Title: Systematic language input improved productions of elaborated verb phrases of Cantonese-speaking children with language difficulties

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Abstract

It has been well-documented that language input designed according to the principles of statistical learning can promote language acquisition among children with or without language disorder. Cantonese-speaking children with language disorder were reported to have difficulties using expanded verb phrases and prepositional phrases, but the corresponding intervention is relatively unexplored. The current study evaluated the efficacy of an intervention designed using the statistical learning principles to promote the acquisition of these two structures. A retrospective study of existing data collected from a total of 16 Cantonese-speaking children (four female; mean age = 6.70 years) with suspected language disorder was conducted. The participants were initially divided into the 'Treatment' and the 'Control' groups. A total of eight sessions of language treatment, which focused on giving systematic language input of expanded verb phrases and prepositional phrases, were conducted on each child. Results showed that the Treatment group produced significantly more expanded verb phrases in the post-treatment language samples, while the Control group did not. The final pre- and post- comparison conducted after the Control group also received treatment indicated overall significant increased number of expanded verb phrases produced across time. On the contrary, improvement in the production of prepositional phrases was not significant. It is suggested that the unique thematic roles coded by individual prepositions possibly restricted the generalization effect of treatment, which explains the non-significant improvement across time. Theoretical and clinical implications were discussed.

Keywords: Language difficulties, language intervention, Cantonese, elaborated verb phrases, prepositional phrases

Young children learn to use language to achieve different communicative functions, from making simple requests to sharing personal experience using complex narratives. When they grow older, language further plays an important role which allows them to learn different knowledge. Children with language disorders, on the other hand, demonstrated deficits in using language to fulfil these functional needs. It has been well-documented that language disorders may lead to negative impact on the individuals' social, psychological, and academic development (e.g. Fujiki et al., 1999; Tomblin et al, 2000; Maggio et al., 2014). This has created the strong need for effective language intervention that can promote language learning among children with language disorders, so as to reduce the listed negative impacts. In the current study, we investigated whether an intervention designed to provide systematic language input will promote language acquisition among Cantonese-speaking children with language difficulties.

Cantonese-speaking children with language disorders

Cantonese is a dialect of the Yue group of Chinese, spoken primarily by people in the southern Chinese provinces of Guangdong and Guangzi, as well as Hong Kong and Macau. Cantonese and Mandarin, the official language used in Mainland China and Taiwan, differ largely in terms of phonology. One commonly identified difference is that there are nine lexical tones in Cantonese (To et al., 2013) but only four different lexical tones in Mandarin (Hua & Dodd, 2000).

In terms of morphosyntax, there are many similarities between Cantonese and Mandarin. For example, both Cantonese and Mandarin mainly rely on word order to express grammatical relations such as subject and object and they both have the basic word order of [subject-verb-object]. There are also differences between them. For example, the order of the direct and indirect objects in the expression of bitransitive sentences in Cantonese is different from that

in Mandarin. In Cantonese, the direct object goes before the indirect object, while in Mandarin, the direct object goes after the indirect object. In light of the focus on the current study, we will not discuss in the detail the similarities and differences between the two. Instead, we highlighted that the two are the most influential variety of Chinese (Fung, 2009) that previous studies of Chinese language disorders involve mostly Mandarin or Cantonese speakers.

A significant number of studies conducted in Hong Kong have documented that there exist children who demonstrated difficulties in learning to use Cantonese. For example, previous studies have documented that preschool Cantonese-speaking children with language disorders were reported to demonstrate poor performance in syntax (Klee et al., 2004; Wong et al., 2010), morphology (Fletcher et al., 2005; Fletcher et al., 2008; Wong et al., 2003), as well as vocabulary learning (Klee et al., 2004; Stokes & So, 1997; Wong et al., 2010). Studies that recruited school-age children with language disorders in Hong Kong, on the other hand, documented their deficits in narrative productions (To et al., 2008; 2010). For example, To et al. (2010) have reported that when compared with typically developing children, school-age children with language disorders in Hong Kong demonstrated fewer usage of complex constructions, such as relative clause, elaborated verb phrase, prepositional phrase, verb complement and pivotal construction, which would be usually reflected in the relatively lower scores in microstructures in narrative assessments. Results of these studies have highlighted the need for language intervention that can enhance language acquisition among Cantonese-speaking children with language disorders.

