viable (Odom, et al., 2001; Green, et al., 2014; Nahmias, et al., 2014). For children with Autism Spectrum Disorder (ASD), the critical period for early and consistent intervention is up to age 3 (Zwaigenbaum, et al., 2015). Meaningful inclusion during the early years can improve long-term outcomes, resulting in broad societal benefits including reduced special education expenses in children with ASD (Chasson, et al., 2007). Therefore, developing effective educational interventions is the most efficient way to ensure inclusiveness in classrooms. There is general evidence in literature that a child's active engagement in the classroom can predict their educational progress (Ladd, et al., 2009). Thus, active engagement can act as an important metric that can be used to assess learning outcomes, as well as a child's participation in classroom activities. Active engagement can look different across individuals, and these differences can arise due to the child's learning skill or the classroom structure. Students with emotional or behavioral disorders can benefit from effective instruction methods, as their learning is often influenced by classroom contextual factors (Sutherland, et al., 2008). While there has been extensive research showing that children with ASD benefit from early intervention programs (Smith, 1999), there is little research that analyzes how specific classroom set-ups and contexts can drive that effect. The 2019 pandemic has caused unprecedented disruptions to education in the United States, with a large proportion of schooling moving to online formats. COVID-19 has posed unique challenges to parents and children, with parents reporting a significant decline in their emotional well-being. Families reported food insecurity increase, decrease in regular child care, decrease in employer sponsored insurance for kids and worse mental and behavioral health

for the parents and children (Patrick et al., 2020). These abrupt changes to daily life caused a marked change in the mental health, specifically in adolescents (Bhatia, 2020). Research by Friedman et al (2021) suggests that online learning exacerbates the racial and ethnic socioeconomic disparities in learning for children. Along similar lines, Patrick et al., 2020 found that some populations (e.g. single parent households, families with young kids) were disproportionately affected by online learning. The differences in access to facilities for online learning was large, with black children whose parents have less than a high school diploma being 20-times more likely to not have access to internet facilities. While there was a clear decrease in satisfaction with life in families more susceptible to food insecurity and with a history of mental health issues, contrasting research showed increase in satisfaction and improvements in behavioral, mental and physical health for some families. The discrepancies in the literature about the effect of distance learning and work from home implementations is further amplified when focusing on children with special needs. Due to the unusual implications of the pandemic, there is little research about how distance learning can effect classroom engagement in children with neurodevelopmental disorders.

The current study aims to understand the interaction between online learning environments and active social engagement as a measure of effective learning, by observing a sample of 4 preschool aged students with ASD in a research laboratory based inclusive classroom. The current study analyzed active engagement in terms of directed communication and social attention, and the differential effects of online learning on engagement in children with ASD. High quality teacher-student interactions were associated with greater active engagement, and that more engagement was associated with better academic achievement (Guo, et al., 2011). This led to the belief that active engagement is highly contextually influenced,

especially in young children who are still dependent on environmental and social support. (Siller, et al., 2020). Directed communication was operationalized as the number of times a child vocalizes, verbalizes or makes communicative gestures towards another person to serve as a communicative function. Social attention was operationalized by time spent looking at peers or teachers in the classroom. The students were observed during three classroom contexts, namely, large group (60 minutes daily, all students), small group (20 minutes daily, two students), and one-to-one instruction (15 minutes, twice a week). Measurement of active engagement includes behaviors such as attending, completing assignments, responding, and following classroom instructions (Ponitz et al. 2009). We hypothesize that the context in which the lessons will be taught will affect the overall engagement that a child shows in the classroom, with more structured and individual activities resulting in higher levels of directed communication and social attention.

Methods

Setting

Data for this project was collected during the 2020-2021 school year in a publicly-funded Georgia Pre-K Inclusion classroom, operated by a university-based lab preschool (Preschool Education Lab [PEL] at Marcus Autism Center). Georgia Pre-K Inclusion classrooms are expected to enroll 18 children who are four years on September 1st of the corresponding school year, including 6 students with disability. The classrooms are required to have 180 days of instruction per school year and 6.5 hours of instruction per day, with a daily attendance requirement. The classroom is led by two teachers, one with a special education background and one assistant teacher. All students with disabilities in the PEL have been previously diagnosed

with ASD. These diagnoses are confirmed using standard diagnostic measures upon enrollment. Children with ASD were eligible to enroll if they had (1) a previous clinical diagnosis of ASD, OR (2) an educational disability classification of ASD. Children's ASD diagnosis was confirmed using the Autism Diagnostic Observation Schedule (ADOS-2), administered by research-trained clinicians before admittance to the program. Children without ASD were eligible to participate if (1) parents did not report and concerns about social communication development, and (2) children did not show autism concerns on one of two autism-specific screening measures (Social Responsiveness Scales, SRS-2; Modified Checklist for Autism in Toddlers, M-CHAT). All children completed developmental and behavioral assessments, administered by research-trained clinicians.

COVID-19 has posed restrictions to traditional learning. Due to social distancing guidelines, schools across the world have shifted to an online format of instruction. Due to the attendance requirement in Georgia Pre-K classrooms, a full distance-learning model was offered for the first 9 weeks to families not ready to return to traditional in-person classrooms. This option was chosen by 4 families. Online instruction comprised of three 'classroom' settings with varying number of students on each call. These are described below.

