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Exploring the impact of online parent-led therapy (PLT) on social communication skills of autistic children in culturally and linguistically diverse (CaLD) environments

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Abstract

Purpose

This study explores outcomes of social communication skills for young autistic children in CaLD environments when supported by online PLT delivered in differing formats with language adaptations (LA).

Methods

A longitudinal between-groups multi-level design was used to study main factors of online PLT format (coached vs self-directed) and LA (provided vs not) over time (six months). The dependent variables included the Social Communication Questionnaire and the Vineland Adaptive Behaviour Scales-Third Edition across four timepoints (two pre- and two post-program) in approximately six months. Participant (n = 23) data were analysed with linear mixed effects models using Satterthwaite's t-test method.

Results

Significant improvement ($p \leq 0.05$) was found for combined participants, as well as for separate sub-groups, except for the LA group on vineland-3 V-scores.

Conclusions

Online PLT can be an effective specific support approach to boost social communication skills of young autistic children in bilingual environments. Promising trends must be confirmed in larger sample populations and within autistic CaLD subgroups. In addition to providing linguistic adaptations, clinicians should adapt standard monolingually designed strategies to be more culturally and contextually responsive.

MAIN TEXT

Specific communication support for autistic[1] children during the early years is crucial, particularly from parents and key caregivers, as children tend to spend more time in their homes and neighbourhoods during this period than in other settings (Zwaigenbaum et al., 2019). This is even more so for pre- and/or minimally verbal autistic children, for whom key vehicles of social communication development, such as joint attention, imitation, and gesture are considered more difficult (Blume et al., 2021; Talbott et al., 2020).

Language is central for social communication, participation in education and specific support, and social-emotional development (Fusaroli et al., 2019; Ganz et al., 2022). However, little is known about the

social communication development of young autistic children beyond single language (often English) environments (Siyambalapitiya et al., 2022). There is a critical need for investigation of how parents' language use within parent-child interactions impacts young autistic children in culturally and linguistically diverse (CaLD) environments.

Current recommendations encourage greater and more direct participation of parents in their children's learning support (Hyman et al., 2020). The role of family environments, parent language factors, and parent responsiveness within parent-child interactions is pivotal in the development of social communication skills for young autistic children (Caplan, 2020; Fusaroli et al., 2019; Pecukonis, Butler, et al., 2024). Parents may contribute to greater learning success and generalisation of skills by providing more focused learning opportunities, specific support in naturally occurring teachable moments, and stronger durability of acquired skills over time (Bordini et al., 2020; Brian, Drmic, et al., 2022; C. Y. Liao et al., 2023).

However, there are many tangible barriers to accessing appropriate services, including availability of practitioners in families' geophysical proximity, long waitlists, scheduling, potentially long commutes to numerous appointments, and the cost of clinical time (Carruthers et al., 2023; Pecukonis, Levinson, et al., 2024). These barriers are likely to be amplified for families of autistic children in CaLD environments who may also struggle with proficiency of the societal language, availability of bilingual practitioners, access to public infrastructure, and resource environment (Lim et al., 2021; Oudet et al., 2026). An online parent-led service delivery model, as opposed to traditional clinician-centred service provision, is relevant to addressing barriers by focusing on parents as direct implementors of specific support for their children.

The online context

Emerging research indicates a promising evidence base for the use of parent-led therapy (PLT) via telehealth in "coached" or "self-directed" formats (also referred to as parent-mediated, parent-implemented, or indirect therapy) to support the social communication development of autistic children (Brian, Solish, et al., 2022; Glenn et al., 2022), including positive outcomes for play and interactive skills, and adaptive functioning (Li et al., 2022; Liu & Schertz, 2022; Pierson et al., 2021).

The value of PLTs has been recently reviewed as beneficial and effective regarding skill development of young autistic children (Heidlage et al., 2020; C.-Y. Liao et al., 2022). Recent demonstrations of the efficacy of online PLTs in both coached and self-directed formats is promising (Azzano et al., 2023; Glenn et al., 2022). Emerging evidence also indicates that PLT provided during the early years is more cost-effective for families over time that traditional clinician-led specific support (Tinelli et al., 2023). However, the evidence remains rooted in the monolingual WEIRD (Western Educated Industrialised, Rich, Democratic) context (Oudet et al., 2024). Families with young autistic children beyond high-income and European countries are beginning to be included in research, indicating acceptability of PLT approach, and improved parent-child interactions and child social communication outcomes (Kalorath et al., 2022; Koly et al., 2021; Sengupta et al., 2020). However, there remains a paucity of evidence that specifically

pertains to online PLT in these settings and its impact on the social communication development of young autistic children in culturally and linguistically diverse (CaLD) environments.

Given the discourse regarding socio-cultural adaptation constructs (Deng et al., 2024), and the differences in parent-child verbal and behavioural interactions, it is critical to examine the impact that online PLT may have for young autistic children of CaLD families in the growing context of telehealth. Questions exploring the impact of online PLT to support social communication skills for young autistic children in CaLD environments are warranted.

Aim

This study aimed to explore the impact of online PLT delivered in differing formats and conditions. Research questions were:

1. What are the outcomes for self-directed vs coached formats of online PLT for young autistic children?
2. What are the outcomes when language adaptations to the standard online PLT are provided?

Methods

Ethical considerations

Ethical approval for this project was provided by the Canton Research Ethics Committee (Commission cantonale (VD) d'éthique de la recherche sur l'être humain) (CER-VD): Project ID 2023-00562. Written informed consent was provided by each participant.

Design and procedure

A between-groups multi-level longitudinal design was used to study main factors of mode of online PLT format (coached vs self-directed), and language adaptation (LA provided vs none). Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Fribourg (Harris et al., 2009, 2019). REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.

Once informed written consent had been provided, parents were asked to share demographic data using an adapted version of the Questionnaire for Parents of Bilingual Children (COST Action IS0804, 2011). A pre- and post-program schedule was used to take measures from each participant for their child in question using the Social Communication Questionnaire (Rutter et al., 2003) and Vineland Adaptive Behaviour Scales-Third edition (Sparrow et al., 2016). A summary of the timeline of measures is display in Figure 1. Click or tap here to enter text. Participants were asked to complete questionnaires

approximately one month before starting the program (T1) and just before starting the program (T2) to obtain their child's baseline level of social communication skills. Immediately following the end of the program, participants were asked to complete a third round of questionnaires (T3) to identify changes, if any, following their allocated online PLT program. Approximately three months later, participants were asked to complete a final round of questionnaires (T4) to determine outcome durability. All data was collected online via REDCap to maintain confidentiality and consistency of the platform use for participants. Total participation time was approximately six months for each participant.

Participants

Parents were recruited through Swiss-based clinical, educational, and family support organisations. Parents expressed interest via email and were offered individual information meetings via Microsoft Teams to provide more detail about the study and answer questions orally. A detailed written information form in either English or French was also provided. An Indian speech-language therapist, who also completed education at the University of Zurich, collaborated as a clinical liaison with Indian participants.

