A Social Turn-Taking, Parent Mediated Learning Intervention for a Young Child with Autism: Findings of a Pilot Telehealth Study

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Abstract

Social turn taking, a preverbal social communication competency often difficult for young children with autism, may be foundational to joint attention when included as a component of interventions for children with autism. In this study, social turn-taking was promoted through a parent mediated learning approach to intervention in a telehealth setting. Following a mixed-methods design, the present study explored the results of this new intervention model for a toddler with autism. The study also sought to understand any changes in the parent-child relationship because of the intervention. Findings indicate that the intervention supported the child's social communication competencies, including social turn-taking, joint attention, and facial focusing. Qualitative data revealed improvements in the parent-child relationship. These preliminary results lend support for promoting social turn-taking in interventions for children with autism, as well as for following developmental, parent-driven approaches to intervention. Studies with larger sample sizes are needed to understand these findings further. Implications for practice and research in early intervention are presented.

Introduction

Challenges in social communication, such as in social-emotional reciprocity and some forms of preverbal communication, are core characteristics of autism that begin to appear in early childhood (American Psychiatric Association [APA], 2013). Young children with autism who received early social communication interventions have shown improvements in social communication, language, and cognition (Watkins et al., 2017). Turn-taking and joint attention are two preverbal social communication competencies that start emerging early in life and support later developmental outcomes (Adamson et al., 2009; Kellerman et al., 2020). Turn-taking occurs when two communicative partners engage in repetitive, reciprocal exchanges (Lee & Schertz, 2022; Kellerman et al., 2020). Joint attention is defined as visually coordinated attention sharing between two communicative partners about a point of interest (Mundy, 2016). It begins to appear in infancy, and by 18 months, children with typical development are often competent in its use (Adamson et al., 2009). Difficulty with joint attention—a difficulty not found in children with typical development and children with other disabilities (Adamson et al., 2009; Wetherby et al., 2007)— is often one of the first indicators that a child has autism (Mundy, 2016). Research also shows that children with autism often have difficulty with turn-taking when the exchange is socially defined and person-centered, such as during reciprocal games or while interest sharing during free play (Chiang et al., 2008; Kellerman et al., 2020). As a simpler form of social communication, turn-taking may lay the foundation for more complex joint attention (Hubley & Trevarthen, 1979; Schertz et al., 2018). As such, turn-taking has been embedded into early interventions seeking to support joint attention outcomes (e.g., Schertz et al., 2018; Shire et al., 2020).

Preverbal turn-taking is frequently an embedded component in interventions for children with autism, designed to support various child outcomes (e.g., language, play, and joint attention); however, there is inconsistency in how it

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is operationally defined in the literature (Lee & Staggs, 2021). Some studies define turn-taking as serving an instrumental function in which communicative partners initiate or respond to requests to gain something for the self or follow directions rather than for mutual interest sharing (e.g., Kemp et al., 2019; Rieth et al., 2014; Therrien & Light, 2018). Instrumental turn-taking interventions often promote back-and-forth exchanges through directives (e.g., "Your turn," "My turn"), instructing children to initiate and respond to turn-taking at the request of the interventionist or other agent (e.g., the parent or peer) (Kemp et al., 2019; Rieth et al., 2014; Therrien & Light, 2018). Instrumental turn-taking may be observed, for example, when a parent prompts their child to place a puzzle piece in a specific spot. The child responds to the parent's request by placing the puzzle piece where directed. They continue this routine for a few turns.

In other studies, turn-taking is defined as social, back-and-forth engagement between two communicative partners for mutual interest sharing (e.g., Gengoux et al., 2019; Green et al., 2017; Schertz et al., 2018). Social turn-taking may be observed, for example, during a game of peek-a-boo between a parent and their child. In this exchange, the parent hides their eyes, building the child's excitement, and then exclaims, "Peek-a-Boo!" In response, the child laughs and claps, indicating that the exchange was socially meaningful, and the game continues for several minutes. Social turn-taking interventions follow the child's lead, allow children to freely engage in reciprocal, synchronous exchanges with their partners, and promote social-emotional competency (Green et al., 2017; Schertz et al., 2018). Turn-taking may serve a social or instrumental function depending on communicative intent; however, research indicates that social turn-taking, not instrumental turn-taking, is positively related to joint attention in young children with autism (Lee & Schertz, 2022).

Parent Mediated Learning: A Parent-Mediated Intervention Approach

There currently exist few interventions that promote preverbal social turn-taking in toddlers with autism (Lee & Staggs, 2021). Some of these interventions employ parent mediation, which is a relationship-based early intervention method that encourages the family's active engagement in their child's learning and includes them as intervention agents (e.g., Green et al., 2017; Schertz et al., 2018; Shalev et al., 2020). This content aligns with recommended developmentally appropriate practices and promotes family self-efficacy and capacity building (Division for Early Childhood [DEC], 2014; NAEYC, 2020). Parent-mediated interventions for children with autism involve parents through different

intervention approaches (Boyd et al., 2010; Shalev et al., 2020). For instance, Zhou and colleagues (2018) implemented the Early Start Denver Model, which combines a developmental, naturalistic approach with a behavioral intervention. In this study, therapists coached parents in specific intervention strategies to support their children's language, social communication, and behavioral outcomes in daily routines and natural environments. Brian et al. (2017) implemented a parent-mediated intervention called the Social ABCs based on applied behavioral analysis. In this study, interventionists coached parents in didactic, behavioral techniques to support their children's vocalization and positive facial affect in daily routines.