Whole group. The preschool schedule includes daily morning circle time. During this time, all four children complete a range of activities including greetings, songs, calendar activities, and weather discussions. These sessions typically were 30-40 minutes in duration.

Small group. The preschool included daily lessons in small groups, where children were divided into pairs of two for the WebEx calls. Teachers guide the lessons by providing various amounts of structure and support. These sessions typically were 20 minutes in duration.

One-on-one. Twice a week, each child attends individual WebEx calls with the teachers. The calls consist of short activities to engage child interaction. These sessions typically were 15 minutes in duration.

Measures.

Classroom Measure of Active Engagement (CMAE). The CMAE quantifies active engagement within classroom activities by measuring (1) the amount of time students spent directing their attention towards other people, and (2) the frequency of spontaneous direct communication. Each video segment was coded using timed-event recording of the focal participant.

Social Responsiveness Scale, Second Edition (SRS-II). The Social Responsiveness Scale (SRS) identifies the presence and severity of social impairment within the autism spectrum and differentiates it from social impairment due to other disorders. It is a 65-item scale scored on a 4 point Likert scale ranging from 0 (not true) to 3 (almost always true). For the current study, we administered the pre-school form of the SRS (SRS-II). The SRS has been standardized and thus yields both raw scores and T scores. Higher scores indicating greater severity of social impairment. The SRS-II has also been shown to have high discriminant validity when children with an ASD were compared to children with other psychiatric disorders, as well as high concurrent validity when a sample of children with autism were administered the SRS-II and the Autism Diagnostic Interview–Revised ($r = 0.63$) (Roeyers, et al. 2011). Total T-score cutoffs have been established as a way of screening for ASD in the general population. The sum of all items is calculated to provide a total score (max 195). T-scores are interpreted as: ≤59T as within normal limits; 60–65T as mild; 66–75T as moderate; and ≥76T as severe range (Kerr-Gaffney, et al. 2020). In the current research, we used a cut- off T score > 59 to identify risk for ASD.

MacArthur-Bates Communicative Development Inventory. The MacArthur-Bates Communicative Development Inventory (CDI) assesses development of language and communication skills in children of ages 8-30 months. The inventory includes parent reported items to identify development of a child's receptive and expressive language. It consists of a Vocabulary Checklist, and a section on how children use words. The validity of the CDIs is well established. First, the CDIs demonstrate good content validity. The CDI's have high concurrent validity, Moderate to high correlations have been reported across numerous studies on typically developing children as well as children with language impairment and developmental delays.

Child Behavior Checklist. This study used the preschool version of the child behavior checklist (CBCL $1^{1}/_{2}$-5), in which parents or others who interact with the child in regular contexts rate the child's behavior. The preschool checklist contains 100 problem behavior questions. Items are scored on the following syndrome scales: Emotionally Reactive, Anxious/Depressed, Somatic Complaints, Withdrawn, Attention Problems, Aggressive Behavior, and Sleep Problems. The scale showed high test-retest reliability, and construct validity. The CBCL is on a 3-point scale of 0 to 2 (0 = not true, 1= somewhat or sometimes true, 2 = very true or often true of the child).

Participants

Four students selected the full-distance option during the first nine weeks of the 2020-2021 school year. Two of these students had a diagnosis of ASD. Descriptive information about these four students is provided below.

Edgar (name changed). Edgar, a boy who is Caucasian, was 4 years 6 months at the beginning of the 2020-21 school year. During the prior school year, Edgar attended the 3-year-old classroom of PEL. Edgar scored 82 on the SRS, indicating severe ASD.

His mother expressed concerns about the child's communication and social skills. Edgar had previously been attending speech therapy twice a week. Edgar's parents were divorced, and his mother had completed a standard college degree. Aside from his mother, Edgar resided with an older brother. According to the Child Development Inventory (CDI), Edgar's mother reported a receptive and expressive vocabulary of 187 and 59 words, respectively (out of 396). In addition, his mother reported that Edgar uses a range of early (16) and late (35) gestures.

Henry (name changed). Henry, a boy who is African-American, was 4 years 5 months old at the beginning of the 2020-21 school year. Henry enrolled in the PEL classroom on 10 August 2020, and had not attended any preschool program before enrollment. Henry scored 52 on the SRS, indicating no social impairment, but expressive speech delay was noted on the CDI (ADD SCORES). Due to the expressive speech delay, Henry has been attending speech therapy since November 2020. Henry's mother was single, and his mother had completed a partial college degree, seeking a Bachelor's of Science in Nursing. Aside from his mother, Henry's grandmother and grandfather were listed as caregivers for Henry. His grandmother had a high school degree, and his grandfather had completed a standard college degree. In addition to this, Henry resided with his uncle (26 years) and aunt (11 years) . According to the CBCL, Henry had an internalizing T-score of 55 and an externalizing T-score of 48.

John (name changed). John, a boy who is African-American, was 4 years 9 months at the beginning of the 2020-21 school year. During the prior school year, John attended the 3-year-old classroom of PEL. Although John scored in the normal range on the SRS when seeking enrollment, his parents expressed concerns about the child's communication skills. A subsequent diagnostic evaluation using the ADOS confirmed a diagnosis of ASD. John's parents were married, and had completed a standard college degree (mother) and graduate degree (father).