Significance of systematic language input

A growing body of literature has reported the significance of the use of statistical learning techniques to promote rapid learning. It has been suggested that statistically regular patterns,

structures and co-occurrences that occur in language contribute to the learning process (Saffran, 2003). Previous studies have demonstrated that language intervention designed following the principles of statistical learning has resulted positive outcomes in the acquisition of vocabulary (Alt, et al., 2014) and morphosyntax (Plante et al., 2018) among children. Researchers have also documented that language input designed according to the principles of statistical learning can promote language acquisition among typically developing children (Maguire et al., 2008; Perry at el., 2010) as well as children with language disorders (Aguilar et al., 2018; Alt et al., 2012; Plante et al., 2018).

According to Plante and Gómez (2018), there are two major principles, namely regularity and variability, that are essential in the design of language treatment using the theory of statistical learning. The regularity principle concerns the consistency of the treatment targets that the children encounter and the frequency of occurrence of the treatment targets during the treatment. In order to facilitate children's acquisition of the treatment targets, high frequency of occurrence of the treatment targets with high consistency in the language input is necessary. For example, if the treatment targets on a child's acquisition of the use of the perfective aspect marker 咗 [zo2] following verbs to express past events in Cantonese, the language input for the child should include frequently occurring utterances in the form of verb+咗[zo2], so that the target structure will lead to more efficient acquisition.

The variability principle concerns the use of varied elements in association with the treatment target in the presentation of language input. Using the same example of verb+咗[zo2] in the above, the verbs in the language input presented to the child should vary, e.g. 食咗 <eat + perfective maker>, 飲咗 <drink + perfective marker>, and 買咗 <buy + perfective marker>.

According to Plante and Gómez (2018), the use of highly varied non-target elements in the input will promotes the acquisition of the treatment targets.

In general, it is agreed that the regularity and variability principles, when combined, in the design of language input make the treatment targets more prominent to children and therefore facilitate children's acquisition of the treatment targets. To our knowledge, previous studies of statistical learning in Chinese mainly focused on its application in the learning of the regularities of the written language with or without disorders (e.g. Lee & Tong, 2020; Tong & McBride, 2014). In this study, we attempted to apply it on children acquiring the oral language of Chinese.

This study

In the current study, we aimed to evaluate the efficacy of an intervention designed using the statistical learning principles on a group of Cantonese-speaking children with suspected language disorder[1]. Specifically, two structures, namely elaborated verb phrases and prepositional phrases were targeted, as the literature has documented limited usage of these structures by Cantonese-speaking children with language disorder (To et al., 2010). To achieve the regularity principle of statistical learning, the two structures were divided into two treatment objectives during the treatment sessions. Objective 1 focused on elaborated

[1] As described in the Method section, the participants of the current study were reported to have language difficulties, despite having sufficient language exposures, that result in negative impact on their social communication and academic performance. That the children were entering into school age with unresolved language difficulties also indicated relatively poor prognosis. In light of the CALALISE framework (Bishop et al. 2017), the participants of the current study should be regarded as children with language disorder. Nevertheless, these participants were seen by student clinicians during COVID times when the student clinicians could only rely on non norm-referenced language assessments and informal speech and language assessments in tele-therapy online sessions without normative data to substantiate their lack of age-appropriate language competence in their L1 best language. The student clinicians were not allowed to use the Cantonese norm-referenced language assessment tests in telepractice, even after our speech therapy unit had liaised with the test publisher (Department of Health of the HKSAR government) as the test publisher had concerns about leakage of test questions during online testing. Given that the children's language problems were not formally diagnosed using norm-referenced assessment, it is decided that a more conservative term 'suspected language disorder' should be used in this article.

verb phrases and Objective 2 focused on prepositional phrases. The structural language input following the principles that emphasized repeated occurrences of consistent structure with variable constituents are presented in the context of a conversational interaction between a clinician and a child (e.g. Leonard et al., 2004; 2006).

In short, the current study explored whether language input designed according to the principles of statistical learning can promote the acquisition of (1) elaborated verb phrases, and (2) prepositional phrases among Cantonese-speaking children with suspected language disorder. Given the prior evidence of statistical learning reported in the literature, it was hypothesized that by offering systematic language input to Cantonese-speaking children with suspected language disorder, they would demonstrate improvement in the two selected structures after the intervention.