In another parent-mediated intervention, Schertz and colleagues (2018) encouraged children's social communication competency through a parent mediated learning (PML), developmental approach in the Joint Attention Mediated Learning (JAML) study. During the intervention, rather than directly training parents, an interventionist conceptually guided them in promoting embedded intervention components through the PML principles. The PML principles include focusing, organizing and planning, giving meaning, encouraging, and expanding (Klein, 2003; Schertz et al., 2018). The PML approach was first introduced by Klein (1996; 2003), whose work focuses on supporting children's internalization of learned competencies through active learning rather than through didactic instruction. Schertz and colleagues (2018) adapted Klein's (2003) PML principles in the JAML model to support young children with autism and their families. Toddlers who participated in the JAML intervention showed improvement in joint attention post-intervention (Schertz et al., 2018). The toddlers' parents also reported overall satisfaction with the intervention, improved relationships with their children, and enhanced self-efficacy in supporting their children's social-emotional learning (Amsbary et al., 2021; Schertz et al., 2020).

Aside from the JAML study (Schertz et al., 2018), limited explorations in the reported literature have followed the PML approach in interventions for children with autism. Additionally, Schertz and colleagues (2018) promoted social turn-taking as one of three embedded intervention components to encourage later joint attention outcomes. Because children with autism often have difficulty with social turn-taking, promoting it as the sole focus of intervention may provide further insight into how this competency helps children build a foundation for later joint attention. Some intervention studies have promoted preverbal turn taking in isolation (e.g., Kemp et al., 2019; Rieth et al., 2014). However, the authors of these studies facilitated instrumental exchanges by teaching children to respond to and initiate turn-taking to obtain something, or to follow the directions of their communicative partner, instead of

freely engaging for their own interests and volition (e.g., Kemp et al., 2019; Rieth et al., 2014). There are currently no reported PML early interventions for toddlers with autism that solely embed social turn taking to optimize children's joint attention learning. Therefore, further study is needed to understand how this approach impacts child social communication outcomes.

Telehealth Early Interventions

Telehealth family-based early intervention services for children with autism are becoming increasingly popular for reasons of flexibility, convenience, accessibility, and cost-effectiveness for practitioners and families (e.g., Dahiya et al., 2022; Ingersoll & Berger, 2015; Kunze et al., 2021; Wainer et al., 2021). Telehealth interventions often employ synchronous audio-video conferencing to allow face-to-face remote interactions between families and intervention teams. Parent-mediated interventions for children with autism have successfully been implemented in a virtual setting and have shown strong parent intervention acceptability, as well as improved child outcomes (e.g., Dahiya et al., 2022; Ingersoll & Berger, 2015; Wainer et al., 2021). Because the PML approach is designed for relatively limited interference with families' daily lives (Schertz et al., 2018), it may be optimally implemented in a telehealth setting. However, there are currently no reported PML telehealth interventions in the literature. More research is needed to understand how the PML intervention approach may be implemented in virtual modalities to provide families with better access to early intervention services.

In this study, we reported on the results of a new, telehealth PML intervention designed to promote social communication in a toddler with autism. We present this intervention model to understand its feasibility for broader use. By exploring trends in the intervention data, we sought to understand if the child progressed naturally to joint attention through a social turn-taking intervention. Although not supported in intervention, we also sought to identify trends in the child's use of instrumental turn-taking throughout the study. Another purpose was to explore a parent's views of

Table 1 Pre-intervention assessment data

Assessment tools	Scores
CARS-2	Raw score = 36 T-Score = 47 Interpretation = Mild-to-moderate symptoms of autism
TELE-ASD-PEDS	Score of 18 (total score = 21 with cutoff of > 11 for risk). Interpretation = Elevated risk for autism

Note CARS-2 = Childhood Autism Rating Scale-Second Edition (Schopler et al., 2010); TELE-ASD-PEDS (Corona et al., 2020).

the impact of the intervention on their child's progress and the parent-child relationship.

Method

Participants

The participants were Leo[1], a male toddler with autism, and his mother. They were recruited through a distributed study letter at a Part C early intervention provider. To be eligible for the study, the child had to be 36 months or younger at the time of entry into the study, be previously diagnosed with autism as documented by a formal assessment, and have difficulty in social communication as reported by the parent and formal assessment. The parent had to be the child's primary caregiver and be willing to participate in a telehealth setting, including regular video capturing and uploading. Leo and his parents are of Latin American descent and live in an urbanized area of New England. The family primarily speaks Spanish at home. Leo's mother and father are his biological parents and are married. They are both educated at the graduate level and work full-time.

Leo, the only child of his parents, was diagnosed with autism at 27 months of age through clinical evaluation by his Part C provider. Leo's mother confirmed his diagnosis through the provider's medical documentation, including assessment results, as presented in Table 1. Based on the evaluation data, the provider indicated that Leo met the criteria for autism as per the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (APA, 2013), with a level two severity specifier, meaning he may require substantial support with social communication and with some restricted, repetitive behaviors.

Birth and Development

Leo entered the study at 28 months. Per his mother, he was born prematurely, was five pounds at birth, and had a slow fetal heart rate. For the first five months of his life, he had digestive challenges that required medication. At the time of the intervention, Leo received speech-language pathology services for a speech or language delay and occupational therapy for unspecified eating challenges. He was not receiving additional turn-taking therapy or parent-mediated intervention outside of the present study. In an initial interview with the research team and a pre-intervention survey, Leo's mother expressed concerns about his development beginning when he was two. She reported that he had difficulty pointing, waving, verbally communicating, and

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[1] Leo is a pseudonym.

making eye contact. She also expressed that he frequently initiated requests, such as pulling her arms and hands to request objects; however, he showed difficulty following her requests. When asked how Leo shares interests, such as a favorite toy or book, she responded that he does not often communicate this way and that she felt difficulty socially connecting with him. When he shares interests, he usually only does so with familiar people and at home. Leo's mother also noted several of his strengths and interests. He excels in rough-and-tumble play with his father. He enjoys toy cars and observing spinning objects, such as ceiling fans or pinwheels. He also likes numbers and the alphabet.