Aside from his parents, John resided with a younger brother. According to the Child Development Inventory (CDI), John's parents reported a receptive and expressive vocabulary of 385 and 333 words, respectively (out of 396). In addition, his parents reported that John uses a range of early (17) and late (30) gestures.

Theresa (name changed). Theresa, a girl of mixed descent (Asian and White), was 4 years 5 months old at the beginning of the 2020-21 school year. Theresa enrolled in the PEL classroom on 10 August 2020, and had attended a different preschool prior to enrollment. Theresa scored 43 on the SRS, indicating no social impairment. Her parents expressed no concerns about the child's current development, but Theresa had previously graduated from speech therapy and occupational therapy. At the time, Theresa had an individualized education plan, and worked with a special communication teacher twice a week for social communication. Theresa's parents were married, and her parents had completed a graduate professional training degree (father) and a standard college degree (mother). Aside from her parents, Theresa resided with a younger sister. According to the CBCL, Theresa had an internalizing T-score of 53 and an externalizing T-score of 47.

Procedure

For each child, we randomly selected one Whole Group, one Small Group, and one 1:1 session per week for observational coding. Further, upon completion of the nine-week period, parents were invited to participate in exit interviews, and teachers were invited to participate in an exit focus group.

Observational Coding of Instructional Sessions. Observational coding focused on two aspects of children's active engagement (social attention and directed communication). Coding was completed by a team of three undergraduate students. Each video was coded independently by

two observers, using rating scales applied to each 30-second interval of each video. Per-session total scores were computed as the average rating across all 30-second intervals. Average score across both observers were computed. Finally, per-session total scores were also used to estimate inter-observer reliability (i.e., average level Intraclass Correlation Coefficients).

Social Attention. This code was adapted from the CMAE. Social attention was operationalized by time spent looking at peers or teachers on the screen or parents at home. The children were given scores of 1-4 for each 30 second interval of the video in which they were present, with 15 seconds or more as high attention (4), 5-10 seconds as medium attention (3), and less than 5 seconds as low attention (2). This was measured by tracking the amount of time the students' eye gaze is on either the screen or the parent for every 30 second interval. Scores of 0 were given to students who were not on the WebEx call, or had their audio muted. Scores of 9 were given when the students eyes were not visible on the screen for at least 20 seconds of the interval. Two-way mixed, average measurement absolute agreement reliability tests for intraclass correlation coefficients for social attention showed a high degree of reliability between social attention scores, with the average measure ICC of 0.85 with a 95% confidence interval from 0.765 to 0.905.

***Directed Communication*.** Directed communication was operationalized as the number of times a child vocalizes, verbalizes or makes communicative gestures towards another person to serve as a communicative function. The children were given scores of 1-3 (communication) for each 30 second interval of the video in which they were present. Students' communication was rated as either sustained and frequent communication for 10 or more seconds (3), inconsistent communication not appropriate to the context (2), or no directed communication (1). Two-way mixed, average measurement absolute agreement reliability tests for intraclass correlation

coefficients for directed communication showed a high degree of reliability between directed communication scores. The average measure ICC was 0.89 with a 95% confidence interval from 0.831 to 0.927.

Exit Parent Interview. Two parents volunteered to participate in an exit interview (John and Theresa). A semi-structured interview guide was used to facilitate parent interviews. The interview guide consisted of open-ended questions, as well as probing questions. Parent interviews lasted approximately 25 minutes, were administered online, and captured via screen capture. Recordings were then transcribed verbatim by an independent transcription service and analyzed by a team of three coders using team-based conventional content analysis. Investigator triangulation was achieved by having three researchers participating in the content analysis. This type of triangulation contributes to the confirmation of findings and allows for different perspectives (Denzin, 1978; Carter et al., 2014). Themes were identified through deductive and inductive coding. Consensus of the codes and themes was achieved among the three coders. These codes were formulated based on the interview questions, and consisted of positive and negative codes for child engagement, communication, parental support and general impact (*Table 1).*

Results

Parent Interviews. Participant responses were categorized into three themes contributing to one major overarching theme. The three themes are summarized with sub -themes in Table 1 and include interview questions and participant quotes to provide context.

General Impression of Distance Learning

Parents discussed their experiences of supporting distance learning for their children. Parents had a mostly positive sentiment towards the program, but also reported some negative experiences. Negative experiences included technological difficulties, challenges with the materials, and limited social interaction in distance learning. Participants also expressed difficulty in getting their children ready for the calls, and the need of high parental support during the calls. Conversely, positive experiences included effective curriculum and structure of the lessons. Parents reported that they saw an increase in their child's communication, and behavioral regulation over the 8 week program. This theme is well- represented by the following quote from parents referring to their child's progress during the distance learning program:

> *"I thought it was a very well-organized program, the tools that they use and the structure itself was very efficient, especially with him being autistic, the timing of everything, the scheduling of the amount of time spent with each activity and the hands-on portion, was effective. Even how everything was organized in terms of the materials used. He really enjoyed it. Of course, a limitation was not being able to interact with other kids, and one of the things that Jacob needs is social interaction, but other than that, it provided a lot of learning tools."*

Changes in Child Engagement

Parents explained the trajectory of their child's engagement over the 8 week distance learning program. Reports included themes of increased engagement from children over the 8 weeks. Specifically, parents reported more initiation of communication than normal due to distance learning. Interestingly, the parent of the neurotypical child observed that their child grew more unengaged in the lessons with time. The parents stated that it was increasingly difficult to get the child ready for the calls due their engagement. The following quote from the parent interview summarizes these findings:

> *"My child was interested and involved in the program, particularly in the early stages. She enjoyed that, but as sort of the weeks wore on, I think the novelty wore off a little bit, and so she was getting less engaged. She was more reluctant to come to the class, especially in the later weeks, and there was more parent involvement needed there. I think the novelty had worn off a little bit, and so I think it was harder for her to be interested."*

Conversely, parents of children with ASD reported higher levels of engagement as time went by, with their children initiation communication and showing more interest in the calls over the 8 week period. Parents noticed less support necessary to get their children ready for calls. The following quote provides context to the change:

> *"Well, he became more engaged. He used to dread waking up, but as time went on he insisted on wanting to go to school, and he would sit at the table and we would go over stuff before class and he would organize his materials. He was looking forward to it every day."*

Challenges and Suggestions for Future Work

Parents reported various challenges of distance learning. In particular, the difficulty in picking up and using the class-materials efficiently. Technological difficulties also were reported, with parents having issues with internet and audio feedback. The main limitation of distance learning seemed to be the lack of social interaction. Parents suggested more organized and structured calls, with materials being more accessible. Stress was placed on the implementation of more structure and consistency in curriculum, with the possibility of more frequent sessions. The following quotes exemplify the challenges and suggestions provided by the parents:

> *"I think she had some reservations about it being all on a computer screen and would have liked to have seen them in person. We had some issues with the pick-up of materials, There was proactive messaging from the teachers that was helpful about what was coming up and what was required. There was*

> *consistency week to week, but I would suggest day-to-day consistency in timing."*

> *"I think oftentimes with online learning, there are challenges with computer delays when they play music and songs and things of that nature, but you can't mitigate that, I guess, because technology does what it wants, sometimes. I felt that it was really well structured. I guess, the audio part, when it comes to the active participation with music on one end, the delay makes it hard to hear."*

Active Engagement Coding.

Social attention. For each child, line graphs were used to present week-by-week change in social attention, separated out by instructional format (i.e., Whole Group, Small Group, 1:1) (Figure 1). Social attention scores for Edgar (Figure 1A) showed week-by-week variation, with whole group sessions having consistently high attention scores compared to 1:1 and small group. Social attention scores for Henry (Figure 1B) indicated higher attention in the 1:1 setting in the later weeks (weeks 5-8). While large group sessions for Henry had higher attention scores in week 1 and 2, the scores dropped in weeks 6,7 and 8. Scores varied largely for John (Figure 1C), with large group sessions showing higher scores in weeks 4, 6 and 8 than in the beginning of the program. Theresa's scores (Figure 1D) showed consistently high attention in the large group format from week 0 to week 8. Attention scores for Theresa were lower in the small group and 1:1 format in week 6, 7 and 8 compared to week 0 and 1. Graphs of children with ASD (Figure 1A & 1C) showed lower average attention to the screen compared to children without ASD. Edgar (*M = 2.80, SD = 0.42),* Henry (*M = 2.93, SD = 0.41*), John (*M = 2.14, SD = 0.51*) and Theresa (*M = 3.40, SD = 0.60*) all showed higher than individual average attention in the large group session compared to the small group and 1:1 sessions (Table 2).

Directed Communication. Line graphs showed the correlation between each child's directed communication score and week of instruction for all three classrooms contexts (Figure

2). Communication scores for Edgar (Figure 2A) showed week-by-week variation, with whole group sessions having consistently low communication scores compared to 1:1 and small group. Directed communication scores for Henry (Figure 2B) indicated higher communication in the 1:1 setting in the later weeks (weeks 4-8). Scores for all three contexts increased with time, with 1:1 sessions showing a stark increase in communication scores. Scores varied largely for John (Figure 2C), with small group sessions showing higher scores in weeks 4, 5, 6 and 8 than in the beginning of the program. John's graph showed low scores for communication in the large group setting compared to 1:1 and small group. Theresa's scores (Figure 2D) showed consistently high communication in the 1:1 format from week 0 to week 4. Communication scores were lower in the large group sessions compared to 1:1 and small group over all 9 weeks. All three formats showed decreased communication scores for Theresa in weeks 6, 7 and 8. Graphs of children with ASD (Figure 2A & 2C) showed lower average frequency of communication compared to children without ASD. Edgar (*M = 1.55, SD = 0.26),* Henry (*M = 1.64, SD = 0.33*), Jacob (*M = 1.59, SD = 0.34*) and Theresa (*M = 1.93, SD = 0.42)* all showed higher than individual average communication in the 1:1 sessions compared to the small group and whole group sessions (Table 3).

Discussion

The current study analyzed active engagement in terms of directed communication and social attention, and the differential effects of online learning on engagement in children with ASD. Quantitative coding and analysis of the children's attention and communication during calls served as a measure of active engagement. The results indicated that children's social

attention scores varied substantially across the nine weeks of instruction. No clear differences were seen between the three teaching formats (1:1, small group, whole group). Theresa (typically developing girl) showed the highest level of attention amongst all four children. For her, social attention was the highest and most consistent during the whole group sessions. Compared to Theresa, the social attention of Edgar, Henry and John was lower. All three children showed higher average social attention scores in the whole group format, and lowest average social attention scores in the small group format (Table 2).

