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Enhanced milieu teaching for children with autism spectrum disorder in South Africa

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Abstract

Purpose—Efficient and effective interventions are required to meet the communication needs of children with autism spectrum disorders (ASDs). However, most children with ASD living in South Africa do not receive individualised interventions.

Method—This multiple baseline study examined the effects of therapist-implemented enhanced milieu teaching (EMT) on the diversity and frequency of spoken language of three children with ASD in South Africa.

Result—A moderate functional relation was demonstrated between the introduction of EMT and increases in (1) the number of different words and (2) the number of spontaneous utterances used by each participant. Some evidence of generalisation to novel partners and contexts was observed.

Conclusion—Results indicated that EMT may be effective for improving communication in South African children with ASD. Implications for clinical practice and cultural and linguistic adaptations are discussed.

Keywords

autism; South Africa; naturalistic language intervention; spoken language; enhanced milieu teaching

Introduction

One defining characteristic of children with autism spectrum disorder (ASD) is difficulty acquiring and using spoken language for social communication (Tager-Flusberg et al., 2009). Most early intervention programmes for children with ASD aim to improve their spontaneous social communication and vocabulary through either targeted or comprehensive

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Declaration of interest

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interventions (Faja & Dawson, 2006; Moolman-Smok, Vermoter, Buckle, & Lindenberg, 2008). In general, there is evidence indicating a range of interventions for children with ASD are effective; however, it is not yet clear which interventions are most effective for children with ASD who are minimally verbal (Hampton & Kaiser, 2016; Tager-Flusberg & Kasari, 2013). Naturalistic developmental behavioural interventions (NDBIs; Schreibman et al., 2015), in particular, have been demonstrated to be effective at improving communication skills in young children with ASD (Prelock, Calhoun, Morris, & Platt, 2011; Woods, Wilcox, Friedman, & Murch, 2011). NDBIs emphasise teaching in naturalistic interactions, responding to children's interests and communication attempts, and embedding instructional strategies, such as modelling, expanding child utterances, and prompting procedures, to teach new forms and functions of language (Schreibman et al., 2015). The vast majority of research on NDBIs for children with ASD has been conducted in developed country contexts (Reichow, Servili, Yasamy, Barbui, & Saxena, 2013; Warren et al., 2011). Literature does suggest that naturalistic interventions can be successfully implemented in low-resource settings by parents, classroom teachers or paraprofessionals (Divan et al., 2015; Karaaslan, Diken, & Mahoney, 2013; Kasari, Kaiser, et al., 2014; Kasari, Lawton, et al., 2014; Reichow et al., 2013). However, the generalisability and feasibility of using naturalistic strategies to promote communication by children with ASD in developing African country contexts have not been assessed.

The South African context of early communication intervention for children with ASD

In South Africa, access to early intervention services for children with ASD is extremely limited in the public sector (Bateman, 2013). As is the case in many developing countries, resource constraints in the public healthcare sector manifest in a lack of professionals available and lack of collaboration between professionals and families (Pascoe & Norman, 2011). Collaboration is often limited due to difficulties associated with accessing these services (Samuels, Slemming, & Balton, 2012). Autism intervention in this context is infrequent and based in direct teaching (van Schalkwyk, Beyer, & de Vries, 2016). Families may travel long distances to access services which affects the consistency and frequency with which their children receive these services. A recent survey indicated that 87% of the population does not have access to private healthcare and therefore, must rely on the public healthcare system alone (Statistics South Africa, 2013). Data from another South African study indicate that 84% of parents who are aware of their children's delayed communication abilities do not have access to appropriate resources to address these observed delays (Popich, Louw, & Eloff, 2006).

In the Western Cape (one of the nine provinces of South Africa), 10 children are diagnosed with ASD each week, yet there are only nine specialised autism treatment centres in the whole of South Africa (Bateman, 2013). Children in the Western Cape wait an average of 24 months following diagnosis for placement in a school appropriate for their needs (Malcolm-Smith, Hoogenhout, Ing, Thomas, & deVries, 2013; Springer, van Toorn, Laughton, & Kidd, 2013). The current model of specialised and hospital-based service delivery is unable to

provide sufficient services to the increasing numbers of children with ASD and their families.

In the US, one approach to increasing access to language intervention for children with ASD has been to train their parents, teachers and other communication partners to use NDBIs. Little evidence exists indicating whether such naturalistic communication models could be implemented with fidelity in South African contexts and whether implementing naturalistic interventions would yield results similar to those achieved in studies conducted in developed countries. A preliminary demonstration of the effectiveness of naturalistic teaching for children with ASD in the South African context is needed before recommending that these strategies be adopted for use by caregivers, teachers and family members in children's natural environments.