Design

This case study combines quantitative and qualitative research methods. The intervention follows a single-subject design with a baseline, intervention period, and post-intervention period. Triangulating quantitative child intervention data with qualitative data may contribute to an in-depth understanding of the intervention (Johnson & Onwuegbuzie, 2004). Similar mixed methods studies have provided insight into innovative intervention models and revealed implications for future research and practice (Schertz & Odom, 2007).

The Social Turn-Taking Intervention (STTI) is based on the JAML model, in which an interventionist guides parents in promoting learned concepts with their children through five mediated learning principles adapted from Klein (2003) by Schertz and colleagues (2018). Under this relationship-based developmental model, parents support their children in learning social communication using indirect teaching methods. STTI is family-centered and child-led and is implemented during familiar routines and in natural settings. Through parent-child engagement, it encourages the child's active, social communication learning. In STTI, the parent is an integral intervention team member and is guided in translating intervention concepts using their own ideas about their child's interests and needs. This content aligns with recommended childhood practices for children with disabilities (DEC, 2014).

Although STTI is derived from the JAML model, it differs in duration. In JAML, parents are guided in the five PML principles through three phases: Focusing on Faces, Turn-Taking, and Joint Attention (Schertz et al., 2018). In the present study, the principles are introduced in a single turn-taking phase. Therefore, the intervention is shorter in duration than JAML, which was implemented across 32 weeks compared to the originally planned 10 weeks in the present study. In the present study, the parent was only introduced to social turn-taking. In JAML, parents were sequentially introduced to the concepts of focusing on faces, social

turn-taking, and joint attention. The present study assumed that promoting the child's social turn taking in intervention would lead to joint attention without introducing the latter concept to the parent. This study's design may reveal additional insight into the relationship between social turn-taking and joint attention identified in recent research (Lee & Schertz, 2022).

The present study also differs from JAML in modality. In JAML, an interventionist visited parents' homes weekly for intervention sessions and video data collection (Schertz et al., 2018). In the present study, intervention procedures were conducted in a telehealth setting using synchronous audio-visual conferencing software (i.e., Zoom©). The parent, not the interventionist, captured weekly video data to monitor child progress. The decision to conduct the intervention in a telehealth setting was partly made due to pandemic-related safety concerns (i.e., COVID-19) at the time of the study. Additionally, the telehealth setting provided greater flexibility for the parent regarding their work schedule, as well as efficiency and cost-effectiveness for the parent and the research team. The parent and interventionist participated in the telehealth intervention sessions at places and during times of their choosing.

Intervention Procedures

Pre-Intervention Procedures

After obtaining written informed consent from Leo's mother, the principal investigator met her virtually for a full eligibility interview, a demographic questionnaire, and the pre-intervention survey. After confirming full eligibility, the research team mailed Leo's mother a digital camcorder, three standard-definition memory cards, a tripod, and a detailed instructional manual on capturing video data and uploading it to a secure cloud-based server for the study. The manual specified that videos of parent-child interactions should capture the child's face, their actions, and the parent's actions. Leo's mother had the option to record the sessions alone using the provided tripod or with the assistance of another household member, which in this case was Leo's father. She also had the option to use a smart device of her choosing (e.g., a phone or tablet) if the device was capable of uploading quality videos to the server. She was provided pre-stamped envelopes with the option to return the memory cards by mail but chose to upload them to the server instead. Throughout the study, the research team provided technical assistance to her whenever necessary. She had the option of various video conferencing platforms throughout the study when meeting with the research team, and she chose to use Zoom©.

Before beginning the intervention, Leo's mother was introduced to the interventionist, a graduate researcher and early childhood educator trained by the principal investigator in intervention concepts and procedures. At this pre-intervention meeting, the interventionist provided an intervention overview and the definition of social turn taking. The mother was then instructed to record at least two 10-minute videos of play sessions on different days with Leo to establish a baseline of his use of facial focusing, social turn taking, instrumental turn taking, and joint attention before introducing intervention.

Intervention Procedures

After baseline, the research team mailed Leo's mother a bound copy of the STTI manual and a logbook to document weekly social turn-taking activities. The manual was adapted from Schertz and Horn (2018) and guided the parent throughout the intervention in procedures and concepts. The interventionist met with the mother throughout the intervention weekly at a mutually agreed upon day and time through Zoom©. Weekly sessions were held for an hour and were originally planned across ten weeks. During these sessions, the interventionist conceptually guided the parent on how to promote social turn taking through the five mediated learning principles: (1) Focusing, (2) Organizing and Planning, (3) Giving Meaning, (4) Encouraging, and (5) Expanding (Klein, 2003; Schertz et al., 2018). Two weeks were allotted for each principle, but this timeline varied depending on whether the mother wanted to extend Leo's time working on a principle. The intervention, therefore, lasted 12 weeks. Conceptual guidance was provided through the STTI manual, mutual viewing of the weekly videos (as described in data collection), a review of the weekly logbook, and verbal discussions with the interventionist. Throughout the week, she was asked to engage for at least 30 min in daily planned, play-based activities that incorporated the learned principles with her child, which could be integrated into everyday routines (e.g., during playtime or story time). The interventionist suggested activities to Leo's mother but did not prescribe them to guide her in planning her own social turn-taking activities for her child.