Method

Participants

A total of 16 children (four female; mean age = 6.70 years) were identified from 50 Cantonese-speaking children participated in two clinical education courses of an entry level master programme of speech therapy conducted between July and October 2020. The 16 children were targeted because (1) they were reported to have used Cantonese as their first and dominant language, (2) they were reported to have language difficulties without history of hearing, visual, and intellectual impairments by the parents, (3) their parents reported that the concerned children exhibited language difficulties leading to negative functional impact affecting their daily social communication and academic progress, (4) they received the language intervention targeted for promoting the production of elaborated verb phrases and prepositional phrases through systematic language input for eight sessions, and (5) they agreed to allow video and audio recordings of their corresponding clinical sessions for

education and research purposes. All 16 children participated in the initial assessment at the beginning of the studied period.

Study design

This study involved the retrospective analysis of data from participants recruited in the above-mentioned clinical education courses. According to the design of the two courses, there are 10 sessions in each course. Student clinicians were assigned to deliver language assessments in the first and the last sessions, as well as language treatment in the remaining eight sessions to individuals reported to have language difficulties under the supervision of clinical educators. Due to the COVID-19 international pandemic, all the sessions were conducted via Zoom with video recordings. In this study, the video recordings of the targeted participants in the first and last sessions, i.e. pre- and post-intervention, of the clinical courses were extracted for language sample analyses. The retrospective study involving analyses of data collected from human participants was reviewed and approved by the Human Subjects Ethics Sub-committee of the affiliated institute of the authors.

Due to the limited availability of student clinicians, half of the group was randomly selected to receive treatment, which is taken as the Treatment group in this study, and the other half was allocated to the 'waiting' group, which is taken as the Control group in this study. The Treatment Group received the language intervention between July and August 2020 while the Control Group was waiting. By the end of Treatment Group's intervention, both groups were assessed again. The Control group received the same language intervention one week after the second assessment session and were assessed once more by the end of their intervention. Despite not intended at the beginning of the clinical education courses, the data obtained eventually fit into a between-participant design (Ebbels, 2017). Pre- and post-intervention

language measures were obtained. Participants allocated to the Treatment Group were compared with those allocated to the Control Group.

Assessments

Each participant was assessed individually by two student speech therapists via Zoom. During the pandemic, one major difficulties faced by clinicians in Hong Kong concerns the possibility of conducting standardized language assessments online without violating the confidentiality agreement of the assessments. To allow student clinicians enrolled in the two clinical education courses to gain experience of conducting both standardized and non-standardized assessments, which are intended learning outcomes of the courses, they were instructed to conduct the following assessments on the participants recruited in the first and last sessions of the clinical education courses.

Standardized assessment. The Multilingual Assessment Instrument for Narratives (MAIN) adapted in Cantonese (Chan et al., 2020; Kan et al., 2020) was conducted. The test contains four pictured-stories, each consisting of six pictures, which allows the elicitation of story retelling and story telling. The Baby-bird story was selected in the clinical education courses mentioned. The comprehension score, obtained according to the accuracy towards the 10 questions pre-designed according to the picture sequences given in the test, as well as the MAIN section I: Production scores, calculated based on the correct productions of story macrostructure components, including settings, goals, attempts, outcomes and internal state terms, of the story telling and story retelling conditions were obtained in the first session of the course. In the current study, they were taken as one of the indicators that the Treatment and the Control groups have comparable narrative abilities.

Language sample analysis. Language samples were obtained throughout the assessment sessions using three tasks. In the first task, the Cookie Theft picture description task was used. In the second task, a story telling task using the 'the tortoise and the hare' and the 'cry wolf' pictures obtained from the Cantonese AphasiaBank (Kong & Law, 2019) was conducted. Finally, a personal narrative requiring the participants to share their own experience of having an injury or major illness was conducted. On average, each assessment session lasted for 30 minutes.

All the language samples obtained were recorded and transcribed into Chinese orthography for data analysis. For each participant, three dependent variables, namely the number of utterances with expanded verb phrases, number of utterances with prepositional phrases, and total number of utterances produced, in each assessment session were tallied from the transcribed language samples obtained in the three narrative tasks.

Language intervention

Altogether, the language intervention consisted of eight sessions, each lasted for 90 minutes. Intervention sessions were conducted twice a week, such that all eight sessions were completed within four weeks. All of the sessions conducted by final year students studying in an entry level master programme of speech therapy. Each session was approximately divided into two halves, one focusing on Objective 1 and the other focusing on Objective 2. To engage the participants into the activities, each session was packaged in a 'gaming' theme, such as the 'Super Mario Challenge'. During which, each participant has to complete different 'tasks' in the format of picture description or video clip description in order to 'win the game'.