Inclusion criteria:

1. Participant had a child, or was a key carer of a child, on the autism spectrum. In this study the parent was the participant. No direct contact was had between the research team and the children in question.
2. Participant's autistic child lived in a bilingual environment, that is, two or more L1s are spoken in the child's household, or the shared home language is different to the dominant societal language.
3. Participant could adequately communicate in English or French. While online PLT materials were available in many languages, participants were required to communicate independently in oral and written form in one of the languages spoken by the clinical researcher. Participants were deemed to have sufficient language proficiency by their own report and during the initial individual information meeting with the clinical researcher.
4. Children in question were aged 8 years or younger at the time of recruitment. This encompassed the early years of communication development and the years before formal schooling begins across different countries (Our World in Data, 2025).

Exclusion criteria:

1. Parents had already participated in a More Than Words program, to exclude the possibility of a compound effect from having already completed this PLT.
2. Children in question were currently receiving support services from any member of the research team, to exclude the possibility of extra coaching beyond the program.
3. Parents could not make the time commitment to participate in the totality of the online PLT and pre-/post-program assessments, to increase the probability of participant retention for the study.

4. Parents were unable to adequately communicate in English or French to independently correspond with the clinical researcher.

Once informed written consent was obtained via REDCap, participants were allocated to one of four groups. Random allocation was planned for all groups but not possible as some participants expressed constraints that limited them to a certain delivery format. For example, a participant's work and/or travel schedule or time difference from the researcher's Central European Time meant they could not participate in the synchronous small group sessions, and they were therefore allocated to the self-directed groups. All participants chose to receive primary communication and complete questionnaires in English. Two coached groups received online PLT materials during weekly small group sessions lasting approximately 2.5 hours each. Two self-directed groups received online PLT materials by email each week, engaging with the content at their own pace. Following full participation, each parent was offered individual follow-up and a summary report of their child's progress within the study.

Of the initial 52 parents who expressed interest and received individual information meetings, 38 consented to participate. Twenty-six participants were allocated to the coached groups and 20 to the self-directed groups. Twenty-three participants remained involved until the end of their programs (T3) and 20 participants completed final measures (T4). The distribution of participants who completed online PLT programs across group conditions is displayed in Table 1.

Of the 23 participants who were retained for at least one post-program measure, there were 14 mothers (60.9%) and nine fathers (39.1%). Ten participants were married parents of the same children (five heterosexual couples). One parent reported being a single (divorced) mother. One parent reported living away from his children during the business week. All parents reported that their children were biologically theirs. Children of participants ranged in age from 2:2 years to 8;10 years at T1.

Participants were highly educated with all but one (who did not respond) (95.7%) reporting tertiary levels of education. Nine participants held bachelor's degrees, 10 held master's degrees, and three held doctoral degrees. Even though recruitment took place through Swiss-based organisations, only three participants were Swiss residents (13.0%). First languages (L1s) reported by final participants included English (3), Finnish (1), French (1), Hindi (6), Mandarin (1), Marathi (3), Odia (1), Portuguese (1), Spanish (4), and Thai (1). However, 15 participants (65.2%) reported that English was their child's L1.

Twelve participants (52.1%) reported being born and/or raised in low- and/or middle-income countries (LMIC) (World Bank, n.d.). Of those, 11 participants (47.8%) were from formerly British-colonised countries (India, Ireland, Kenya, US). Fifteen participants (65.2%) reported living outside their "home" country. Seven participants (30.4%) reported basic/weak societal language proficiency.

Materials

More Than Words®

The PLT program used for coached groups was the abridged More Than Words® - The Hanen Program® for Parents of Children on the Autism Spectrum or Who Have Social Communication Difficulties (More Than Words) in telehealth (online) format. This program is delivered by a speech-language therapist certified by the Hanen Centre. In addition to eight group sessions, More Than Words includes three individual video feedback sessions with each parent. Within this study, missed group sessions were not made up. Missed individual sessions were rescheduled insofar as it was possible within the group session agenda. Including all weekly group and individual video feedback sessions (12 sessions in total), the More Than Words program runs for approximately three months. All sessions were conducted via Microsoft Teams. Given the number of L1s reported, coached groups were run in English, which was the only common language spoken by all participants. Six separate programs were run to best account for participants' availability across multiple time zones and cultural calendars (Table 1). The programs took place between April and December 2024.

Participants in the self-directed groups followed the same timeline as their coached counterparts. However, instead of weekly group sessions, they received weekly emails with materials and strategies to asynchronously read, reflect on, and implement with their child. Materials for the self-directed program were based on the More Than Words guidebook, which all participants received regardless of group allocation. Self-directed participants did not receive video feedback sessions. Participants completed these programs between May and December 2024. Following completion of T4 measures, all participants in self-directed groups were offered individual synchronous sessions with the clinical researcher/clinician. This ensured that despite group allocations during data collection phases, all parents left the study with the opportunity to complete the More Than Words program.

All participants were offered a More Than Words guidebook (Sussman, 2012) in English or an e-book in French to accompany the program, regardless of the group to which they were assigned. All participants requested the English guidebook.

Language adaptations provided

LA were provided to participants in LA groups that explicitly guided them to tailor the standard program strategies to their specific CaLD context. Specific adaptations were provided through open discussions with each participant and varied depending their children's specific language environments. LA included:

1. **Bilingual materials.** Program content was provided in the language of the participant's choice. Participants in this study's LA groups requested French, Spanish, and Hindi translations. Participants in the coached LA group received official More Than Words translated materials requested from Hanen. Participants in the self-directed LA group received content translated by this study's research team.
2. **Bilingual vocabulary goals.** Participants were guided to teach and reinforce target vocabulary in all environmental languages.

3. **Cultural sensitivity.** Awareness of cultural differences were an important consideration and program activities were adapted accordingly. Some cultural practices may influence communication styles or social interactions. Sensitivity to such differences was important to create an inclusive program for all families.
4. **Home language support.** Participants were encouraged to continue using their L1s with their children and incorporate their language(s) in daily activities and interactions.
5. **Collaboration with bilingual professionals.** Additional feedback was provided by a panel of experts by experience (autistic individual and two parents of autistic children) as appropriate. Collaboration with participants' existing clinical teams was also offered for more effective implementation of program strategies within existing specific support plans.

Following full participation in this study, all participants were given the opportunity to receive LA and coaching, ensuring that every parent who completed this study had the same opportunity to receive the same level of PLT.

Social Communication Questionnaire (SCQ)

The SCQ (Rutter et al., 2003), which is based on the Autism Diagnostic Interview (ADI-R) (de Bildt et al., 2015; Lord et al., 1994), is a brief 40-item yes/no response caregiver-reported screening of traits associated with autismClick or tap here to enter text.. While a screening tool cannot be used to make a diagnosis, it can provide relevant and informative data from which to determine progress and assess observable social communication skill development over time. Available in a variety of (mostly European) languages, the SCQ has been validated for use with young children and is commonly used in clinical and education settings.