Data Collection and Analysis

Leo's mother collected video data throughout the study. She collected two 10-minute videos at baseline using the procedures described above. Throughout the intervention period, she captured and uploaded 2–3 weekly, 10-minute videos of her play sessions with Leo for a total of 22 intervention videos. She recorded and uploaded four post-intervention videos two weeks after completing the last principle.

Using video-splitting software, each 10-minute video was split into 60, 10-second intervals. For each 10-second interval of each 10-minute parent-child video, variables were coded as occurring with a "1" or not occurring with a "0" (Yoder & Symons, 2010). Each variable was coded only once in every interval that it occurred. Two trained observers coded the video data. The primary observer was a research assistant. The secondary observer, who was the principal investigator, trained the primary observer in coding. The primary observer coded the videos for variable occurrences. The secondary observer coded 25% of the videos for interobserver agreement. The training was held until a minimum agreement of 85% was reached. Interobserver agreement was calculated by dividing interval occurrences by the sum of agreement and disagreement and multiplying by 100. Mean Cohen's kappas and ranges were calculated for 25% of randomly selected video data: 0.92 (0.88-1) for FF, 0.84 (0.45-1) for ITT, 0.91 (0.79-1) for STT, 1 (0–1.0) for RJA, and 0.75 (0.65-0.84) for IJA.

All coding measures used in the present study are drawn from Lee and Schertz (2022) and Schertz (2013). Operational definitions and coding measures are as follows: Social Turn-Taking (STT) is defined as playful, back-and-forth exchanges for the purpose of engaging socially with a communicative partner. Instrumental Turn-Taking (ITT) is defined as back-and-forth exchanges for the purpose of following or initiating requests. To be coded, STT and ITT must occur across two consecutive 10-second intervals and involve a minimum of two related child actions to be considered a full routine. Although ITT was not purposefully supported in intervention, it was measured to identify potential trends in Leo's use of ITT throughout the study. Focusing on Faces (FF) was coded when Leo clearly looked at his parent's face. FF was coded in place of eye contact because it is difficult to capture and code when the child is making direct eye contact with their parent. FF is often, but not always, indicative of joint attention, so it must be coded. Joint attention is defined as a coordinated exchange of looks between a child and their parent about a referent to share social interest (Mundy, 2016). Joint attention coding in the present study is based on Leo's initiating or responding actions during interactions with his mother. Initiating Joint Attention (IJA) is a drawing of attention, such as through pointing or eye gaze, to share interest in a referent (e.g., an object or event). IJA was coded when Leo exchanged looks with his mother while he drew attention to a referent to share interest with her. Responding to Joint Attention (RJA) is defined as Leo's response to his mother's bids for attention sharing. RJA was coded when he responded to his mother's attempts to draw attention to a referent to share interest with him. IJA and RJA coding required that Leo display positive affect to indicate that the exchange was socially meaningful for him.

Table 2 presents examples of each coding measure from the video data.

The primary qualitative data source for the study is the intervention session transcripts between Leo's mother and the interventionist. Supplemental data sources for background and context include the initial demographic interview, pre-intervention survey, interventionist notes, and parent weekly logbooks. A research assistant transcribed verbatim ten recorded parent-interventionist sessions. Of the original 12 intervention sessions, weeks 8 and 10 were not recorded because of technical difficulties at the time of the sessions. This process resulted in 167 pages of transcriptions for analysis. All transcripts were read for familiarity, coded, categorized, and organized around themes related to the research aims (Braun & Clarke, 2006). Dedoose (Socio-Cultural Research Consultants, 2015), a qualitative analysis software, was used for coding and categorizing transcript data for thematic analysis. Triangulation of the quantitative and qualitative data derived from different data sources strengthened the trustworthiness of conclusions (Brantlinger et al., 2005). When applicable, detailed excerpts that captured the parent's voice are included as evidence for conclusions made.

Intervention Fidelity

The interventionist and a research assistant independently measured fidelity on different aspects of intervention implementation to determine if the parent and interventionist conducted procedures as intended. After eight of the 12 intervention sessions and using a 10-item internal study checklist, the interventionist rated how Leo's mother implemented intervention procedures using the following scale: full fidelity (3), partial fidelity (2), or no fidelity (1). Full fidelity means that the parent fully implemented an item on the checklist. For example, the checklist includes a weekly logbook item. For this item, full fidelity was measured if the parent reported at least 30 min of planned play for each day in a given week. Partial fidelity indicates that an item was implemented, but only partially. For the weekly logbook item, for example, partial fidelity was measured if the parent implemented 30 min of planned play for fewer than seven days a week. No fidelity means the parent did not implement an item on the checklist. For the weekly logbook item, for example, no fidelity was measured if the parent did not report any planned play activities for any day in a given week. Mean percentages were calculated across sessions related to the following checklist categories: planned weekly activities, log notes, and video recordings (88.88%), and parent mediation of the principles (89.86%). Then, the research assistant, who was naive to intervention sessions, listened to all session recordings and blindly rated them using a 12-item checklist to rate how the interventionist implemented intervention procedures with the parent. The research assistant rated the interventionist's fidelity using the same scale described above. Mean percentages were calculated across sessions related to the following categories: Session initiation and listening to the parent (98.14%), reviewing the parent log and video recordings (91.35%), reflection and support (100%), and planning and conceptual guidance (100%).

Results

Quantitative

Table 3 summarizes Leo's performance across the four variables (i.e., FF, ITT, STT, RJA, and IJA) at baseline, during the intervention, and post-intervention. Figures 1, 2, 3, 4, 5 and 6 depict trends in the variables.