EMT as a socially responsive intervention for children with ASD

Enhanced milieu teaching (EMT) is an NDBI that uses child initiations and interests during every day social interactions to model and prompt language and communication use (Roberts & Kaiser, 2015). EMT teaches in the natural environment with six key strategies: environmental arrangement, responsiveness, modelling target language, expanding communication, eliciting, and prompting communication (Kaiser & Hampton, 2016). This model is in contrast to the prevailing direct teaching framework used by most school programmes for children with ASD in South Africa (van Schalkwyk et al., 2016). Many children, including children with ASD and children from at-risk and low-resource communities, have demonstrated improvements in early language development when taught using naturalistic intervention strategies (Kaiser & Hampton, 2016; Kaiser & Roberts, 2013). For children with ASD, including those who are minimally verbal, EMT has been found to be effective for improving spontaneous language (Hancock & Kaiser, 2002; Kaiser, Hancock, & Nietfeld, 2000; Kasari, Kaiser, et al., 2014; Kasari, Lawton, et al., 2014). A systematic model for teaching EMT to professionals and parents has been developed (Teach-Model-Coach-Reflect; Kaiser & Roberts, 2013) and its effectiveness has been demonstrated (Roberts, Kaiser, Wolfe, Bryant, & Spidalieri, 2014).

Background to the current study

Implementing this initial study within a school context was informed by discussions with a group of speech-language pathologists (SLPs) working in educational and healthcare settings in South Africa and with the educational staff at the school proposed as a research site. The discussions took place over a period of 12 months in conjunction with an initial EMT training workshop and in meetings with the administrative director, the school psychologist and therapists at the research site. Across these meetings, two specific concerns were raised: the high transport costs for families to reach hospital facilities for research and the limited potential for therapists in healthcare to be involved in research because of their substantial caseloads and the very limited intervention dosage typically provided to individual children. Due to these constraints, it was decided to first investigate whether a naturalistic communication intervention could feasibly be implemented with fidelity by an SLP in a public, special-school setting in South Africa.

In sum, the purpose of this initial investigation of EMT to determine whether it was effective and feasible in the South African educational context (where access to resources is more stable and uniform). Therefore, the benefit of this study is two-fold: a systematic replication of an evidence-based intervention in a new low-resourced setting (Tait et al., 2014) and implementing the beginning steps of feasibility in training others. The purpose of this study was targeted through addressing three research questions: (1) Does EMT increase the diversity of language used during intervention sessions by minimally verbal children with ASD? (2) Does EMT increase the frequency of spontaneous social communication during intervention sessions by children with ASD? (3) Do the effects of EMT generalise to a novel therapist and novel materials?

Method

Participants

This study included three male school-aged children (ages 5–7) diagnosed with ASD; the boys are referred to in this study as Musa, Tahir and Imran. The children were from moderately sized under-represented families that reportedly spoke English at home. Musa's family also spoke French (Table I). Each child attended a public school for children with ASD in a metropolitan area in South Africa. In South Africa, schools for learners with special educational needs (called special schools) admit students who have undergone an assessment process; children are enrolled if they have an established disability (such as ASD) and cognitive delays. The school in which the study took place enrolled 80 children with ASD in nine classrooms. The school staff included eight teachers, 12 assistants, an SLP, an occupational therapist and a school psychologist. All instruction in the school was provided in English although children and staff came from a large range of linguistic and cultural backgrounds. The study was approved by the Province Education Department's Research Directorate, the local University Human Research Ethics Committee and Vanderbilt University's Institutional Review Board.

Children for the current study were nominated by the school therapy team based on their low rates of communication. The inclusion criteria were: (a) confirmed ASD diagnosis, (b) fewer than 10 different words during a 20-min semi-structured language sample (Miller, 1981; described below), (c) no hearing or vision impairments, (d) school-aged and (e) parental consent for the child's participation in the research. Due to the minimally verbal status of the participants, child assent could not be attained; however, all sessions were ended if the child indicated dissent by crying or by asking to leave for three or more consecutive minutes.

Prior to beginning the study, multiple assessments were completed to characterise the participants and to aid in selecting appropriate spoken language and play targets (Table I). Participants demonstrated age equivalent expressive and receptive language scores between 1 and 2 years-old on the Preschool Language Scale-4th Edition (PLS-4; Zimmerman, Steiner, & Pond, 2002). The Childhood Autism Rating Scale (CARS) was used to confirm ASD severity (Schopler, Reichler, & Renner, 2002). The participants demonstrated early pretend play skills, including giving a doll attributes of life (Doll as Agent) or pretending to oneself such as brushing one's own teeth or hair (Child as Agent), during a Structured Play Assessment (SPA; Ungerer & Sigman, 1981). The participants demonstrated spontaneous

language in a naturalistic language sample, in which they interacted with a therapist and a standard set of toys for 20-min (Miller, 1981). All assessments were completed by an SLP. The formal and informal language assessments used in this study are routinely used by SLPs within the educational context in South Africa.