Objective 1: Elaborated verb phrases

In this objective, pictures and video clips designed to elicit elaborated verb phrases were selected. During each trial of the task, a student clinician and a participant took turns to describe a presented picture or video clip. The student clinician would first demonstrate the use of expanded verb phrase to describe the picture, e.g. 好安靜咁行路 (walking quietly)

After which, the participant would be invited to describe another similar picture or video clip. If the participant did not use any expanded verb phrase to describe the picture or video clip, the student clinician would model the use of an expanded verb phrase. On the other hand, if an expanded verb phrase was used, the student clinician would acknowledge and repeat the participant's production and give a comment to extend the meaning, e.g. 係喎，好安靜咁行路，唔好嘈醒其他人 (Yes, walking quietly, to avoid waking others). Sample clinician-client interactions in each trial were given in Appendix A. At least 20 practice trials were given in each session. Action verbs were primarily used in the treatment trials because they are relatively imageable, which can be displayed in the pictures and video clips via Zoom.

Objective 2: Prepositional phrases

In this objective, pictures and video clips designed to elicit elaborated verb phrases were selected. The structure of the intervention is similar to the descriptions under Objective 1, with the exception that prepositional phrases, e.g. 小朋友喺火車 (the child is on the train), instead of elaborated verb phrases were focused. If the participant correctly used a prepositional phrase to describe a picture, the student clinician would acknowledge and expand the participant's production into a serial verb construction, e.g. 小朋友喺火車睇書 (the child is reading on the train). Sample clinician-client interactions in each trial were given

in Appendix B. Similarly, at least 20 practice trials were given in each session. The prepositions of 喺[hai2] (to indicate location), 向[hoeng3] (indicate direction), and 畀[bei2] (to indicate recipient) were used in the treatment trials, again, because they are relatively imageable, which can be displayed in the pictures and video clips via Zoom.

Data analysis

To compare the performance between the Treatment and Control group, a one way (Treatment vs Control) repeated measure analysis of variance (ANOVA) was conducted to compare each set of dependent variable pairs before and after the treatment.

After the Control group also received the Intervention, the two groups were combined. A paired-sample t-test was conducted to compare each set of dependent variable pairs before and after the treatment.

Results

Table 1 shows the demographic information of the Treatment and the Control groups. Results of t-tests indicated that the two groups did not differ in terms of their age and their scores in the MAIN.

Table 1 about here

Treatment Group vs Control Group

Table 2 shows the performances of the two groups in the pre- and post-intervention assessments.

Table 2 about here

Total number of utterances produced. The results of one way ANOVA with repeated measures indicated a significant main effect of Time [$F(1, 14) = 15.65$, $p = .002$] suggesting that more utterances were produced in the post-intervention assessment. Neither the main effect of Group ($p = .755$), nor the interaction effect between Group and Time ($p = .356$) was significant.

Number of elaborated verb phrases produced. Figure 1 shows the comparisons between the two groups in the pre- and post-intervention assessment in terms of number of elaborated verb phrases produced. The results of one way ANOVA with repeated measures indicated that neither main effect of Group ($p = .124$) nor main effect of Time was significant ($p = .123$). Instead, a significant interaction effect between Group and Time [$F(1, 14) = 6.42$, $p = .024$] was noted. Post-hoc analyses using the *Tukey HSD* test indicated that the Treatment Group produced significantly more elaborated verb phrases than the Control Group in the post-intervention session ($p = .038$).

Figure 1 about here

Number of prepositional phrases produced. In general, a floor effect was observed among the two groups in both the pre- and post-intervention sessions. The results of one way ANOVA with repeated measures indicated that none of the main effect of Time ($p = .437$), main effect of Group ($p = .619$) and interaction effect between Group and Time ($p = .610$) were significant.

Overall pre- vs post-intervention

After the Control group completed the intervention, the two groups were combined to allow comparisons of each of the dependent variables between pre- and post-intervention. The results obtained before and after the intervention were summarized in Table 3. Results of paired-sample t-test indicated that after the intervention, there was a significant increase in terms of total utterances produced [$t(15) = 4.09$, $p = .001$], a significant increase in the number of elaborated verb phrases produced [$t(15) = 3.615$, $p = .003$], while the number of prepositional phrases produced remained unchanged ($p = .054$).

Table 3 about here

Discussion

This study aimed to evaluate the efficacy of an intervention designed using the statistical learning principles on a group of Cantonese-speaking children with suspected language disorder. Specifically, the use of elaborated verb phrases and prepositional phrases were targeted as Cantonese-speaking children with language disorders were previously reported to have specific difficulties using these two syntactic structures in their narrative productions (To et al., 2010).