Leo displayed FF more often during intervention and post-intervention than at baseline. He showed ITT at baseline, which increased during intervention and then decreased during post-intervention. Leo's use of STT at baseline was minimal, but it increased during intervention. During post-intervention, he was observed using fewer instances of STT. His use of RJA at baseline and during the intervention was similar, but RJA increased during post-intervention. He was observed using no instances of IJA at baseline, but his

Table 2 Coding measures with examples

Measures	Examples
STT	Leo and his mother are playing with rubber ducks in a water pail. Leo squeezes one of the ducks, so that water spurts out of its mouth. In response, his mother imitates a duck by making a "quacking" sound. Leo laughs and squeezes the duck again. His mother repeats, "Quack, Quack!" This exchange continues for additional turns.
ITT	Leo and his mother are sitting in front of a bubble machine. Leo's mother points to a bubble, directing him to pop it. Leo hits the bubble with his hand. His mother again points to a bubble and requests that he pops it. Leo again hits the bubble with his hand.
FF	Leo's mother is preparing for a play activity. She hides a bag of toys behind her back. The camera captures Leo looking directly at his mother's face. His facial focusing then turns into a joint attention overture.
IJA	Leo is playing with a peg board on the floor and his mother sits in front of him. He pulls out a peg, squeals with excitement, and looks to his mother's face. In response, his mother exclaims, "Go away, peg!"
RJA	Leo is playing with a pinwheel. His mother grabs the pinwheel to stop it, exclaiming, "Stop!" In response, Leo looks between his mother's face and the pinwheel, and smiles.

Table 3 Variable Means, Standard Deviations, and Ranges across time

Variable	Baseline		Intervention		Post-intervention	
	M/SD	Range	*M/SD*	Range	*M/SD*	Range
FF	4.5/3.53	2–7	7/4.29	0–15	7.75/4.78	2–13
ITT	2.5/0.7	2–3	3.68/5.25	0–21	2.25/3.3	0–7
STT	1.5/0.7	1–2	5.31/4.06	0–13	0.75/1.5	0–3
RJA	0.5/0.7	0–1	0.59/0.95	0–3	1.25/1.5	0–3
IJA	0/0	0	1.63/1.64	0–5	1.25/1.25	0–3

FF = Focusing on Faces; ITT = Instrumental Turn-Taking; STT = Social Turn-Taking; RJA = Responding to Joint Attention; IJA = Initiating Joint Attention

Note The possible range is between 0 and 60 intervals in which variables were observed across 10 min of video.

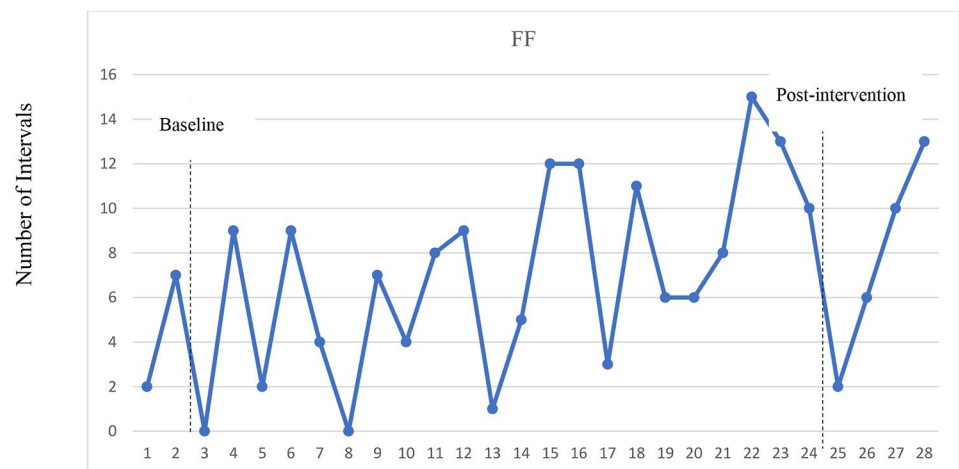**Fig. 1** Multiple line Means of FF, ITT, STT, RJA, and IJA
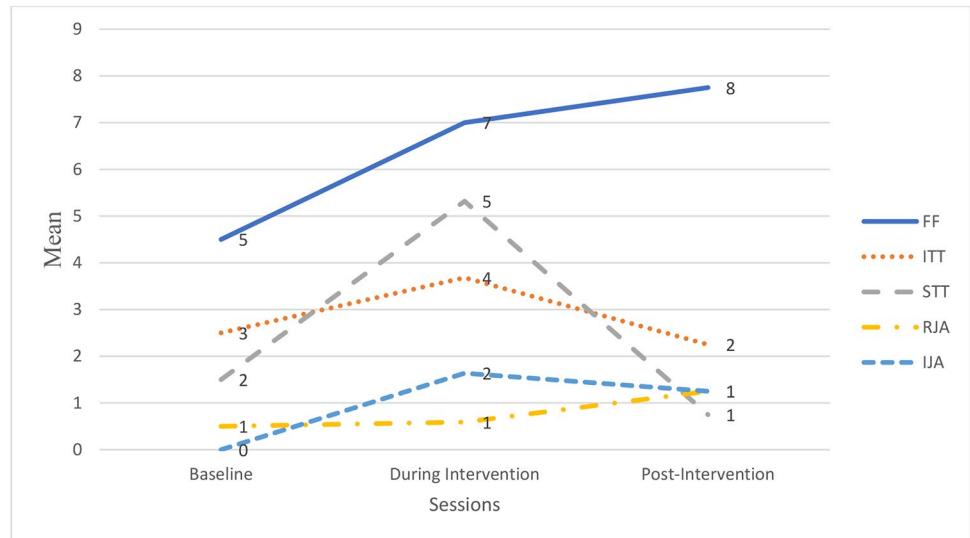
Fig. 2 Graph depicting number of intervals in which FF was observed across videos

use of IJA increased during intervention, and then slightly decreased post-intervention.