The female interventionist in this study was a citizen of South Africa who held a doctoral degree in speech-language pathology and was a member of the academic staff at the University of Cape Town. She had over 10 years of research and clinical experience working with young children with disabilities and their families. She completed initial training in EMTwith a United States research team experienced in this intervention and had reached fidelity criteria (above 90%) for all EMT strategies across five different sessions with four children with ASD or language impairments before implementing the study procedures.

Setting

Assessments, baseline and intervention sessions occurred in a small playroom at the school that the three children attended. Children did not receive any other instruction in this room at any other time before or during the study. This space included a toy chest with a lid, an open toy shelf, a 5-foot square blanket to define the floor space, a child-sized table and chairs, an empty bookshelf, a camera mounted on a tripod and a kitchen timer. The room was similar to rooms used for speech therapy for children enrolled in the school.

Materials

A selection of age-appropriate toys was available during every session. Examples of the toys used included a farm set (farm animals, a fence made of interlocking blocks, a farmer, a tractor and a barn), a racetrack and cars, magnetic plastic tiles, trains and tracks, small dolls and animals, cut-able play-food (fruit, vegetables, sandwiches and a pizza), play dishes and utensils, an oven and a variety of hand puppets. All toy sets were available during every baseline and intervention session. All sessions were video recorded with a digital camera and files were uploaded to a secure server for analysis.

Experimental design and procedures

A single-case, multiple baseline across participants, the design was used to examine the effect of systematically introducing the EMT intervention on language over time (Gast & Ledford, 2014). Securely stored videos were transcribed and coded using the Systematic Analysis of Language Transcripts (SALT; Miller, Iglesias, & Nockerts, 2012). Data on the primary dependent variables were graphed after each session for visual analysis. A random number generator was used to determine the order in which participants began the intervention. A criterion of a stable trend across consecutive baseline sessions was met before the introduction of the intervention for the first participant. Stability was determined using visual analysis of the data to determine that there was low variability in the baseline data and no clear increasing trend (Ledford, & Gast, 2018; Kratochwill et al., 2010). Criteria for introducing the intervention procedures to the subsequent participants included a shift in level and/or trend in the preceding participant's vocabulary diversity (number of different words, NDWs) during the intervention condition. As the participants demonstrated very low

and stable baselines, we also considered an increase in the variability of vocabulary diversity as an indicator of a treatment effect. Some variability in the level of language use across days is expected for children with ASD but using markedly more vocabulary on some days would be a clear improvement over a consistently low rate of vocabulary use.

Baseline

Baseline sessions occurred approximately twice each week and lasted 30-min. The playroom was organised with three or four toy sets available on the floor and the remainder of the toys arranged on a toy shelf immediately adjacent to the play area on the floor. The interventionist joined the child in play with the toys but did not implement the specific EMT intervention procedures. The interventionist responded to most child communication attempts by using long sentences, using short exclamations ("uhoh" and "wow"), asking a question related to the communication attempt, or giving a direction related to the child's communicative attempt ("Put the cow over there in the barn"). The interventionist spoke frequently but did not balance turn length or frequency of communication with the child and did not follow EMT prompting procedures when asking questions. While engaging with the child, the interventionist played alongside the child without modelling new play actions or expanding the child's play actions. Behaviour support strategies were consistent across baseline and intervention sessions. The interventionist used a timer to indicate how long the sessions would last, positively stated behaviour expectations, ignored problem behaviour (such as throwing toys, or self-stimulatory behaviours) or redirected the child to an appropriate behaviour and provided positive feedback for the child's appropriate behaviour.

Intervention

Intervention sessions occurred two or three times each week and lasted 30 min. The playroom was organised in the same arrangement as during baseline sessions with the exception of the addition of specific EMT environmental arrangements such as keeping some blocks or small toys in a clear container with a lid to promote requesting opportunities. The interventionist engaged with the child in play, implementing all of the EMT components including: (a) following the child's lead and interests in play and communication, (b) responding to all of the child's verbal and nonverbal communication attempts, (c) modelling target-level language (1-word level for all three participants), (d) mirroring (imitating) play actions and mapping (describing) those actions with target language, (e) expanding the child's communication by repeating it and adding one content word, (f) using time delay procedures to elicit communication with nonverbal cues and (g) using milieu prompting procedures to teach new language (Kaiser & Hampton, 2016). In addition, the interventionist used play expansions and arranged the environment to promote novel play actions (Frey & Kaiser, 2011). Once the intervention had been introduced to a new participant, the prior participants received intervention sessions only one day per week to maintain their performance.