Increased usage of elaborated verb phrases

The results of the within-group comparisons indicated that across time, the participants produced significantly more number of elaborated verb phrases during the narrative tasks. The significant interaction effect between Time and Group observed in the between-group comparisons further indicated that such increase in the use of elaborated verb phrases should be related to the intervention given. Hence, the results supported that good quality systematic

language input can enhance the acquisition of targeted syntactic structures among children with language disorders (Aguilar et al., 2018; Alt et al., 2012; Plante et al., 2018).

Unchanged usage of prepositional phrases

Unlike the increase in total utterances produced and elaborated verb phrases used, neither the within-group nor the between-group comparisons indicated improvement in the usage of prepositional phrases across time, even though language intervention with systematic language input was given. This observation was actually beyond our expectations, as syntactically, prepositional phrases are considered relatively regular in Cantonese. According to Matthew and Yip (1994), prepositions share with verbs a lot of common features in Cantonese. For example, like many verbs in Cantonese, most prepositions take noun phrases as arguments and many may take aspect markers and post-verb particles. It is also possible to use prepositions independently in sentences as the main verbs in Cantonese. Given the regular syntactic structure of prepositional phrases and their overlapping syntactic features with verbs, it was originally expected that systematic language input can enhance the participants' acquisition of the structure. However, our results indicated a different story. Two possible explanations were identified and were elaborated in the following.

First of all, unique thematic roles were associated with specific prepositions. For example, in Cantonese, the preposition 喺[hai2] is specifically used to code the thematic roles of place (e.g. 喺公園 [in the park]) and time (e.g. 喺黃昏 [in the evening]). Similarly, the preposition 畀[bei2] is specifically used to code the thematic role of recipient (e.g. 畀媽媽 [to mother]). Despite all three examples given share the same syntactic structure 'preposition + noun phrase', the thematic roles coded by the prepositions were different. The different thematic

roles coded, therefore, imposed restrictions regarding the preposition-noun combinations. Using the examples given, switching the corresponding noun phrases of the prepositions (e.g. 喺媽媽 [in mother] or 畀黃昏 [to evening]) will actually result in (semantically) illegal productions. Therefore, it appears that the acquisition of prepositional phrases in Cantonese involves not only the awareness of the regularity of syntactic constructions of the phrases, but also the acquisition of the unique thematic roles associated with different prepositions. As indicated in the examples of illegal productions given in the above, the awareness of the thematic roles associated with different preposition is necessary to prevent children from making errors in the productions of prepositional phrases. Given that the regularity and variability principles of statistical learning mainly highlighted the salience of syntactic structure of the targeted prepositional phrases in our intervention, it is possible that the thematic roles of the prepositions were not salient enough for the participants to acquire them.

Another possible explanation of the increased in elaborated verb phrases produced but unchanged performance in the production of prepositional phrases among the participants concerns about the narrative production task used. In a narrative production task, the use of elaborated verb phrases fulfill the purpose to provide more details of stories, so as to make the stories more interesting to the listeners (e.g. Bliss, et al., 1998; Ukrainetz, et al., 2005). On the other hand, the prepositional phrases may not be comparable with elaborated verb phrases in achieving the goal of enriching the content of the narratives produced. It is, therefore, possible that even if the participants learned the two targeted structures to an equal extent through the intervention given, the motivation to use prepositional phrases may not be as strong compared with the use of elaborated verb phrases. Therefore, the discrepancy between the intervention effect on the use of elaborated verb phrases and prepositional

phrases used by the participants could be due to the difference in their effectiveness in enriching the content of the targeted narratives. It is suggested that future studies with carefully designed narrative tasks that allow the elicitations of a variety of prepositional phrases are needed to warrant this claim.

Increased overall number of utterances produced across time

The results of both the comparisons of pre- and post-treatment measures conducted using the between-group and the within-group designs indicated significant increase in the overall number of utterances produced across time by the participants, no matter intervention was given or not. In fact, all participants, except one, demonstrated increased in the overall number of utterances produced in the post-treatment session compared with the pre-treatment session. This increase in overall number of utterances produced may be attributed to the participants' improved readiness to express in the narrative tasks across time, particularly in the Zoom meetings. Based on our experience, before the pandemic, children with language difficulties in Hong Kong attended speech therapy sessions almost exceptionally in face-to-face format, as travelling to speech therapy clinics is very convenient. In fact, this online language treatment may be one of the pioneers in Hong Kong back in 2020. The observation of improved readiness to express in the online context across time was not surprising, given that the social situation (i.e. talking to a stranger on a computer) should be originally unfamiliar to most of the participants. Besides, since children from Asian cultures are often discouraged to talk excessively in the presence of unfamiliar adults (Cheng, 1991), the increased in total number of utterances produced across time was actually within expectations.