Qualitative

Four themes related to the research aims emerged from thematic analysis: (a) progress related to social communication; (b) progress unrelated to social communication; (c) concerns during intervention; (d) and the parent-child relationship. The parent expressed her views on the impact of Leo's progress and her relationship with him during weekly sessions with the interventionist, her weekly logbook, and the interventionist's notes. Some of the mother's views on her child's progress align with trends in the quantitative data.

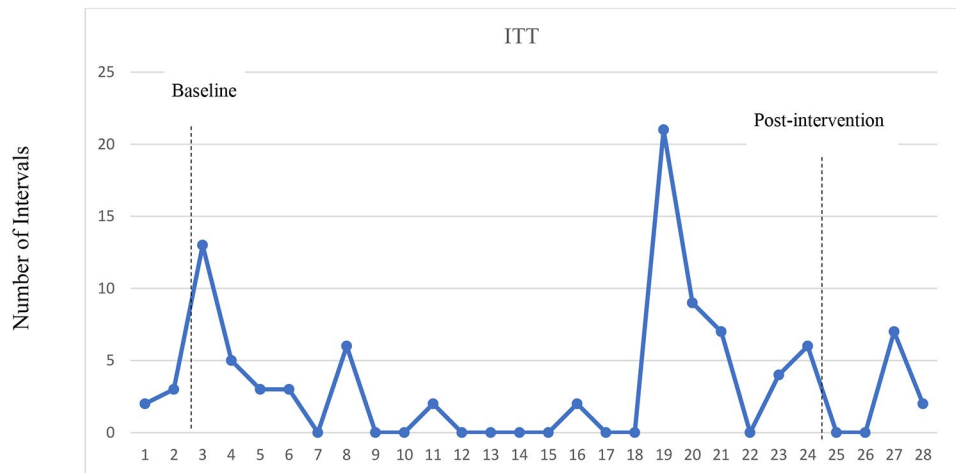**Fig. 3** Graph depicting number of intervals in which ITT was observed across videos

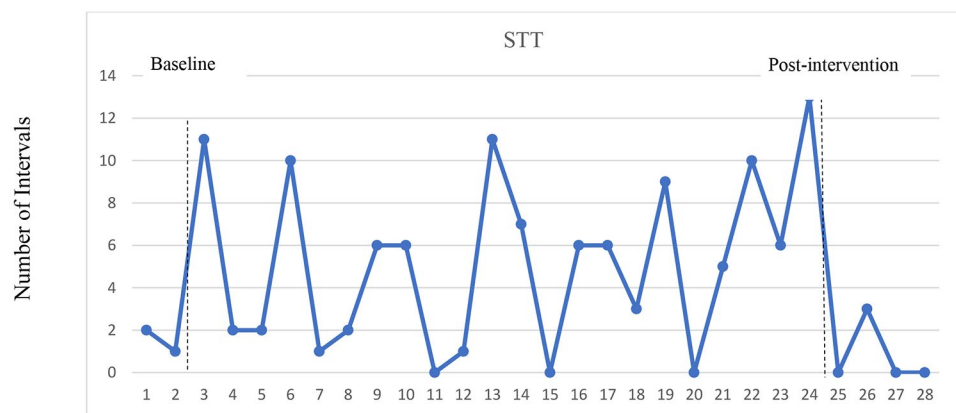**Fig. 4** Graph depicting number of intervals in which STT was observed across videos

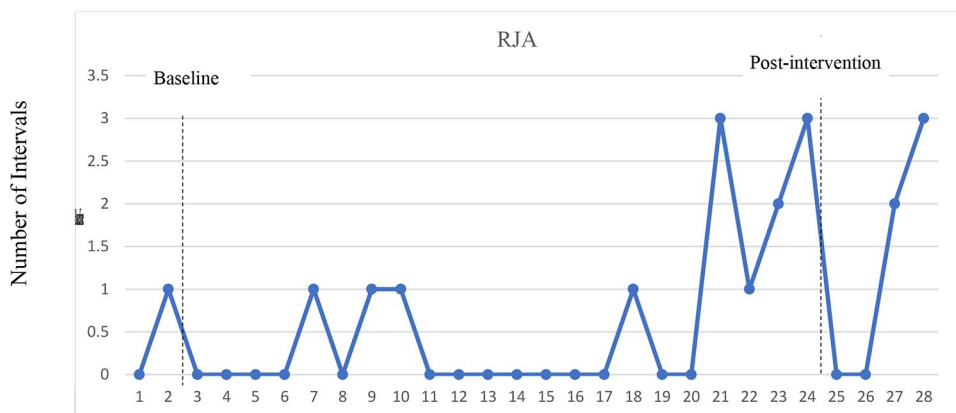**Fig. 5** Graph depicting number of intervals in which RJA was observed across videos

Table 4 includes the themes and weeks in which they were coded.