Vineland Adaptive Behaviour Scales (Vineland)

The Vineland is a leading evaluation tool supporting the assessment of intellectual and developmental skills. The Vineland third edition (Sparrow et al., 2016) is the latest revision, aiding in diagnosis as well as providing valuable information for developing educational and specific support plans. Standardised with an English-speaking population and validated for use with individuals aged 0-99, the Vineland-3 is currently available in Spanish and Canadian French. This measure has a greater number of items than the Vineland-2, reflecting earlier and/or more foundational skills that are likely to be present at lower levels of ability. At the time of this report, European French language version was only available for the Vineland-2 (Sparrow et al., 2005), which was offered as an English alternative to potential participants. However, all participants independently chose to complete all measures in English, making potential limitations related to data adjustment between Vineland versions redundant.

Data analysis

Original analysis protocol

The initial data analysis plan was formulated with the expectation of data collected from at least 60 participants from both measures of the SCQ and Vineland-3 Communication (subdomains Receptive, Expressive, Written) and Socialisation (subdomains (Interpersonal Relationships, Playing and Leisure, Coping Skills) domains. Vineland-3 domain-level standard scores (sometimes called z-scores) are based on scores from each of their respective subdomains and are standardised to the conventional metric of 100 (mean) and 15 (standard deviation). As a screening rather than a diagnostic tool, SCQ scores are not standardised and raw scores were used in analysis.

Linear mixed effects models were to be built with fixed factors of online service delivery format (coached vs self-directed) and language adaptation (LA) (provided vs none). Other important factors that may impact outcomes were also to be included to see if they improved the model, including socioeconomic status (Baio et al., 2019) and community language proficiency (Zuckerman et al., 2014). Participants were to be automatically included as a random effect with a full random slope structure, or the most complex to converge, as recommended in Matuschek et al. (2017). The final models detailing the random effect structure and included control variables were to be reported for each model. Factors that were not included in the final models were to be treated with broad strokes correlation and descriptive analysis. The original plan and subsequent amendments made are registered with the Open Science Framework (https://doi.org/10.17605/OSF.IO/8QNGX).

Data attrition

The loss of data (early withdrawal of participants, corrupted data collection) from research projects is a great source of concern for longitudinal studies. The loss of participants during different phases of data collection may affect the validity of results obtained, the effects of which, are also more likely to increase and possibly compound over the length of study period undertaken (Ahern & Le Brocque, 2005). In this study, participant dropout altered the characteristics of the original sample, as most of the loss happened within the self-directed groups. Data was also lost in the form of incorrect completion of the Vineland-3 questionnaire over the course of the study by some participants. In order to avoid any sampling bias or differential effects depending on these types of missing data, the analysis protocol for complete datasets collected was reassessed and amended.

Amendments to the data analysis protocol

Due the unexpected amount of attrition experienced during this study, particularly from the self-directed groups and incomplete Vineland-3 data, the original analysis protocol was amended.

The only Vineland-3 subdomains found to be unaffected by missing data were within the Socialisation domain: Playing and Leisure, and Coping Skills. As domain-level standard scores (100/15 metric) could not be computed, V-scale scores (15 mean, 3 standard deviation) were computed for these two subdomains that were found to be intact. V-scores are standardised against the normative sample on a smaller scale and represent equal intervals and developmental expectations more precisely than raw scores (Sparrow et al., 2016).

R was used to run statistical analyses (R Core Team, 2024). Linear mixed-effect modelling was used to analyse data, which is recommended for hypothesis testing in psycholinguistics (Barr et al., 2013). This approach allowed experimentally manipulated variables of LA vs non-LA to be analysed with a fixed effect of time. Fixed factors of service delivery format (coached vs self-directed) could not be applied to the model due to imbalanced attrition between groups. Participants were still included as a random effect to account for individual differences as they each differed in baseline levels and response to slope predictors across the multiple timepoints of data. Multiple separate mixed-effects models were run to investigate the role of LA. Three separate models were run, with as outcome SCQ Vineland-3 Playing and Leisure subdomain, and Vineland-3 Coping Skills subdomain data respectively. Separate linear mixed-effects models were run on each dataset for both LA and non-LA groups to examine fixed factors of LA provided. All models were fit with Satterthwaite's t-test method.

Other important factors, including resource status. and community language proficiency, which could not be added to the model, were treated with broad strokes correlation and descriptive analysis.

Results

Seven participants (six of whom were LMIC born/raised) (30.4%) connected to sessions and meetings with the clinical researcher with their mobile telephones. Seven participants (all of whom were LMIC residents) (30.4%) were in shared home spaces (e.g. living room, kitchen) or public spaces (e.g. on the street, in a public courtyard).

While LA were explicitly provided to 10 participants (43.5%), a further six (26.1%) reported adapting strategies for their CaLD environments independently of the online PLT format provided. Therefore, in practice, 69.6% of participants implemented therapeutic strategies received during their online PLT with LA.

A summary of linear mixed-effect modelling results for combined and separated datasets from the SCQ and Vineland-3 scores are displayed in Table 3. Overall, datasets showed statistically significant gains ($p \leq 0.05$) of all online PLT programs delivered to participants in this study over time across measures on autistic children's social communication, play, and adapting skills. The only group that showed non-significant gains on the Vineland-3 V-scores of Playing ($p = 0.385$) and Coping ($p = 0.282$) subdomains was the LA participants. This non-significant gain in the LA Vineland-3 datasets, in contrast to the significant gains in the non-LA Vineland-3 datasets, did not impact the finding of significance in the combined scores of either Vineland-3 subdomain, indicating the strength of gains reported by participants overall.

Combined data averages of SCQ (Tables 4–5) indicate that greatest gains of skills were reported both during the program period (T3-T2). This indicates that parents observed fewer behaviours associated with autism from their autistic children during the active period of training. Combined data averages of Vinelands-3 V-scores (Tables 6–9) indicate that greatest gains of skills were reported during the

generalisation period (T4-T3). Summaries of Vinelands-3 raw score analyses are included as supplementary data (Tables 10–14).

Discussion

This study aimed to identify the outcomes of coached vs self-directed online PLT delivered to parents of young autistic children in bilingual environments, and whether explicitly provided LA improved results. Participants took part in eight sessions of online PLT, with coached groups receiving an additional three individual video feedback sessions, and contributed data over the course of six months. Analyses specifically investigated changes in outcome on social communication skills as measured by the SCQ and Vineland-3.

Ultimately, the first research question regarding comparisons of online PLT format delivery (coached vs self-directed) could not be addressed due to the unforeseen level of data attrition over the course of this longitudinal study, which most notably affected the self-directed groups and Vineland-3 data collected. Regarding the second research question of comparisons between the explicit provision of LA vs none, combined results showed significant outcomes, indicating that online PLT has positive and durable effects for young autistic children in CaLD environments regardless of overt LA provided during the programs. Findings are likely to have been impacted by the specific CaLD and resource environments in which these families were implementing PLT strategies for their autistic children.