All children showed higher levels of attentiveness to the screen during the large group sessions, which could be explained by more visual stimulation from the larger number of people on the call. Interestingly, this is in contrast with previous research showing that children with ASD are negatively impacted by sensory inputs and experiences, causing them to be easily distracted and unengaged when in a busy environment (Jones et al., 2020). Though highest attention was seen in large group sessions, children with ASD, Edgar (score between 2 and 3) and John (score between 1 and 2), consistently showed lower attention to the screen than their peers across all three classroom contexts, indicating that ASD diagnoses could potentially lead to trouble in attending and following on-screen activities.

The results indicated that children's directed communication scores varied substantially across the nine weeks of instruction. No clear differences were seen between the three teaching formats (1:1, small group, whole group). Theresa (typically developing girl) showed the highest level of communication amongst all four children. For her, directed communication was the highest and most consistent during the 1:1 sessions. Compared to Theresa, the communication scores of Edgar, Henry and John were lower. All three children showed higher average social attention scores in the 1:1 format. Henry showed an upward trend across the nine weeks, with his

directed communication increasing across all three contexts in the later weeks. The results of the study indicate that distance learning, while an effective method of teaching, could pose some limitations to the children's full engagement

Parent interviews from John and Theresa's parents suggested that distance learning was perceived as beneficial for their children's learning of pre-academic skills and independence. Overarching themes included changes in engagement with time and familiarity, and effectiveness of curriculum and structure. Theresa's parent reported that her engagement decreased across the nine weeks, while John's parent reported that his engagement increased with time. These reports from parents suggested that neurotypical children (Theresa) were easily distracted and bored when familiarized with the routine of the class, while children with ASD (John) grew more interactive and engaged when familiarized with the class routine. These differences in behavior may be due to ASD diagnoses, since routines are thought to be critical in laying the foundation for development, especially in children with ASD (Marquenie et al., 2011). Thus, the suggestion to have a more structured and routine curriculum could help in making distance learning more effective for neuro-atypical children.

Moreover, practical challenges faced by parents and teachers included technological difficulties, increased support compared to traditional school formats, and difficulty obtaining and organizing materials. These results build on existing evidence of the challenges and barriers that distance learning can place on children's academic success. The data provides a clearer understanding of how the circumstances of the global COVID-19 pandemic have contributed to the struggles faced by parents of children with special needs. While previous research has focused on child engagement in traditional classrooms, the current study demonstrates that effective and efficient instruction methods can be implemented in inclusive classrooms. While

online learning provided an effective method of instruction during COVID-19, the increase in screen-time could be a point of contention for parents and teachers. Research shows that increased screen time is associated with higher than average risks of cardiovascular disease, obesity, poor quality of life and behavioral problems in children (Stiglic & Viner, 2019). Contrastingly, previous research also shows that children with autism were more attentive, more motivated, and learned more vocabulary on the computer than in behavioral programs (Moore & Calvert, 2000). Taking previous research, and the results of the current study, a mix of traditional in-person instruction and distance learning could prove to beneficial to children, but comes with unique limitations.

While the study was conducted in a sample of children in an inclusive classroom, the generalizability of the results is limited by the small sample. Due to the lack data from a control group (traditional in-person instruction group), the results cannot confirm the efficacy of one learning format over the other. From the current study, concerns about distance learning could include increased isolation, lack of resources, increased screen time and decreased interpersonal contact. Physical contact can be an important facet of effective teaching for children with special needs (Bandini, et al., 2013). Distance learning may not allow for this kind of physical contact with peers and teachers.

Further research is needed to establish a concrete causal effect between classroom size and active engagement in children with ASD. Future studies should take into account maternal education level, and resources available to the families. Investigating these variables on a larger scale to improve generalizability, and to provide more clear associations is a future direction for this study.

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Tables

Table 1.

Parent Interviews Qualitative Codes

Code Name	Code Meaning	Example Question
General Comments		What was your overall impression of the Distance Learning Program?
GEN-POS	General positive comment	
GEN-NEG	General negative comment	
GEN-NOS	General – not otherwise specified	
Effective Elements of Program Structure & Content		Which format would you say worked best for your child between the whole group, small group and the one-on-ones?
EE-FREQ	Frequency, duration, pace	
EE-PRED	Predictable structure/organization/routines	
EE-CURR	Program Structure and organization	
EE-FORM	Session format (1:1, small group, whole group)	
EE-NOS	Not otherwise specified.	
Limitations of Distance Teaching		
LIM-SI	Limited social interaction	
LIM-NOS	Not otherwise Specified	
Impact of Distance Teaching on Family Life		How did the WebEx calls fit into your daily schedule and your daily routine in

IMP-POS-REP	Positive: replicate learning activities during other parts of the day	terms of your house work, your parenting and work?
IMP-POS-STR	Positive: provided structure for child's day	
IMP-NEG-DISR	Negative: disruptive to family life/parents' other responsibilities	
IMP-NEG-STRESS	Negative: increased stress for parents	
IMP-NEUTRAL	Fit into daily family life	
IMP-NOS	Not Otherwise Specified	
Child Learning Outcomes		Do you think the WebEx calls helped your child learn, in general, or any skills in particular?
LEARN-ACAD	Pre-academic skills	
LEARN-SELFREG	Self-regulation (e.g., transitioning)	
LEARN-COMM	Communication, interaction	
LEARN-NOS	Not Otherwise Specified	
Child Engagement during Distance Teaching		Can you describe to me how your child interacted with both the teachers and peers during the calls?
ENG-POS-INV	Positive investment (enjoyment)	
ENG-POS-INI	Positive initiations (interaction)	
ENG-POS-IND	Positive independence	
ENG-NEG-UN	Negative – distracted/unengaged	