Fidelity of procedures—Fidelity of implementation was measured for at least 30% of all baseline and intervention sessions for each participant, randomly selected. Two doctoral Special Education students at Vanderbilt University rated fidelity from video recordings of the entire 30-min session using a 30-point checklist (available from the first author). Fidelity

percentages were calculated as the number of checklist items the interventionist correctly implemented according to the session procedures during the 30-min session divided by the total number of items on the checklist. Fidelity of implementation of baseline procedures was 93% (range: 81–100%) and fidelity of implementation of intervention procedures was 89% (range = 80–98%). Fidelity of procedures for each participant and across phases is presented in Table II. To ensure that fidelity ratings were consistent across raters and participants, 20% of those fidelity sessions were randomly selected, across session type and participant, and rated by a second rater to determine the reliability of the fidelity rating. Reliability of ratings was calculated using an exact agreement formula: the number of agreements divided by the sum of the agreements and disagreements. Reliability of baseline fidelity ratings was 85% (range: 80–90%) and reliability of intervention fidelity ratings was 86% (range: 81–93%).

Fidelity ratings were also used to provide formative feedback to the interventionist. Due to the distance and time difference between the US and South African research sites, immediate feedback was not always possible. Fidelity ratings were posted in a file on a shared server and the US researchers met with the interventionist via video conferencing weekly to discuss implementation and challenges. These discussions focussed on strategies for maintaining child engagement, use of specific EMT intervention techniques and child progress in the intervention.

Dependent measures

A 10-min segment from the beginning of each session was transcribed and coded from video using the SALTs (Miller et al., 2012) with the KidTalk EMT code (available from authors). All sessions were transcribed by a master's level speech-language pathologist in South Africa. Given the clear difference in the behaviour of the interventionist between baseline and intervention sessions, blind coding was not possible.

Doctoral students in Special Education at Vanderbilt verified and coded each session. Both students coded a minimum of 20% of the sessions for each participant in each condition to assess reliability of the coding; sessions were randomly selected. Exact agreement was calculated as the number of agreements divided by the sum of the agreements and disagreements. Agreement averaged 92% (range: 79–100%) across all codes, participants and sessions (Table II). Lower reliability scores occurred in one of 20 reliability sessions for spontaneous utterances when the overall rate of communication was low and some of the child's communicative utterances were repetitive scripts that were difficult to classify.

Number of different words—Transcripts were automatically analysed using the SALT software for the total NDWs used during each baseline and intervention session. Only content words (specific nouns, verbs, proto-verbs, modifiers and requesting words) were included in this analysis; exclamations (e.g. "wow" or "uhoh") and non-specific words (determiners) used alone (this, that, those) were not counted. Additionally, words that functioned the same but varied in pronunciation were counted as a single word (e.g. no, nope, naw; yeah, yup, yes). NDW was selected as the primary measure because the diversity

of target language use was expected to be the first behaviour to change during the intervention.

Spontaneous utterances—Each child utterance was coded for spontaneity and the total number of spontaneous utterances was summarised for each 10-min session. All child verbal communicative utterances that were not prompted (in response to a question), elicited (in response to a time-delay strategy) or imitated (a repetition or partial repetition of the adult within five seconds of the adult's speech), were considered spontaneous. Utterances were segmented by an adult verbal turn or a pause of at least 3 s. The rate of spontaneous utterances was a secondary outcome in the study. This variable represented the child's initiations and was expected to change more slowly than NDW, although increasing this behaviour may be key for children with ASD who have low levels of spontaneous communicative initiations.

Generalisation

In addition to the time-series session data, the participants' use of language was measured prior to the start of baseline sessions and following the end of intervention. The same measures of NDW and spontaneous utterances used for session data were coded from two generalisation probes in untrained contexts: novel materials and novel materials/partner. Each 20-min assessment consisted of unstructured play in which the participant was offered six different standard sets of toys that varied in complexity (i.e. a shape sorter, baby dolls and bottles, blocks, a farm set). The participants were allowed to play with each set at their own pace, although the assessor ensured that each toy set was offered within the 20-min probe. The adult did not use the EMT language support strategies, such as milieu prompting procedures, or model specific language. The toy sets were determined before the start of the study and differed across probe types. In the novel materials probe, the participant interacted with the interventionist who implemented the treatment but played with novel toy sets that were not used during the intervention or baseline sessions. In the novel materials/partner probe, the child interacted with an SLP who was not affiliated with the study and a novel set of toys. These assessments provided an opportunity to measure the participants' use of language in untrained contexts; both the materials available to the child and the adult's interaction style differed from that which occurred during intervention sessions.

Result

The authors used visual analysis to evaluate the effect of EMTon NDW and spontaneous utterances across participants. Figures 1 and 2 present the graphed data for the three participants during baseline, intervention and maintenance conditions. Data are presented across school days representing sessions. During the intervention phase with Musa, the school was closed for 5 weeks due to the summer holiday; this is marked as a break on the graph (Figures 1 and 2). The data are presented without trend lines, mean lines or effect size metrics to allow readers to apply visual analysis without leading bias from these summary statistics (Wolery, Busick, Reichow, & Barton, 2010).