Given this relatively small sample size (n=23), it is difficult to inference why LA participants showed non-significant results in the Vineland-3 Playing & Leisure and Coping Skills subdomain analyses, which indicate development of social skills. These results were surprising and prompted a related qualitative study with a subset of this participant cohort to better understand the perspectives of participants who struggled during their online PLT programs (Oudet et al., 2026). The combination of results from this current study and the related qualitative study align with contemporary arguments for greater attention to the role of individual parent factors and the importance of specific socio-cultural customisation (beyond language adaptations) for effective online PLT (Pecukonis, Butler, et al., 2024).

Nevertheless, while gains in the LA group may not have been statistically significant on the Vinelands-3 V-scores, SCQ scores for this same group were statistically significant. These significant results indicate that LA provided within the participants' online PLT programs were observably and quantifiably effective. This promising finding adds to the emerging research demonstrating that online PLT supporting social communication development has positive outcomes (Azzano et al., 2023; Glenn et al., 2022) when delivered for young autistic children in CaLD environments.

There was a great diversity of CaLD families represented in this study, with only three participants reporting that English was their L1. However, almost two-thirds of parents reported that English was their child's L1, despite only one family reportedly living in an English-speaking community. This indicates that many families continue to prioritise English, regardless of whether it is their L1 or heritage language. Given the global mobility of families today and the effects associated with low societal language

proficiency when living abroad, it is possible that, where heritage languages are not an available option, families find specific support and education structures in English more accessible than non-English language local services, regardless of whether it is their own L1. For families who anticipate relocating internationally, or wanting to preserve their child's possibility to access international opportunities, it is also conceivable that the global accessibility of English language services persuades parents to foster English language learning for their autistic children in hopes of ensuring continuity of care in future non-L1 speaking countries. Additionally, given that almost half (47.8%) of participants were from formerly British-colonised countries, this priority for English-language development may be associated with English-language dominance in their cultures and perceived language prestige more globally. While beyond the scope of this study, factors of parents' language use and choices for their young autistic children, and how this impacts the efficacy of online PLT in CaLD environments must be examined in future research.

The extensive diversity with this study's sample cohort may have affected the ability for the online PLT programs to be as specifically tailored to each family's socio-cultural context as needed, which may have led to even greater positive outcomes. This study supports the call for greater understanding of the needs of CaLD subgroups within the autism community and the specific conditions under which adaptations must be made to ensure greater effectiveness of online PLT for social communication skills development of young autistic children (Oudet et al., 2026).

Nevertheless, overall, participants reported statistically significant outcomes for their young autistic children's social communication skills following online PLT. These findings align with emerging evidence indicating that online PLT can enable learning and skill acquisition for parents in CaLD environments, in turn leading to effecting specific support for their young autistic children (Glenn et al., 2022; Pierson et al., 2021). Results from this online study extend contemporary evidence recommending online PLT as an effective approach to supporting language development for young autistic children in bilingual environments (C. Y. Liao et al., 2023; Pierson et al., 2021; Siyambalapitiya et al., 2022).

Limitations and further directions

While this study adds to the scant evidence-base recommending online PLT as an effective service delivery model for specific support of social communication skills in CaLD environments for young autistic children, limitations related to the sample population and feasibility issues must be acknowledge.

The final sample population was considerably smaller than initial estimates. The unanticipated attrition, particularly within the self-directed groups required a shift in data analysis protocol. Consequently, these results have a low effect size and must be replicated with larger participant numbers for greater statistical power. Additionally, the imbalanced attrition did not allow for the specific investigation of the first research question, which should be explored in further research. It is possible that attrition within the self-directed group was influenced by the reduced clinical contact that is inherent within self-directed online PLT formats, though may perhaps of greater importance when supporting families in CaLD

environments. Other factors that may have contributed to this attrition likely include individual family environmental factors that initially made the coached format non-feasible (for example, changing of jobs, international relocation, childbirth/newborn care responsibilities). While possible contributing factors are speculative at this time, the levels of attrition for the self-directed programs remain meaningful. These findings are clinically informative and practitioners of online PLT must take into account the specific feasibility factors that may impact engagement for each CaLD family when recommending self-directed formats.

Connectivity and device availability was a practical issue, particularly for participants connecting from LMIC countries. Some parents had unstable internet, connected on their mobile telephone devices, and/or from shared/busy/noisy spaces, all of which made it difficult for them to maintain engagement during synchronous sessions. Punctuality for both synchronous sessions and questionnaire completion also varied between participants, meaning that program attendance and measures became approximative rather than fixed, as initially planned. While this may have had minimal impact on this study's results, it further indicates the need for socio-cultural tailoring of online PLT programs to ensure that families from non-WEIRD settings can maximise the benefits of this specific support approach. Future study design should pay attention to individual parent profiles, including greater flexibility for resource availability and culturally informed habits, when collecting data from such diverse populations.

While many participants expressed a priority for their young autistic child to be supported in English, themselves reporting comfortable/fluent proficiency in English, it is possible that some participants did not have the necessary language competence to fully engage with the subtleties of the program content and discussions, including those surrounding how to implement LA. Some participants may have overestimated their non-L1 English language proficiency, which may have been conversationally comfortable, but ultimately inadequate for structured and nuanced learning of therapeutic strategies and the corresponding LA. Provision of online PLT in a participant's L1 may allow them to engage with the program more naturally, further maximising the benefits of this support approach. However, the exploratory scope of this study and desire to include a range of CaLD participants meant that English became the common language amongst the highly diverse cohort recruited. Future studies may consider narrowing the inclusion criteria to purposefully target families with young autistic children in specific CaLD subpopulations. A more limited inclusion criteria may also reduce the tangible constraints imposed by coordinating across global time zones and the intangible effects of participants connecting at times of day when they are likely to be more fatigued and/or stressed than others. Further research should consider closer collaboration with clinical stakeholders local to the specific CaLD population in question who can deliver the online PLT program with LA in closer CaLD proximity to the families being supported. Research questions regarding how CaLD families experience LA and the impact of more specific socio-cultural customisation of online PLT strategies for population subgroups are warranted.

Other factors that could not be investigated in this study include the impact for families in which each parent completed a different format of online PLT (for example, coached vs self-directed vs hybrid), differing household structures in which the participating parent did not have constant custody of their

child (for example, co-parenting arrangements, parents who often work away from home), and the differences in outcomes associated with parents who were employed outside the home (versus not) and for differing numbers of hours (for example, part-time vs full-time vs overtime equivalents). For example, it is likely that the social communication outcomes of online PLT for young autistic children in CaLD environments are impacted by differences in the amount of interaction time spent with their parent, who is engaging with their program alongside differing amounts of clinical support, and with differing levels of stress and energy related to external demands. These factors constitute key elements of participants' individual parent considerations and socio-cultural-economic dynamics that may impact a parent's ability to successfully engage with online PLT. Future quantitative and qualitative research should include these factors in analysis.