ENG-NEG-DIS	Negative – child distress	
ENG-NEG-DIF	Negative – difficulties getting child ready for the calls	
ENG-NOS	Not Otherwise Specified	
Time course of child engagement		How did your child's comfort communicating with their peers and teachers change over the course of the eight weeks?
ENG-TIME-IMP	Became more engaged over time	
ENG-TIME-VAR	Day-by-day changes in child reaction	
ENG-TIME-DEC	Became less engaged over time	
ENG-TIME-NOS	Not Otherwise Specified	
Parent-implemented supports		
SUPP-VAR	Varied support needs (day-by-day fluctuations)	How much support did your child need from you to stay on task during the calls?
SUPP-DEC	Less support necessary over time	
SUPP-INC	More support necessary over time	
SUPP-REG	Behavior-/emotion-regulation supports	
SUPP-ACT	Needs support during certain activities	
SUPP-NOS	Not Otherwise Specified	
Challenges experienced by parents		
CHAL-MAT	Materials not readily accessible	

CHAL-TECH	Technological difficulties	
CHAL-NOS	Not Otherwise Specified	
Suggestions for next time		What's one thing you'd like to see differently if we were to offer distance learning again in the future?
SUGG-TECH	Technology improvements	
SUGG-MOR	More sessions/increase frequency	
SUGG-STR	Suggests consistent structure/schedule/staffing	
SUGG-NOS	Not Otherwise Specified	

Table 2

Means and Standard Deviation of Social Attention for all children in 1:1, Small Group and Large Group Sessions

Child	1:1		Small Group		Large Group	
	M	*SD*	*M*	*SD*	*M*	*SD*
Edgar	2.79	0.38	2.65	0.56	2.97	0.22
Henry	2.89	0.38	2.80	0.41	3.08	0.43
John	2.14	0.52	2.11	0.50	2.18	0.55
Theresa	3.15	0.74	3.35	0.65	3.70	0.16

Table 3

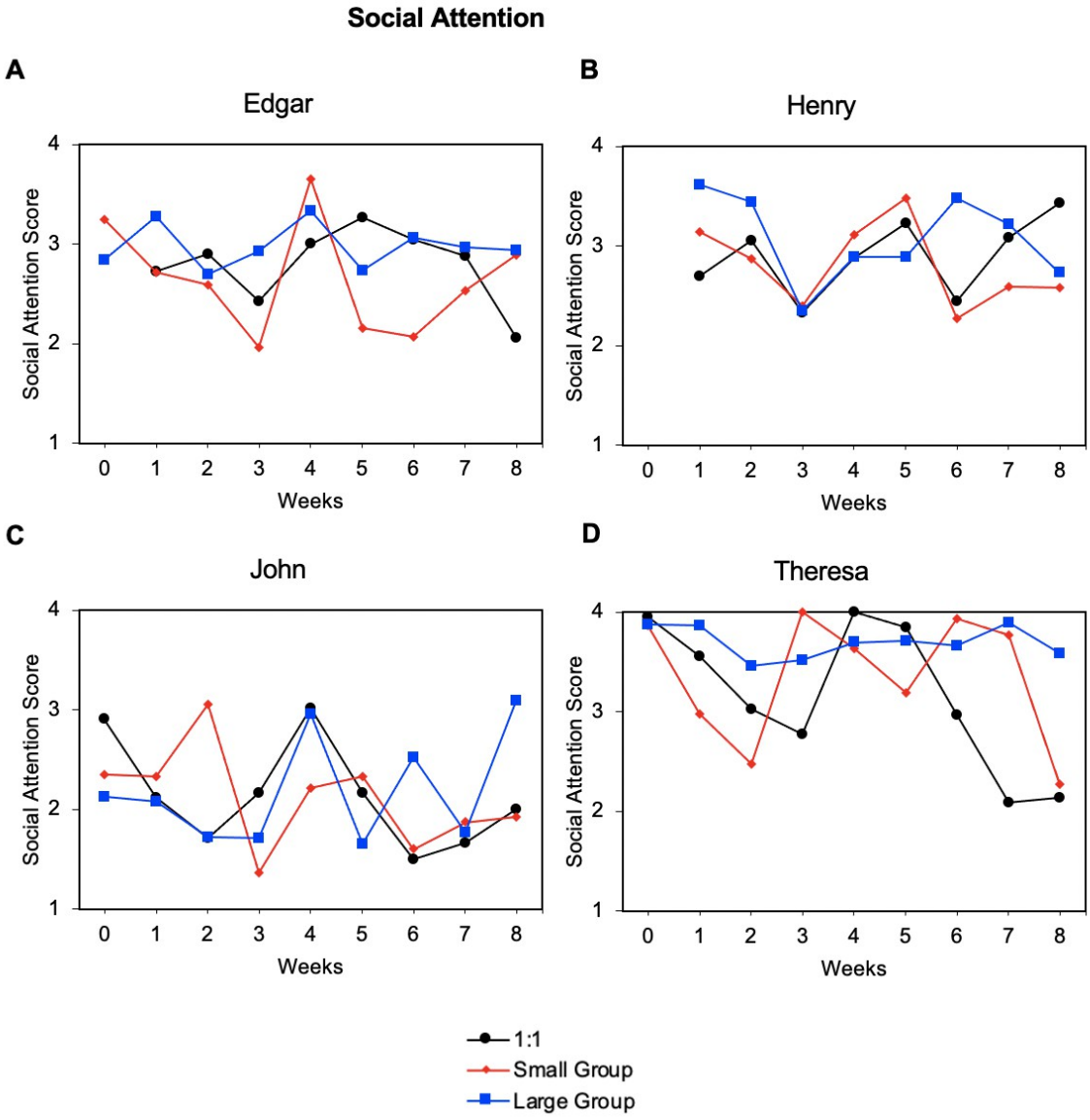
Means and Standard Deviation of Directed Communication Scores for all children in 1:1, Small Group and Large Group Sessions