Number of different words

All three participants had low stable baselines with very little variability for NDW; Tahir and Imran had descending trends in the baseline (Figure 1). Each participant used fewer than 10 different words in each baseline session. Each participant demonstrated an immediate shift in level, trend and/or variability following the introduction of the intervention. Musa demonstrated an increase in variability over the course of intervention, but because of a potentially ascending baseline, there was not a clear change in level or trend during intervention. Tahir and Imran used a greater NDW with an immediate increase in level, trend and variability following the introduction of the intervention. These data demonstrate multiply determined evidence of a moderately strong functional relation between the EMT intervention and increases in NDW.

Spontaneous utterances

Visual analysis of spontaneous utterances was used to address the second research question. All three participants used six or fewer spontaneous utterances during each baseline sessions and baseline data were fairly stable over time (Figure 2). Each participant demonstrated an increase in level and variability of spontaneous utterances immediately following the introduction of the intervention. These increases were immediate for Musa and Tahir and somewhat delayed for Imran, providing moderate evidence of a functional relationship between the EMT intervention and increases in spontaneous utterances.

Generalisation

Data from interactions during the two generalisation probes (novel materials and novel materials/partner) are displayed in Table III. Data are presented as a rate per 10-min to allow comparison to data collected during intervention sessions. All three participants increased in their NDW and spontaneous language from the pre-treatment to post-treatment generalisation probes. On average, participants had 3.5 more NDW (range: 1.5–4.5) and 10.3 more spontaneous utterances (range: 6–13) during the novel materials/ person probe and 5.5 more NDW (range: 4–6.5) and 8.6 more spontaneous utterances (range: 1–16.7) during the novel materials probe. The consistent pattern of increased level across all participants and measures suggests that participants were able to generalise their ability to use language to new materials and partners. However, while the observed rate of language showed a consistent increase across participants from pre- to post-treatment, language use in these generalisation probes was below the levels of NDW and spontaneous utterances demonstrated during intervention sessions. The measures of change in the generalisation contexts must be considered cautiously given the lack of a control for maturation in the pre-post design; nevertheless, these data provide some indication of change associated with the intervention.

Behavioural adaptations

Musa used greater NDW immediately following the introduction of the intervention, but his data were variable beginning with the sixth session, immediately after the summer break. The variability coincided with poor attendance. Musa was absent from school less than 10% of planned sessions prior to the summer break, but he missed more than 40% of planned

sessions following the break due to inconsistent transportation to school. His inconsistent attendance was associated with an increase in problem behaviour during intervention sessions and in his classroom. As problem behaviour is related to greater difficulties in language use and disrupts the delivery of the naturalistic intervention, after session 5, behaviour supports were introduced (Boonen et al., 2014). These included a visual schedule to provide a framework for the session and intermittent positive reinforcement (descriptive praise and rubbing his back) for appropriate behaviour. Although Musa's spoken language was variable throughout intervention, the use of behaviour support strategies greatly reduced the occurrence of problem behaviour. The intervention was introduced with Tahir even though Musa's data were not entirely stable across three sessions due to concerns about his inconsistent school attendance. Musa's data subsequently stabilised.

Discussion

The purpose of this study was to demonstrate the effects of EMT on the NDWs and spontaneous language use by children with ASD in a South African educational context. All participants demonstrated an increase in level, trend and/or variability in NDW at rates similar to those seen in intervention studies conducted in developed country contexts (Hancock & Kaiser, 2002; Kaiser et al., 2000), providing moderate evidence of positive effects of a naturalistic communication intervention for children living in a developing country context. Although there was variability in the data, particularly for the first participant, all participants showed changes in NDW immediately following the onset of the EMT intervention, with average increases from baseline to intervention ranging from 4 to 12 different words. With relatively few intervention sessions (mean number of intervention sessions = 20) at a relatively low dosage (30 min per session), the gains made by participants in spoken functional language represented meaningful changes in NDW and number of spontaneous utterances. Consistent changes in performance during the generalisation probes indicated that there was also generalisation to an untrained adult partner who was not implementing EMT and to the use of novel materials with a familiar communication partner. The SLP who delivered the intervention was able to consistently implement the EMT intervention at high levels of fidelity. Thus, this initial experimental application of EMT in South Africa supports the feasibility of disseminating this evidence-based practice to practitioners working in schools in a developing country context. The intervention was efficient as indicated by gains in NDW and increased rate of spontaneous communication achieved in a relatively modest number of sessions (e.g. twenty 30-min sessions over 4 months or approximately 10 hours of intervention).

Clinical and practical implications

Results indicated that EMT may be an effective intervention for children with ASD in a developing country context. Establishing that an intervention is effective, efficient and feasible to implement within the school context is an important step toward addressing the needs of the growing population of children with ASD in South Africa. This demonstration may be especially important for the population of minimally verbal children with ASD, who may require intensive intervention to make progress in social communication. The demonstration of EMT as an effective intervention for minimally verbal children with ASD

represents a paradigm shift in this context. This study demonstrated moderate effects on spoken language following biweekly sessions, a dosage that may be feasible in the school context. There are no studies directly comparing the outcomes of communication intervention using naturalistic and structured teaching approaches for this population. Thus, this study demonstrated that EMT can be efficacious within a special school context in South Africa, but further research is needed to establish its relative effectiveness when implemented by school staff compared to current intervention strategies being implemented.