Effect of systematic language input on language learning among children with suspected language disorder

Overall, the current study provides some evidence to support that Cantonese-speaking children with suspected language disorder are responsive to language intervention that emphasizes on systematic language input. We demonstrated that the increased use of elaborated verb phrases among Cantonese-speaking children with suspected language disorder by giving input-based language intervention.

It is important to point out that according to Plante and Gómez (2018), language input alone may be sufficient enough to affect children's language output. In the current study, however, activities that requires the participants to take turn with the clinicians to describe pictures or video clips were used in the intervention. While in our original design, emphasizing the participants' production turns were more to serve the purpose of engaging the participants in the unfamiliar online task instead. Whether the participants' production turns are necessary to achieve the positive effect remains unknown. In fact, a recently published systematic review of the impact of intervention dose form on oral language outcomes conducted by Frizelle et al. (2020) also indicated that production turns may be beneficial to promote intervention outcomes. One thing we did not measure was whether the number of correct target productions within the intervention sessions of individual participants is associated with their improvement across time. We suggest that this can be a concrete direction for future studies.

Another way to evaluate the incorporation of both language input and production turns in language intervention concerns the level of explicitness of the language intervention. There is a growing interest to categorise different language intervention approaches according to the level of explicitness in the instructions given. According to the evaluation given by Baron &

Arbel (2022), it appears that younger preschool children respond better to implicit methods while school-aged children benefit more from explicit instructions. With reference to the implicit-explicit continuum suggested by Baron and Arbel (2022), incorporating both language input and production turns in the language invention is considered less implicit-dominant, which may be more suitable for the participants in this study, who are entering into school-age.

One interesting observation in the current study concerns the discrepancy between the participants' responsiveness towards the language input of the two structures. We suggested that the unchanged prepositional phrases production could be due to the unique thematic roles associated with individual prepositions in Cantonese, which may not be highlighted enough during the intervention. In fact, the literature suggested that children with language disorder can learn from input-based language intervention that highlight the *prominence of statistical structures* (Alt et al., 2012; Plante & Gómez, 2018). It is, however, unclear if children's acquisition of the statistical structures apply to both grammatical word order and the thematic roles associated. Given that some thematic roles, e.g. agent and patient, are coded in word order, while others, e.g. direction and location, are coded using prepositions, it may not be easy to check if children pay attention to both grammatical word order and the thematic roles associated if only input-based language intervention is used. Given that there were also previous studies that reported potential difficulties with thematic role assignments in both language comprehension and production associated with children with language disorders (e.g. De López et al, 2014; Friedmann & Novogrodsky, 2017), we suggest that more studies in this area will be needed.

Clinical implications

The results of the current study demonstrated that systematic language input promotes the language learning among Cantonese-speaking children with suspected language disorder. It is suggested that clinically, systematic language input can be given to promote the learning of different structures that Cantonese children with language disorders are usually weak in their production, such as verb complements and pivotal construction (To, et al., 2010). The fact that the intervention in the current study was conducted online via Zoom further opens up more flexibility in the conduction of similar language intervention in the future. This is important given that lockdown seems to be a recurring policy applied by many governments during the pandemic. Telepractice in speech therapy (e.g. Fong et al., 2021; Weidner & Lowman, 2020) associated with systematic language input may be a good solution for child rehabilitation.

In addition, we speculated that the null effect observed in the prepositional phrase productions may be related to thematic roles associated with specific prepositions. If this is proved to be true, clinicians may need to be aware of these *exceptions* and consider the application of explicit instructions (Balthazar et al., 2020; Calder et al., 2021; Finestack, 2018) or combining both implicit and explicit instructions (e.g. Calder et al., 2018; Finestack et al., 2020) when conducting language intervention.

Limitations and future studies

One major limitation of the current study concerns the small sample size, which has limited the statistical power of the comparisons. Due to the pandemic in 2020, a convenient sampling in the format of retrospective study of existing data was used in participant recruitment. While the current design was the best we could achieved during the pandemic in 2020, so as to fulfil the strong demands of language intervention by the parents of children with language

difficulties at that time, it would be more ideal if a real waitlist crossover randomized controlled trial design (Ebbels, 2017) was used.