Conclusions

Promising findings from this study demonstrate clear trends that reinforce the recommendation that young autistic children's social communication skills can be effectively supported through online PLT in the CaLD context. Despite the non-significant gains within the group that received LA, gains and positive feedback were reported nonetheless. Alongside related qualitative analysis, this study indicates that the nuances of each family's CaLD environment, including their individual personal factors, need to be more specifically incorporated when providing LA. More investigation is needed regarding how to better and more accessibly tailor LA within online PLT to each CaLD families' unique context to maximise social communication gains for young autistic children in these environments. This work contributes to the emerging literature calling for a shift towards centralising parents in their autistic children's specific support structures through online PLT. Further research is needed to substantiate these results with larger sample populations. More attention must be paid to specific subgroups within the extremely heterogenous autism and CaLD communities. Feasibility issues and close collaboration with local stakeholders for each family's particular context should be considered, especially when working with non-WEIRD populations.

References

1. Ahern, K., & Le Brocque, R. (2005). Methodological Issues in the Effects of Attrition: Simple Solutions for Social Scientists. *Field Methods*, *17*(1), 53–69. https://doi.org/10.1177/1525822X04271006
2. Azzano, A., Vause, T., Ward, R., & Feldman, M. A. (2023). Telehealth parent training for a young child at risk for autism spectrum disorder. *BEHAVIORAL INTERVENTIONS*. https://doi.org/10.1002/bin.1917
3. Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., Kurzius-Spencer, M., Zahorodny, W., Rosenberg, C. R., White, T., Durkin, M. S., Imm, P., Nikolaou, L., Yeargin-Allsopp, M., Lee, L. C., Harrington, R., Lopez, M., Fitzgerald, R. T., Hewitt, A., … Dowling, N. F. (2019). Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities

Monitoring Network, 11 Sites, United States, 2014. *MMWR. Surveillance Summaries*, *67*(6), 1–23. https://doi.org/10.15585/MMWR.SS6706A1

4. Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, *68*(3), 255–278. https://doi.org/10.1016/J.JML.2012.11.001
5. Blume, J., Wittke, K., Naigles, L., & Mastergeorge, A. M. (2021). Language Growth in Young Children with Autism: Interactions Between Language Production and Social Communication. *Journal of Autism and Developmental Disorders*, *51*(2), 644–665. https://doi.org/10.1007/s10803-020-04576-3
6. Bordini, D., Paula, C. S., Cunha, G. R., Caetano, S. C., Bagaiolo, L. F., Ribeiro, T. C., Martone, M. C. C., Portolese, J., Moya, A. C., Brunoni, D., Bosa, C., Brentani, H., Cogo-Moreira, H., & Jesus Mari, J. (2020). A randomised clinical pilot trial to test the effectiveness of parent training with video modelling to improve functioning and symptoms in children with autism spectrum disorders and intellectual disability. *Journal of Intellectual Disability Research*, *64*(8), 629–643. https://doi.org/10.1111/jir.12759
7. Brian, J., Drmic, I., Roncadin, C., Dowds, E., Shaver, C., Smith, I. M., Zwaigenbaum, L., Sacrey, L.-A. R., & Bryson, S. E. (2022). Effectiveness of a Parent-Mediated Intervention for Toddlers with Autism Spectrum Disorder: Evidence from a Large Community Implementation. *Autism: The International Journal of Research and Practice*, *26*(7), 1882–1897. https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1350543&site=ehost-live
8. Brian, J., Solish, A., Dowds, E., Roth, I., Bernardi, K., Perry, K., Daoud, S., Jilderda, S., MacWilliam, S., Smith, I. M., Zwaigenbaum, L., & Bryson, S. (2022). "Going Mobile"-Increasing the Reach of Parent-Mediated Intervention for Toddlers with ASD via Group-Based and Virtual Delivery. *Journal of Autism and Developmental Disorders*, *52*(12), 5207–5220. https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1354411&site=ehost-live
9. Bury, S. M., Jellett, R., Spoor, J. R., & Hedley, D. (2020). "It Defines Who I Am" or "It's Something I Have": What Language Do [Autistic] Australian Adults [on the Autism Spectrum] Prefer? [Article]. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-020-04425-3
10. Caplan, B. (2020). Responsive parenting, gene-environment interactions, and heterogeneous social development in autism spectrum disorder. In *Dissertation Abstracts International: Section B: The Sciences and Engineering* (Vol. 81, Issues 5-B). https://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2020-04055-011&site=ehost-live
11. Carruthers, S., Mleczko, N., Page, S., Ahuja, S., Ellis, C., Howlin, P., Leadbitter, K., Taylor, L., Slonims, V., & Charman, T. (2023). Using implementation science frameworks to explore barriers and facilitators for parents' use of therapeutic strategies following a parent-mediated autism intervention. *Autism*, *27*(4), 1011–1025. https://doi.org/10.1177/13623613221125630
12. COST Action IS0804. (2011). *Questionnaire for Parents of Bilingual Children (PaBIQ)* (Vol. 0804). http://www.bi-sli.org

13. de Bildt, A., Sytema, S., Zander, E., Bölte, S., Sturm, H., Yirmiya, N., Yaari, M., Charman, T., Salomone, E., LeCouteur, A., Green, J., Bedia, R. C., Primo, P. G., van Daalen, E., de Jonge, M. V., Guðmundsdóttir, E., Jóhannsdóttir, S., Raleva, M., Boskovska, M., … Oosterling, I. J. (2015). Autism Diagnostic Interview-Revised (ADI-R) Algorithms for Toddlers and Young Preschoolers: Application in a Non-US Sample of 1,104 Children. *Journal of Autism and Developmental Disorders*, *45*(7), 2076. https://doi.org/10.1007/S10803-015-2372-2
14. Deng, Y., Yan, X., Chen, M. K., Nadeem, M. U., & Kulich, S. J. (2024). Does culture matter? Re-examining cultural distance, conflict, and socio-cultural adaptation in MNCs in southwestern China. *International Journal of Intercultural Relations*, *103*. https://doi.org/10.1016/j.ijintrel.2024.102077
15. Fusaroli, R., Weed, E., Fein, D., & Naigles, L. (2019). Hearing me hearing you: Reciprocal effects between child and parent language in autism and typical development. *Cognition*, *183*, 1–18. https://doi.org/10.1016/j.cognition.2018.10.022
16. Ganz, J. B., Liew, J., Yllades, V., Liao, C. Y., Luo, W., Hong, E. R., Yoro, A. J., Rodriguez, D., Clark, S., Stein, K., & Ura, S. K. (2022). Communication and Affective Synchrony between Parents and Their Children with Autism during a Multimodal Communication Parent-Coaching Intervention. *Child and Family Behavior Therapy*, *44*(2), 113–134. https://doi.org/10.1080/07317107.2022.2043683
17. Glenn, E., Taiwo, A., Arbuckle, S., Riehl, H., & McIntyre, L. L. (2022). Self-Directed Web-Based Parent-Mediated Interventions for Autistic Children: A systematic review. In *Review Journal of Autism and Developmental Disorders*. Springer. https://doi.org/10.1007/s40489-022-00307-9
18. Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., & Duda, S. N. (2019). The REDCap consortium: Building an international community of software platform partners. In *Journal of Biomedical Informatics* (Vol. 95). Academic Press Inc. https://doi.org/10.1016/j.jbi.2019.103208
19. Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*(2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010
20. Heidlage, J. K., Cunningham, J. E., Kaiser, A. P., Trivette, C. M., Barton, E. E., Frey, J. R., & Roberts, M. Y. (2020). The effects of parent-implemented language interventions on child linguistic outcomes: A meta-analysis. *Early Childhood Research Quarterly*, *50*, 6–23. https://doi.org/10.1016/J.ECRESQ.2018.12.006
21. Hyman, S. L., Levy, S. E., Myers, S. M., Kuo, D. Z., Apkon, C. S., Davidson, L. F., Ellerbeck, K. A., Foster, J. E. A., Noritz, G. H., O'Connor Leppert, M., Saunders, B. S., Stille, C., Yin, L., Brei, T., Davis, B. E., Lipkin, P. H., Norwood, K., Coleman, C., Mann, M., … Paul, L. (2020). Identification, evaluation, and management of children with autism spectrum disorder. *Pediatrics*, *145*(1). https://doi.org/10.1542/PEDS.2019-3447
22. Kalorath, N., Menon, S. B., & Jayan, C. (2022). A systematic review on parent mediated intervention programmes for children with autism spectrum disorders in Indi. *International Journal Of Community*