Research in the United States has demonstrated that EMT can be taught to parents, teachers and professionals and in turn, these individuals can implement the intervention strategies at high levels of fidelity resulting in positive changes in child communication (Hancock & Kaiser, 2002; Roberts & Kaiser, 2015). Training therapists, teachers and paraprofessionals in the school setting to use EMT strategies could greatly increase the amount of language instruction accessible to children with the most severe language deficits. We acknowledge, however, that further research is needed to develop and test culturally appropriate coaching strategies for EMT in this context. Next steps for establishing feasibility and acceptability of EMT in South Africa include validating the cultural appropriateness of the language interventions strategies with parents and professionals, making systematic adaptations for the multilingual environment, and a larger study to assess the relative effectiveness of EMT compared to other approaches in this context.

Limitations

Although this study meets the standards for multiple baseline design (Kratochwill et al., 2010), the results should be considered in light of several limitations. First, the procedures were implemented in a cliniclike setting with a limited assessment of generalisation of the effects of the intervention to other contexts. EMT, like many NBDIs, is designed for use in natural environments. While the play context used in this study is a more naturalistic interaction setting for young children, play is unlikely to be a primary context for parent-child interactions in many of the homes of South African children with ASD, due to high rates of poverty which limits access to toy materials (Lehohla, 2017). Thus, it is important to determine if intervention in a play context generalises to routine-based interactions in other settings.

Although measures of generalisation across materials and interaction style were collected in this study, the pre-post nature of these measures does not demonstrate a functional relation between EMTand generalised changes in language use. A more systematic analysis of generalisation of newly-learned language skills to the classroom and to interactions at home would have greatly increased evidence indicating the effectiveness and social validity of the intervention approach. This is particularly important considering the dependent variables in this study were measured within the session, and thus changes in language were potentially context dependent. Expanding measures of generalisation would capture generalised changes in language as a result of intervention. Additionally, direct measures of acceptability such as surveying parents and teachers about the intervention techniques could add to the social validity and acceptability of this intervention in the South African context.

Second, due to limited availability of native transcribers, we selected verification rather than reliability for the transcription of the session data. This process was necessary to ensure the child's accent and any non-English words were not misinterpreted by the coders who were not native South Africans. Although this process is not ideal and may increase the likelihood of underestimated results, edits were minor and often resulted in small edits (Dog eats vs. Doggie) rather than changes in identification. Coding was applied with true reliability where two coders independently coded the transcripts for communicative function. Reliability between coders was high across participants and conditions.

Third, there was variability in the stability and magnitude of effects of the intervention across children. It is not clear if this variability was the result of individual child characteristics or differences in the consistent delivery of the intervention. For example, the long breaks due to school holidays and Musa's absences due to the lack of transportation resulted in inconsistent intervention delivery, which may have affected his outcomes in two different ways. The long breaks limit interpretation of the increases in NDW and rate of spontaneous utterances due to the unknown potential natural language growth during these times. However, the breaks in the study schedule were equivalent across participants and growth in NDWand spontaneous utterances were minimal during the corresponding baseline sessions for Tahir and Imran. Musa's inconsistent participation in intervention sessions also may have limited the impact of EMT. If the effects of the intervention are built on the child's learning history outside of the intervention sessions, effects could have been minimised as a result of his inconsistent attendance.

Future research

The next steps for this line of research are twofold. First, it is important to better understand how to best adapt EMT for a new cultural context. In the current study, the majority of toys were locally sourced and relevant vernacular language was used as cultural adaptations. Additional changes were not necessary to meet cultural differences because the school instructional staff already valued play as an important part of children's learning, children already participated in regular speech therapy sessions, and all children were communicating in English at school, irrespective of what other languages may have been spoken in their homes. However, future studies will need to further examine the role of play as an instructional context and the linguistic adaptations necessary in a multilingual culture like South Africa. Second, EMT has been implemented by parents alone and in collaboration with therapists in many studies (Kaiser & Roberts, 2013; Roberts & Kaiser, 2015). The use of EMT with parents should be investigated, with particular attention to adaptations for family-specific cultural and linguistic characteristics. Given that the frequent feedback to the interventionist in this study to remain at high fidelity, investigations of the application of feasible training plans for using EMT in the classroom and therapies also merits further investigation. Developing strategies for training caregivers may be an important step toward creating a culturally and linguistically appropriate naturalistic language intervention which is applicable in the South African context.