Besides, restricted by the confidentiality agreement, we were not able to conduct standardized language assessments with norm reference online. Hence, we could only suspect our participants as having language disorder without confirmation using norm-referenced language assessment results. This may affect the possible generalisation of the results. It is suggested that future studies can be conducted to replicate the current findings on children diagnosed as having language disorder using norm-referenced language assessment. This will help not only to confirm the applicability of the results of the current study to individuals with language disorder, but also to improve the confidence of the results (Ebbels, 2017).

Summary and Conclusion

The current study investigated whether or not systematic language input following principles of statistical learning can promote the language learning of Cantonese-speaking children with suspected language disorders. The results obtained suggested that the participants were responsive to the intervention given. Specifically, they demonstrated increased usage of elaborated verb phrases in their narratives productions. However, no significant change was observed in the production of prepositional phrases after the intervention. It is suggested that the unique thematic roles coded by individual prepositions possibly restricted the generalization effect of the intervention. Overall, the results added support to the body of literature that documented the effectiveness of language intervention using statistical learning techniques. Future studies are recommended to investigate the specific design needed that is suitable for introducing prepositional phrases in Cantonese to children with language disorders.

Ethics statement

This study involving human participants was reviewed and approved by the Human Subjects Ethics Sub-committee of The Hong Kong Polytechnic University (HSEARS20220522002). The patients/participants provided written informed consent to participate in this study.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Table 1. Demographic information of the participants.

	Treatment Group	Control Group	*p* values[+]
Number of participants	8 (6 boys, 2 girls)	8 (6 boys, 2 girls)	
Mean age (S.D.)	6.29 years (1.54)	7.10 years (0.96)	0.23
Average MAIN[*] scores			
Comprehension[#] (S.D.)	5.38 (3.02) out of 10	5.75 (3.33) out of 10	0.25
Production[^]			
Story retelling (S.D.)	7.25 (3.11) out of 17	9.13 (3.52) out of 17	0.34
Story telling (S.D.)	7.63 (3.78) out of 17	8.50 (2.93) out of 17	0.56

[*] The Multilingual Assessment Instrument for Narratives (MAIN) adapted in Cantonese (Chan et al., 2020; Kan et al., 2020) was conducted. [#] The comprehension score was calculated based on the children's accuracies towards the 10 questions in the test pre-designed according to the picture sequences. [^] The production scores were calculated based on the accurate productions of story macrostructure components, including settings, goals, attempts, outcomes and internal state terms. Two production scores, one on story telling and the other on story retelling, were obtained. [+] Significance values of independent *t*-tests.

Table 2. Pre- and Post-intervention performances of the Treatment and Control Groups.

	Treatment Group		Control Group	
	Pre-Intervention	Post-Intervention	Pre-Intervention	Post-Intervention
Average total number of utterances (S.D.)	61.25 (15.20)	81.00 (30.51)	57.88 (26.82)	91.38 (29.77)
Average number of elaborated verb phrases (S.D.)	1.75 (1.16)	3.50 (1.19)	1.87 (1.25)	1.50 (1.19)
Average number of prepositional phrases (S.D.)	0.75 (0.71)	1.25 (1.58)	0.25 (0.46)	0.75 (1.16)

Table 3. Overall comparisons between pre- and post-intervention.

	Pre-intervention	Post-intervention
Average number of utterances produced (S.D).	59.56 (21.13)	85.19 (27.42)
Average number of elaborated verb phrases produced (S.D.)	1.43 (1.15)	3.37 (2.39)
Average number of prepositional phrase structures produced (S.D.)	0.50 (0.63)	1.63 (2.19)