Child	1:1		Small Group		Large Group	
	M	*SD*	*M*	*SD*	*M*	*SD*
Edgar	1.69	0.30	1.61	0.25	1.37	0.12
Henry	1.89	0.33	1.58	0.27	1.46	0.24
John	1.72	0.41	1.69	0.33	1.36	0.13
Theresa	2.18	0.43	1.83	0.50	1.78	0.16

Figures

Figure 1

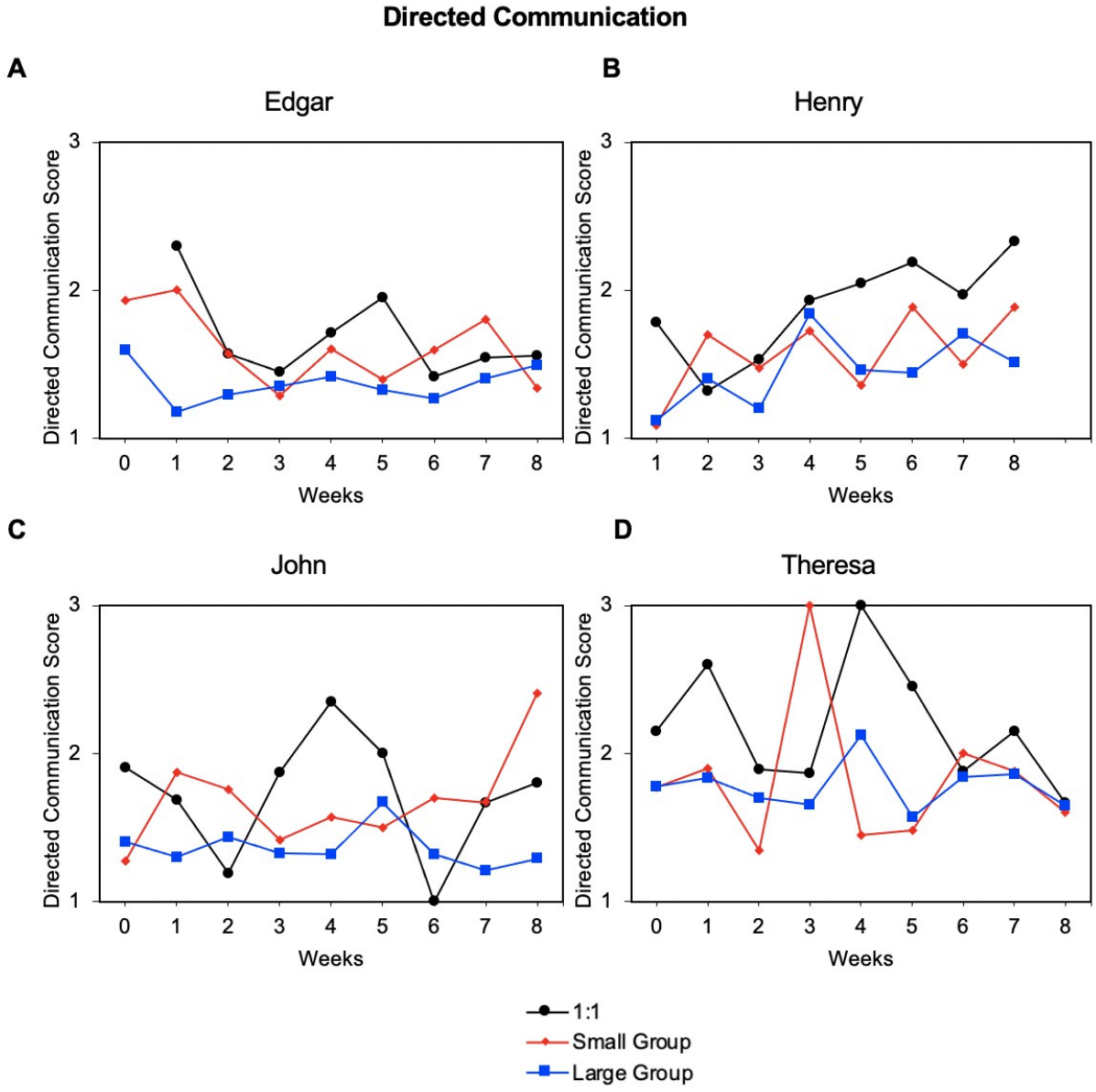
Social Attention Score over 8 Weeks for all four children for 1:1, Small Group and Large Group Sessions



Note. Line graphs showing social attention scores across three classroom contexts (1:1, small group, large group) for weeks 0-8 of the distance learning program for participating children. Scores of 1 indicate no attention, scores of 2 indicate low (0-5 seconds) attention, scores of 3 indicate medium (5-15 seconds) attention, and scores of 4 indicate high (>15 seconds) of attention.