Conclusion

Enhanced milieu teaching is an evidence-based practice with over 30 years of research indicating its effectiveness for multiple populations including children with ASD (Hampton & Kaiser, 2016). As the first replication of EMT in Africa, this study provides an important first step in replicating the effects of this intervention in the South African context. The findings of this study demonstrate that this approach may be appropriate for at least some children with ASD in South Africa. There is an urgent need for further studies extending this naturalistic intervention for populations from varied cultural and linguistic backgrounds. Future research is necessary to continue to adapt EMT across cultures as it is a promising approach for meeting the growing need for language intervention for children with ASD in South Africa. EMT was associated with growth in vocabulary and spontaneous language use during a relatively short period of intervention and there is an important possibility of maximising outcomes by training parents and school staff to deliver the intervention in everyday settings.

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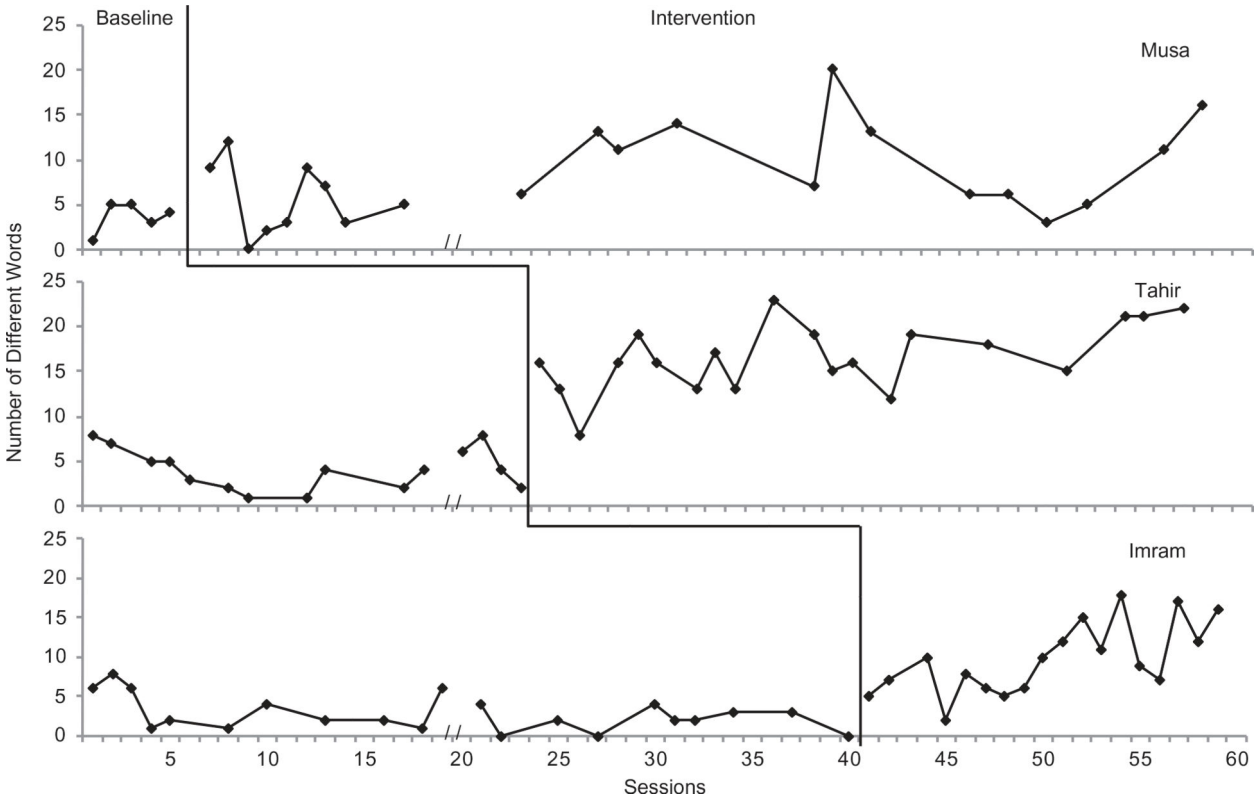

Figure 1.

Effects of EMT on language diversity across participants. *The break in the x-axis prior to session 20 indicates the 5-week summer break in the school schedule.*