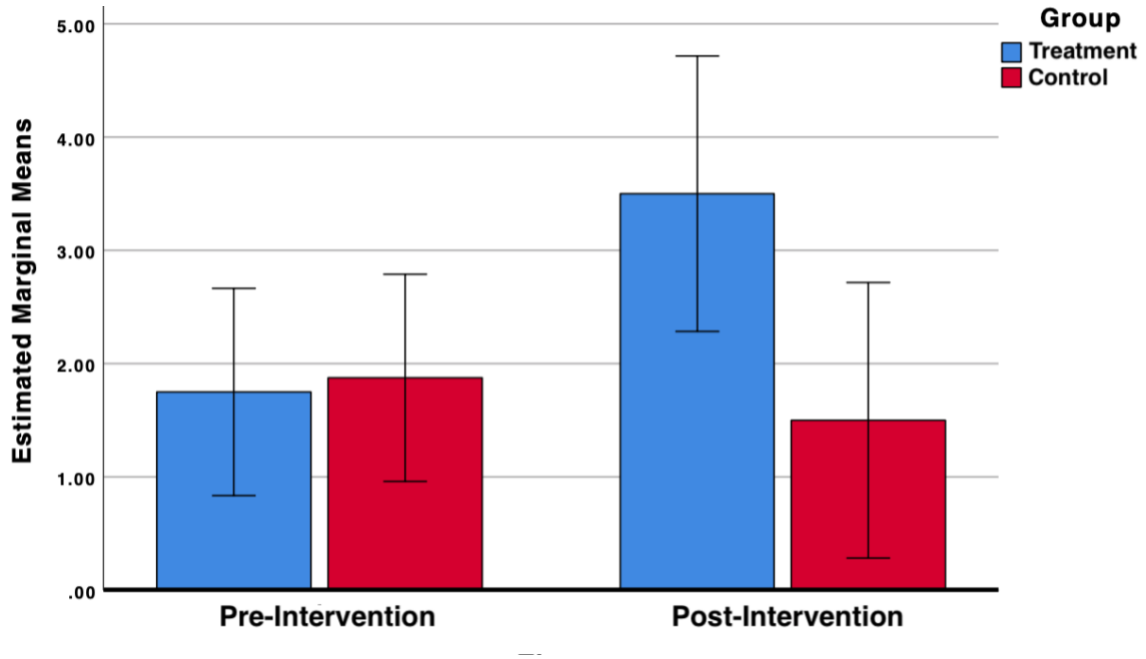
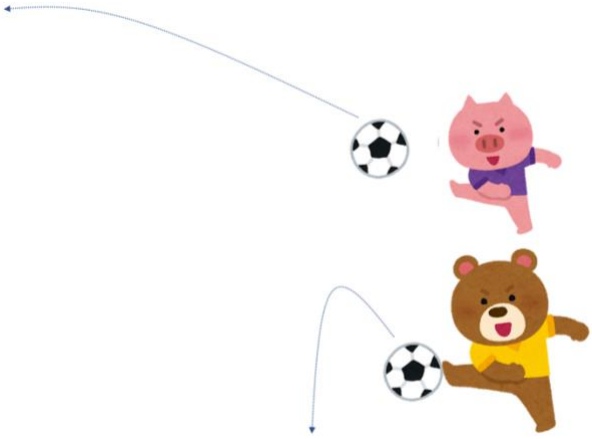


Figure 1. Average number of elaborated verb phrases produced by the two groups in the pre- and post-intervention assessment.

Appendix A



An example of giving recast upon production without verb phrase expansion by the child

Step	Event
1	Clinician pointing to the lower picture.
2	Clinician: 熊仔好細力咁踢波 <The bear kicks the ball softly>
3	Clinician pointing to the upper picture
4	Child: 豬豬踢波 <The piggy kicks the ball>
5	Recast by clinician: 豬豬好大力咁踢波 <The piggy kicks the ball hard>

An example of recast plus extension upon production with verb phrase expansion by the child

Step	Event
1	Clinician pointing to the lower picture.
2	Clinician: 熊仔好細力咁踢波 <The bear kicks the ball softly>
3	Clinician pointing to the upper picture
4	Error by child: 豬豬好大力咁踢波 <The piggy kicks the ball>
5	Recast by clinician: 係喎，豬豬好大力咁踢波，個波飛走咗！<Yes. The piggy kicks the ball hard. The ball flies away!>

Appendix B

An example of giving recast upon production without preposition by the child

Step	Event
1	Clinician pointing to the left picture.
2	Clinician: 小朋友喺廁所 <The children (are)^ in the toilet>
3	Clinician pointing to the right picture
4	Child: 賊人課室 <The thief the classroom>
5	Recast by clinician: 賊人喺課室 <The thief (is)^ in the classroom>

^ Copula verbs are not necessary here in Cantonese

An example of recast plus expansion upon production of prepositional phrase by the child

Step	Event
1	Clinician pointing to the left picture.
2	Clinician: 小朋友喺廁所 <The children (are) in the toilet>
3	Clinician pointing to the right picture
4	Child: 賊人喺課室 <The thief (is) in the classroom>
5	Recast by clinician: 係喎，賊人喺課室偷嘢 <The thief (is) stealing in the classroom>