Figure 2

Directed Communication Score over 8 Weeks for all four children for 1:1, Small Group and Large Group Sessions



Note. Line graphs showing directed communication scores across three classroom contexts (1:1, small group, large group) for weeks 0-8 of the distance learning program for participating children. Scores of 1 indicate no communication, scores of 2 indicate inconsistent communication, and scores of 3 indicate consistent and relevant communication.

Appendix A

Parent Exit Interview Coding Categories

Distance Teaching Coding Categories

General Comment/overall feeling
- GEN-POS: General positive comment
- GEN-NEG: General negative comment
- GEN-NOS: General – not otherwise specified

Effective elements of program structure & content for child learning and engagement
- EE-FREQ: Frequency, duration, pacing
- EE-PRED: Predictable structure/organization/routines (this includes former EE-STRU code)
- EE-CURR: Curriculum/activities/hands-on materials
- EE-FORM: Session format (1:1, small group, large group)
- EE-NOS: Not Otherwise Specified

Limitations of Distance Teaching
- LIM-SI: Limited social interaction
- LIM-NOS: Not Otherwise Specified

Impact of Distance Teaching on family life
- IMP-POS-REP: Positive: replicate learning activities during other parts of the day
- IMP-POS-STR: Positive: provided structure for child's day
- IMP-NEG-DISR: Negative: disruptive to family life/parents' other responsibilities
- IMP-NEG-STRESS: Negative: increased stress for parents
- IMP-NEUTRAL: Fit into daily family life
- IMP-NOS: Not Otherwise Specified

Child learning outcomes:
- LEARN-ACAD: Pre-academic skills
- LEARN-SELFREG: Self-regulation (e.g., transitioning)
- LEARN-COMM: Communication, interaction
- LEARN-NOS: Not Otherwise Specified

Time course of child engagement
- ENG-TIME-IMP: Became more engaged over time
- ENG-TIME-VAR: Day-by-day changes in child reaction
- ENG-TIME-DEC: Became less engaged over time
- ENG-TIME-NOS: Not Otherwise Specified

Child engagement during Distance Teaching
- ENG-POS-INV: Positive investment (enjoyment)
- ENG-POS-INI: Positive initiations (interaction)
- ENG-POS-IND: Positive independence
- ENG-NEG-UN: Negative – distracted/unengaged
- ENG-NEG-DIS: Negative – child distress
- ENG-NEG-DIF: Negative – difficulties getting child ready for the calls
- ENG-NOS: Not Otherwise Specified

Parent-implemented supports
- SUPP-VAR: Varied support needs (day-by-day fluctuations)
- SUPP-DEC: Less support necessary over time
- SUPP-INC: More support necessary over time
- SUPP-REG: Behavior-/emotion-regulation supports
- SUPP-ACT: Needs support during certain activities
- SUPP-NOS: Not Otherwise Specified

Challenges experienced by parents
- CHAL-MAT: Materials not readily accessible
- CHAL-TECH: Technological difficulties
- CHAL-NOS: Not Otherwise Specified

Suggestions for next time
- SUGG-TECH: Technology improvements
- SUGG-MOR: More sessions/increase frequency
- SUGG-STR: Suggests consistent structure/schedule/staffing

Appendix B

Parent Exit Interview Guide

Distance Learning Parent Interview Guide
v.10-5-2020

During the last two months, [child] participated in our Pre-K Distance Learning program. **What were your overall impressions on the distance learning program for [child]?** What was the most impactful part of this program? Did the program meet your expectations? How was it different than you expected?

How did [child] like/feel about the calls? How could you tell? Did [child] seem invested? Did [child]'s investment change over the 8 weeks?

How did [child] interact on the calls? Did [child] seem to enjoy seeing his/her teachers, friends, or both? How could you tell? Did [child] communicate with his teachers/peers during the calls? Did [child]'s communication increase over the 8 weeks?

How much support did [child] need from you to stay ontask during the calls? What kinds of supports did you need to offer? Did [child]'s independence change over the 8 weeks?

Did the calls ever cause distress in your child? Was it always easy to get [child] ready for the calls?

Prior to the calls, the teachers often provided you with hands-on materials. **Were these materials helpful?** Was it difficult to access these materials during the call?

Which format (whole group, small group, one-on-one) worked best for [child]?

Did the webex calls help your child learn? Can you point to specific skills he learned?

How did the webex calls fit into [child]'s daily routine? Were they helpful for creating a daily structure? Were they disruptive of other family activities?

In addition to your child's experience during the calls, we would also like to learn more about your experience as a parent. **How did the webex calls fit into <u>your</u> daily routine and your other obligations (i.e., household, work, parenting)?** Did they make your job as a parent easier, or did they add stress to your life?

What is one thing you would like to see done differently if we were to offer distance learning in the future?