Progress Related to Social Communication

During intervention sessions, Leo's mother frequently discussed his progress in STT and other forms of social communication. The STT quantitative data supports this information. She attributed these positive changes to her promotion of learned concepts and her child's involvement in STTI. In the following excerpts, she described successfully supporting Leo's STT through his interest in spinning objects. "I have a flower that spins. He plays with that and I…stop. And then he laughed [at] me…then I would say stop" (Week 6). "I went to a park here close to my house, and they have a steering wheel toy as well, but smaller. And he was twisting it. And I started taking turns and he let me do it" (Week 7). During the final intervention session, the

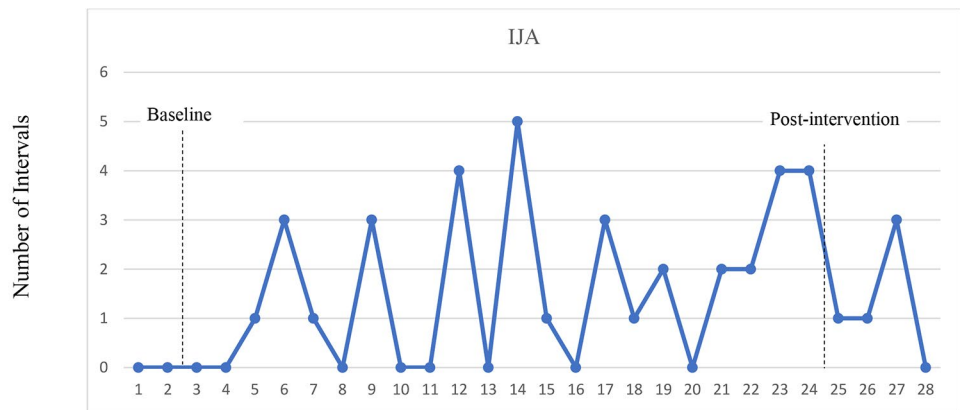**Fig. 6** graph depicting number of intervals in which IJA was observed across videos

Table 4 Themes coded and weekly sessions

Themes, Total excerpts coded	Weeks in which codes were applied
Progress Related to Social Communication, 54	3, 4, 5, 6, 7, 9, 11, 12
Progress Unrelated to Social Communication, 14	3, 5, 6, 7, 9, 11, 12
Concerns During Intervention, 34	1, 3, 4, 5, 6, 7, 9, 11, 12
The Parent-Child Relationship, 15	3, 4, 5, 6, 7, 9, 11, 12

parent described an instance of STT that involved pretend play, an excerpt that reveals her conceptualization of STT and the learned principles:

> Today, I play with him eating fake food. And…it was surprising for me because he initiated the game. He initiated. Took a strawberry from the floor and he started doing "nom, nom" like faking like he was eating the strawberry. He said the word then picked it up and started to eat the strawberry himself. And then he went to me and put it in my mouth, like for me to eat it. So, I ate it. And I would hide it in my shirt. And he was also surprised. So he came and picked another fake food and picks up food and put it in my mouth. So I ate it and he went and pick another one. So I think that's turn taking, you know? (Week 12)

She also consistently reported that Leo showed more eye gaze with her and her husband. "The eye contact I told you [about] last week. It's way more eye contact with me and my husband" (Week 5). Leo's mother described his eye contact as socially oriented and meaningful. "But he's always looking at me or my husband, and what we are doing to try to grab our attention somehow in a playful way" (Week 9). Instances were noted in week three and continued to the final week of intervention. These findings align with trends in the quantitative FF data.

Per Leo's mother, he was initiating and responding to social interactions more frequently than before the intervention, which potentially aligns with trends in quantitative IJA and RJA data. Although Leo's mother was not guided in STTI to promote joint attention, some of her examples from play sessions with Leo indicate that he was possibly initiating joint attention overtures. For example, she described that Leo nonverbally initiated play interactions, "He will grab me, and he will look at me when [he] is playing something" (Week 9). "Even though he doesn't talk, he still leads me to play with him" (Week 9). "He doesn't talk…or he doesn't show me the toy yet, but I notice he is looking at us like when he's enjoying something" (Week 9). As the following example illustrates, some excerpts may indicate that he was responding to his parent's bids for joint attention, "I'm putting [cereal] very far away. I start to put him closer and point to them and he would look at my finger. [He is] looking at me and try to look where I'm pointing" (Week 5). She also noted that Leo was displaying more facial expressions and positive affect, "He's doing that a lot, like smiling to us out of the blue" (Week 9).

Progress Unrelated to Social Communication

There were times throughout the intervention when the parent described improvements in behaviors and competencies unrelated to social communication and the intervention principles. Some of these noted improvements include understanding more commands and making more requests of his parents. "In terms of requesting to take him outside and for help, like he would go and grab his shoes…but he doesn't say shoes or [give] me the shoes, but he shows the shoes. He wants to go outside and he would start whining" (Week 7). She also reported that Leo used more verbal communication, such as repeating his name and vocalizations. "He's talking more like baby talk…Even though he doesn't [talk], he still say no when he don't want something. So he seems more verbal" (Week 9). She also noted changes in Leo's demeanor, that he was calmer and more relaxed, and that his sleeping habits improved.

Concerns During Intervention

Leo's mother also discussed concerns about his engagement during the intervention, including a preference for instrumental communication over STT. This finding may align with trends in the ITT quantitative data. "I engaged in parallel play, and he took me by the hand to the kitchen for cooking something, so I went to do it because he didn't want to play. He just wanted food" (Week 7). Leo often ignored her and preferred solitary play over play with others. She felt that, at times, he did not understand that she was trying to play with him, and he would become upset. Throughout the intervention, Leo's health challenges affected his engagement. He was sick on multiple occasions, which impacted his energy levels, and he reverted to bottle feeding.

The Parent-Child Relationship

She noted that her relationship with Leo improved because they participated in STTI. "Like at least something that I'm going to get from this research is that my relationship with him improved definitively" (Week 11). She experienced these improvements in a few ways. She reported a better connection with her son. "I think he's more connected to me" (Week 9). When leaving him at daycare, she noticed that he had a stronger attachment to her because he cried when she left. This improved attachment was also witnessed in other instances: "He was in the backyard. And I say, [Leo]. And he was smiling, drawn to me, try to run to me. And then because it took me a while to go back out, I hear him crying. He wanted to be with me. So that was something new" (Week 3). Leo engaged better with them in everyday situations and during play, "I really feel it's easier for us to play with him now. He's not like all into his own all the time" (Week 9). In general, he was more playful and engaged with his parents.