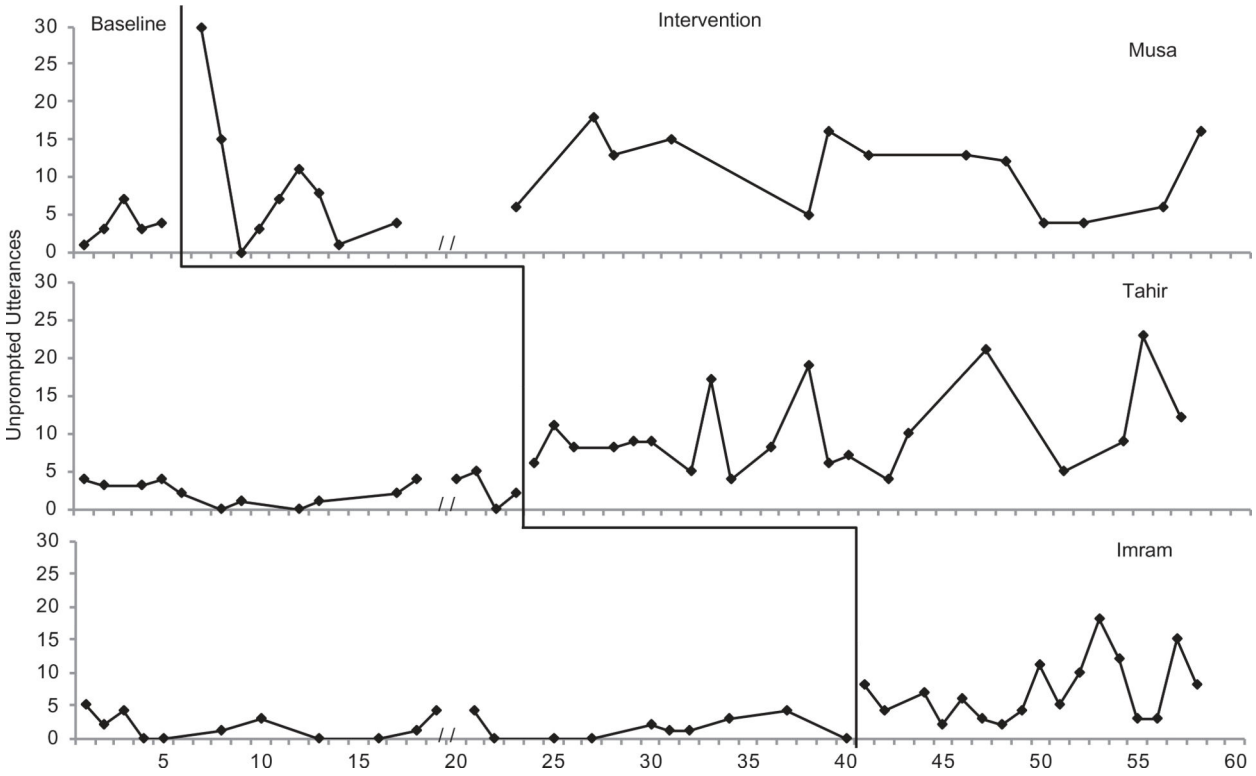

Figure 2.

Effects of EMT on spontaneous language across participants. *The break in the x-axis prior to session 20 indicates the 5-week summer break in the school schedule*.

Table I.

Participant baseline demographics.

	Musa	Tahir	Imran
Age	7 years, 2 months	5 years, 11 months	7 years, 10 months
Languages spoken at home	English and French	English	English
Family size at home	5	4	5
Siblings	2	1	2
Siblings with ASD	1	0	0
Race/Ethnicity	Black African	Indian	Indian
PLS (Zimmerman, Steiner, & Pond,2002)			
Receptive	24	33	29
Expressive	30	30	30
CARS (Schopler et al.,2002)	40	34	32.5
SPA (Ungerer & Sigman,1981)			
Highest level of play	Doll as agent	Substitution with objects	Child as agent
Most frequent level of play	Child as agent	Child as agent	Child as agent

PLS: Preschool Language Scale, PLS raw scores reported; *CARS: Childhood Autism Rating Scale*; SPA: Structured Play Assessment.

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Table II.

Fidelity of implementation and Reliability of coded transcripts across participants.

	Baseline		Intervention	
	Mean % (SD; range)	**Percent of sessions**	**Mean % (SD; range)**	**Percent of sessions**
Fidelity				
Musa	91 (6.2; 83–100)	100%	86 (5.3; 79.8–98)	55%
Tahir	94 (5.5; 81–100)	80%	90 (2.9; 85–94)	35%
Imran	94 (4.1; 88–100)	57%	92 (5.3; 85–98)	39%
Reliability				
Musa	95 (91–100)	60%	94 (83–100)	21 %
Tahir	96 (92–100)	20%	90 (82–100)	20%
Imran	93 (79–100)	21%	97 (89–100)	28%

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Table III.

Pre-post generalisation of language diversity to novel context and partners.

	Baseline		Follow-up	
	NDW	**Unprompted**	**NDW**	**Unprompted**
Musa				
Novel context	4	6.7	10.0	7.1
Novel communication partner and novel context	4.5	6.0	9.0	12.5
Tahir				
Novel context	7.5	6.0	11.5	14.1
Novel communication partner and novel context	3.5	4.0	5.0	15.5
Imran				
Novel context	5.0	4.4	11.5	21.1
Novel communication partner and novel context	3.5	0.5	8.0	13.5

NDW: n*umber of different words. Rate per 10 minutes.*