Medicine And Public Health, *9*(6), 2718. https://doi.org/10.18203/2394-6040.ijcmph20221332

23. Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the UK autism community. *Autism*, *20*(4), 442–462. https://doi.org/10.1177/1362361315588200
24. Koly, K. N., Martin-Herz, S. P., Islam, Md. S., Sharmin, N., Blencowe, H., & Naheed, A. (2021). Parent mediated intervention programmes for children and adolescents with neurodevelopmental disorders in South Asia: A systematic review. *PLoS ONE*, *16*(3). https://doi.org/10.1371/journal.pone.0247432
25. Li, F., Wu, D., Ren, F., Shen, L., Xue, M., Yu, J., Zhang, L., Tang, Y., Liu, X., Tao, M., Zhou, L., Jiang, L., Xu, M., & Li, F. (2022). Effectiveness of Online-Delivered Project ImPACT for Children With ASD and Their Parents: A Pilot Study During the COVID-19 Pandemic. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.806149
26. Liao, C. Y., Ganz, J. B., Vannest, K. J., Wattanawongwan, S., Pierson, L. M., Yllades, V., & Li, Y. F. (2023). Caregiver Involvement in Communication Intervention for Culturally and Linguistically Diverse Families with Individuals with ASD and IDD: a Systematic Review of Cross-Cultural Research. In *Review Journal of Autism and Developmental Disorders* (Vol. 10, Issue 2, pp. 239–254). Springer. https://doi.org/10.1007/s40489-021-00288-1
27. Liao, C.-Y., Ganz, J. B., Wattanawongwan, S., Haas, A. N., Ura, S. K., Vannest, K. J., & Morin, K. L. (2022). Effects of a Parent-Mediated Multimodal Communication Intervention on Communicative Behaviors in Children with Autism Spectrum Disorder. *Education and Treatment of Children*, *45*(4), 321–339. https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1357611&site=ehost-live
28. Lim, N., O'Reilly, M. F., Londono, F. V., & Russell-George, A. (2021). Overcoming language barriers between interventionists and immigrant parents of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *51*(8), 2876–2890. https://doi.org/10.1007/s10803-020-04754-3
29. Liu, X., & Schertz, H. H. (2022). Parent Outcomes of Parent-Mediated Intervention for Toddlers with Autism. *Topics in Early Childhood Special Education*, *42*(3), 259–268. https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1353898&site=ehost-live
30. Lord, C., Rutter, M., & Le Couteur, A. (1994). Autism Diagnostic Interview-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders*, *24*(5), 659–685. https://doi.org/10.1007/BF02172145
31. Monk, R., Whitehouse, A. J. O., & Waddington, H. (2022). The use of language in autism research. *Trends in Neurosciences*. https://doi.org/10.1016/j.tins.2022.08.009
32. Oudet, S., Howard, K., Gilhuber, C., Robert, M., Zimmerli, J., Katsos, N., & Durrleman, S. (2024). Parent-led Communication Therapy for Young Bilingual Autistic Children: A Scoping Review. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-024-06478-0

33. Oudet, S., Howard, K., Katsos, N., & Durrleman, S. (2026). Better engagement with culturally and linguistically diverse parents of autistic children in online parent-led therapy? An interpretative phenomenological analysis. *Advances in Autism*, 1–17. https://doi.org/10.1108/AIA-09-2025-0090
34. Our World in Data. (2025). *Official entrance age to compulsory education, 2024*. UNESCO Institute of Statistics. https://ourworldindata.org/grapher/official-entrance-age-to-compulsory-education
35. Pecukonis, M., Butler, L. K., & Tager-Flusberg, H. (2024). What role does the environment play in language development? Exploring the associations among socioeconomic status, parent language input, and language skills in school-aged children with autism. *Autism Research*. https://doi.org/10.1002/aur.3252
36. Pecukonis, M., Levinson, J., Chu, A., Broder-Fingert, S., Feinberg, E., Cabral, H., & Tager-Flusberg, H. (2024). Investigating the association between socioeconomic status and language skills in children with autism spectrum disorder or other developmental delays. *Infant and Child Development*, *33*(4). https://doi.org/10.1002/ICD.2493
37. Pierson, L. M., Thompson, J. L., Ganz, J. B., Wattanawongwan, S., Haas, A. N., & Yllades, V. (2021). Coaching parents of children with developmental disabilities to implement a modified dialogic reading intervention using low technology via telepractice. *American Journal of Speech-Language Pathology*, *30*(1), 119–136. https://doi.org/10.1044/2020_AJSLP-20-00037
38. R Core Team. (2024). *R: A Language and Environment for Statistical Computing*. https://www.R-project.org/.
39. Rutter, M., Bailey, A., & Lord, C. (2003). *Social Communication Questionnaire*. Western Psychological Services.
40. Sengupta, K., Mahadik, S., & Kapoor, G. (2020). Glocalizing project ImPACT: Feasibility, acceptability and preliminary outcomes of a parent-mediated social communication intervention for autism adapted to the Indian context. *Research in Autism Spectrum Disorders*, *76*. https://doi.org/10.1016/j.rasd.2020.101585
41. Siyambalapitiya, S., Paynter, J., Nair, V. K. K., Reuterskiöld, C., Tucker, M., & Trembath, D. (2022). Longitudinal Social and Communication Outcomes in Children with Autism Raised in Bi/Multilingual Environments. *Journal of Autism and Developmental Disorders*, *52*(1), 339–348. https://doi.org/10.1007/s10803-021-04940-x
42. Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Échelles d'adaptation de Vineland - deuxième édition : Manuel (version française) [Vineland Adaptive Behaviour Scales - Second Edition: Manual (French version)]*. Pearson Assessments.
43. Sparrow, S. S., Cicchetti, D. V., & Saulnier, C. A. (2016). *Vineland Adaptive Behaviour Scales, Third Edition: Manual* .
44. Sussman, F. (2012). *More Than Words: A Parent's Guide to Building Interaction and Language Skills for Children with Autism \Spectrum Disorder or Social Communication Difficulties* (2nd edition). The Hanen Centre.