Discussion

The main purpose of this case study was to present a pilot, telehealth PML intervention model designed to support social communication in a child with autism. We explored trends in the child's social communication throughout the intervention. The intervention data revealed increases in Leo's use of social communication, including STT, IJA, RJA, and FF, during intervention from baseline. These preliminary findings are reflected in the qualitative data, in which Leo's mother discussed improvements in his social communication during the intervention. Based on the quantitative data, Leo's use of STT increased throughout the intervention but decreased post-intervention. His RJA increased post-intervention, but IJA slightly decreased from intervention to post-intervention. This trend is consistent with other research, which found that STT tends to decrease when children gain competency in joint attention (Schertz et al., 2018). These findings support the idea that STT encourages joint attention when included as the sole component in interventions for children with autism. Previous research explored correlations between the two competencies and found positive associations (Lee & Schertz, 2022). The present study provides further evidence of these relationships. Few early interventions for children with autism have embedded a social turn-taking component (Lee & Staggs, 2021). Given the importance of STT on child development, as evidenced in this and other studies (e.g., Feldman, 2015; Green et al., 2017; Schertz et al., 2018), early intervention researchers and practitioners should promote STT more often in intervention for children with autism.

Importantly, Leo also showed increased FF, or eye gaze, throughout the intervention as indicated by the quantitative and qualitative data. Eye gaze impacts children's social-emotional development; however, individuals with autism often have difficulty with this competency, particularly during dyadic engagement (Hessels et al., 2018). Other PML interventions introduced FF as a component of intervention before introducing STT with the idea that FF also helps children build a foundation for later joint attention (Schertz et al., 2018). The STTI findings may indicate that STT supports FF in young children with autism. Because this is the first STTI study, further exploration is needed to understand how this intervention supports children's ability to focus on faces.

Leo's mother discussed improvements in his requests and commands. She also expressed concerns over his preference for instrumental over social communication. These findings mirror trends in the quantitative data, which reveal that Leo's use of ITT increased during the intervention. While the STTI aims to promote social over instrumental communication, these findings are not unexpected. Children with autism are often more competent in instrumental communication than in social communication so they may require more support in social communication (APA, 2013; Harbison et al., 2017). Although instrumental communication is important for daily functioning, such as when making or following requests, it is not associated with later language, whereas social communication is in children with autism (Harbison et al., 2017). Therefore, promoting instrumental communication in interventions for children with autism may be less important. Factors such as illness and eating challenges may have contributed to Leo's difficulty engaging in social communication. Further research across multiple children may help to understand this phenomenon better.

Qualitative analysis revealed an improvement in Leo's relationship with his parents. His mother also reported better engagement with him and that his demeanor improved. Because the STTI is relationship based and is inherently designed to support the parent-child bond, these findings were anticipated. These outcomes align with previous research in which parents reported better relationships with their children because of parent-mediated interventions (Amsbary et al., 2021; Schertz et al., 2020; Stahmer et al., 2017). Among the current early intervention turn-taking literature, most studies involved parents to some degree (Lee & Staggs, 2021). Practitioners should continue incorporating the family to encourage optimal child outcomes in social communication interventions (DEC, 2014).

Previously, there have been few explorations of the PML approach to intervention for children with autism (e.g., Schertz et al., 2013; Schertz et al., 2018). This study lends support to this approach in promoting social communication in some children with autism. It also indicates that developmental, family-driven approaches, which are appropriate for young children and align with childhood-recommended practices, optimally encourage young children's social-emotional learning and enhance family relationships (Wetherby & Woods, 2008). The study also suggests that the PML approach may be successfully implemented in a telehealth setting. This new telehealth model may provide families with greater access to services and flexibility than in-home, in-person interventions. The telehealth design was also relatively cost-effective for the research team and allowed for little interventionist interference in the child's daily life, benefits which are reflected by other researchers (e.g., Dahiya et al., 2022; Freuler et al., 2014). Because this is the first telehealth PML intervention, future research is needed to determine if this model is suitable for other families and practitioners.

The study is limited to a single parent-child dyad, so the results should be interpreted cautiously. However, case studies provide in-depth explorations of innovative practices to understand their feasibility for broader use (e.g., Agazzi et al., 2013; Heale & Twycross, 2018; Vismara & Rogers, 2008). Leo was receiving other therapy services at the time of intervention, which may have impacted some of his progress during this intervention (e.g., his increases in vocalizations), so this progress should also be interpreted with caution. There were no notable technical issues throughout the intervention that impacted the study. This parent is proficient with technology and engaging in the telehealth model was not challenging for her. This experience may not be the same for all parents, so additional research is needed to understand the acceptability of the model across multiple parents.

Another limitation may be the short baseline period. However, despite a short baseline, Leo displayed few instances of social communication before the intervention, as demonstrated by the video data, the parent pre-intervention survey, and provider assessment data, thus indicating that he may benefit from a social communication intervention. Similar pilot intervention research on the Early Start Denver Model has provided valuable directions for future research and practice, even with a short baseline period (Vismara & Rogers, 2008). Because the present study did not demonstrate experimental control, our results should be interpreted with caution. Although this study does not report effect sizes, the increase in trends across variables indicates a need for further understanding of this intervention model. Future, single-subject, or randomized controlled trial explorations will provide data on the effectiveness of the intervention across multiple participants.

Statements and Declarations

Ethics Approval Ethical approval was obtained from the Committee on the Use of Human Subjects in Research at our university.

Conflicts of interest Kwangwon Lee, Fatima Godina, and Delaney Pike declare they have no conflicts of interest to disclose.

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