45. Talbott, M. R., Young, G. S., Munson, J., Estes, A., Vismara, L. A., & Rogers, S. J. (2020). The developmental sequence and relations between gesture and spoken language in toddlers with autism spectrum disorder. *Child Development*, *91*(3), 743–753. https://doi.org/10.1111/cdev.13203
46. Tinelli, M., Roddy, A., Knapp, M., Arango, C., Mendez, M. A., Cusack, J., Murphy, D., Canitano, R., Oakley, B., & Quoidbach, V. (2023). Economic analysis of early intervention for autistic children: findings from four case studies in England, Ireland, Italy, and Spain. *European Psychiatry : The Journal of the Association of European Psychiatrists*, *66*(1). https://doi.org/10.1192/J.EURPSY.2023.2449
47. World Bank. (n.d.). *World Bank country classifications by income level for 2024-2025*. Retrieved November 5, 2025, from https://blogs.worldbank.org/en/opendata/world-bank-country-classifications-by-income-level-for-2024-2025
48. Zuckerman, K. E., Sinche, B., Mejia, A., Cobian, M., Becker, T., & Nicolaidis, C. (2014). Latino Parents' Perspectives on Barriers to Autism Diagnosis. *Academic Pediatrics*, *14*(3), 301–308. https://doi.org/10.1016/J.ACAP.2013.12.004
49. Zwaigenbaum, L., Brian, J. A., & Ip, A. (2019). Early detection for autism spectrum disorder in young children. *Paediatrics & Child Health*, *24*(7), 424–443. https://doi.org/10.1093/pch/pxz119

Footnotes

1. Aligning with preferences expressed by the autism community, this study will use terms "autistic", "on the spectrum," and "specific support" (Bury et al., 2020; Kenny et al., 2016; Monk et al., 2022). The word "therapy" is only used within the widely used term "parent-led therapy."

Figures

Figure 1. Timeline of measures.

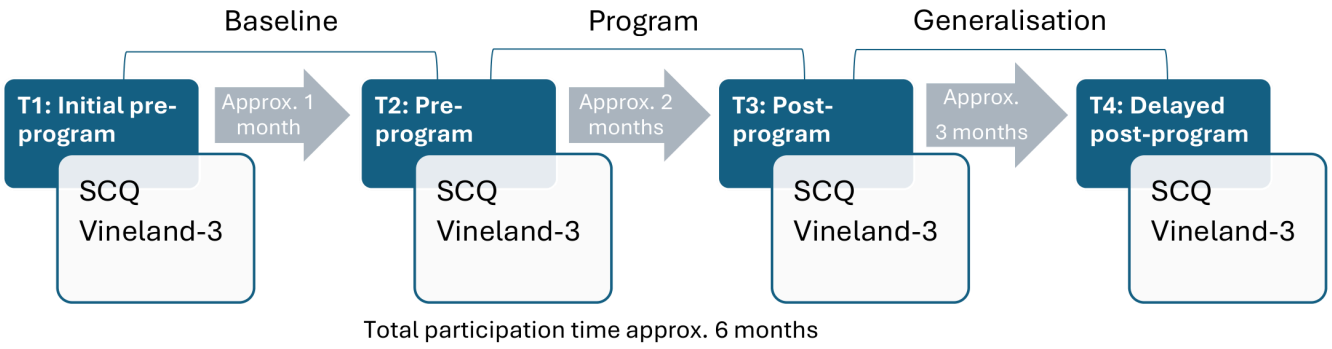
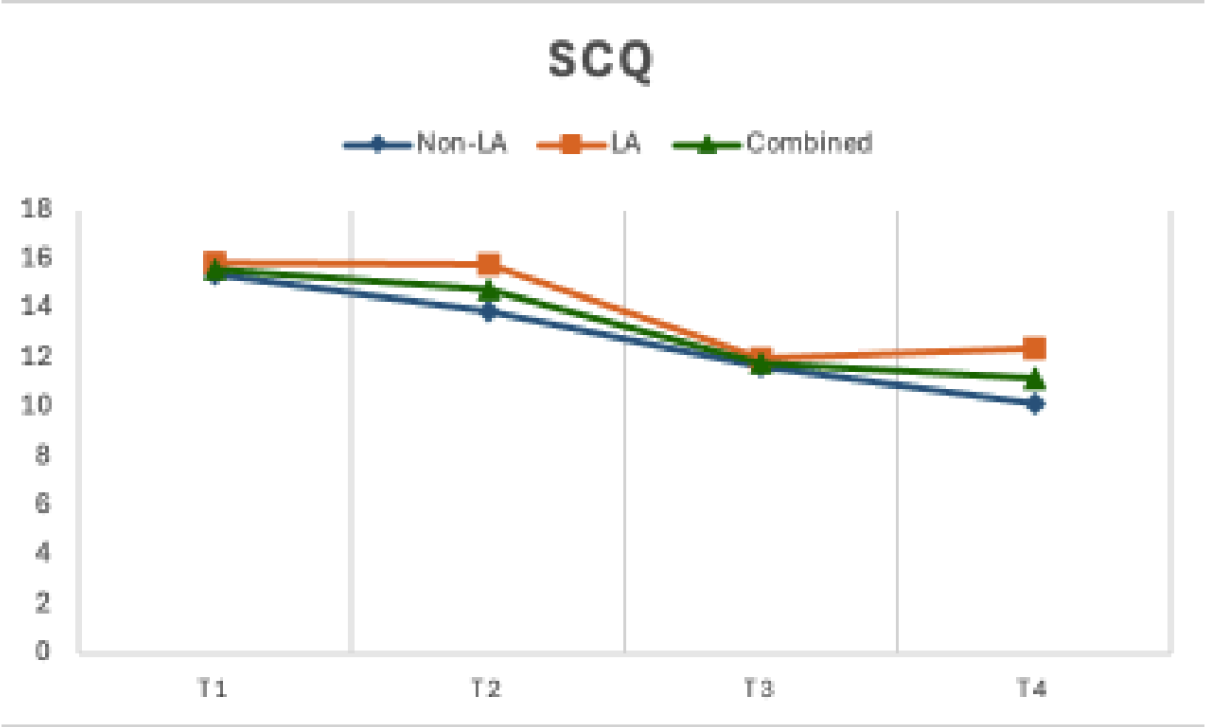


Figure 1

See image above for figure legend.

Figure 2. SCQ score* summary

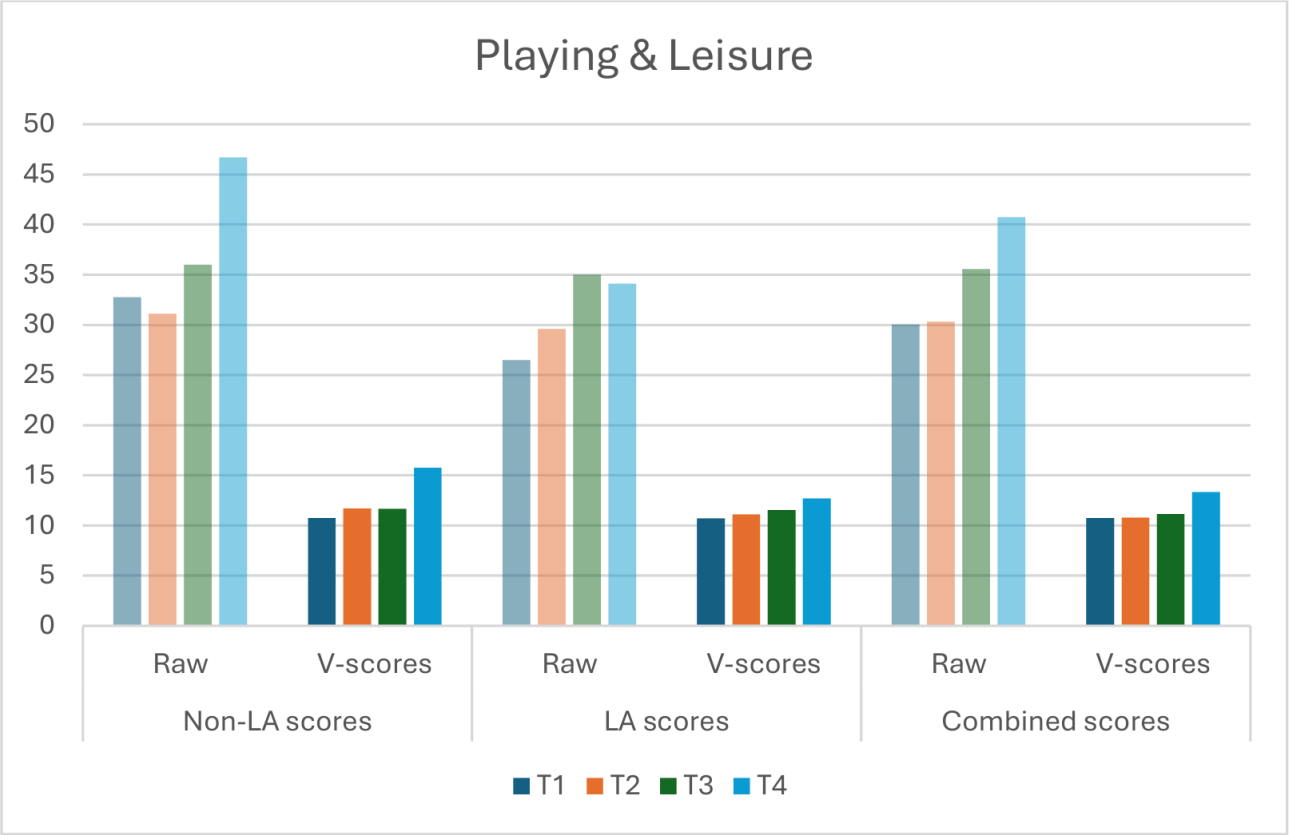


*Lower scores indicate fewer observed autism-related traits.

Figure 2

See image above for figure legend.

Figure 3. Vineland-3 Playing & Leisure (Socialisation Domain) score* summary

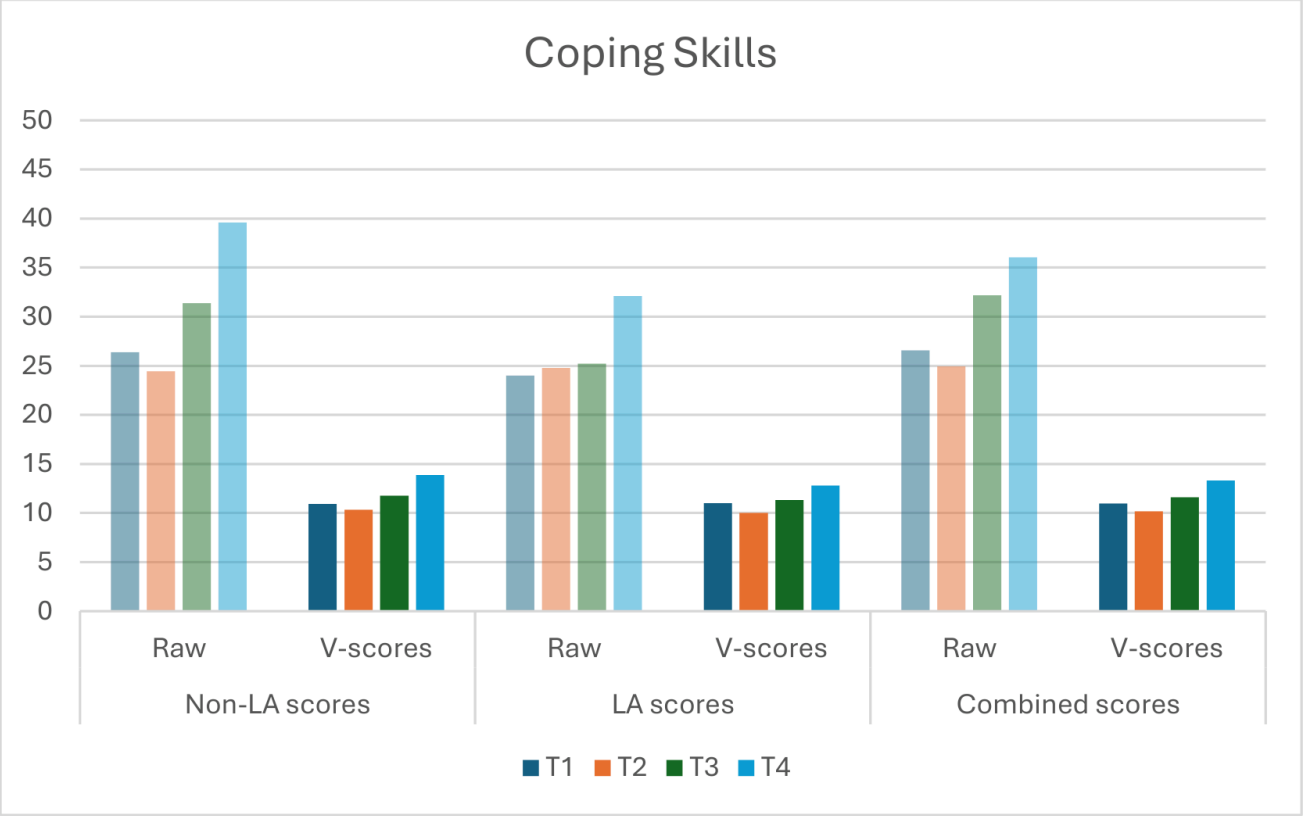


*Higher scores indicate more observed adaptive behaviours.

Figure 3

See image above for figure legend.

Figure 4. Vineland-3 Coping Skills (Socialisation Domain) score* summary



*Higher scores indicate more observed adaptive behaviours.

Figure 4

See image above for figure legend.

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