



Effectiveness of parent coaching on the literacy skills of Hong Kong Chinese Children with and without dyslexia

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Abstract

Literacy skills are important for children's development. The present study explored the effectiveness of a parent coaching approach on the reading and spelling skills and compared cognitive-linguistic skills performances between Chinese children with and without dyslexia. Participants were 33 children with dyslexia and 77 children without dyslexia, as well as their parent, in Hong Kong. Children were divided into three groups: dyslexia with training, non-dyslexia with training, and non-dyslexia without training. Parents in both training groups were instructed to facilitate children's literacy skills. A series of cognitive-linguistic skills were tested on children at pretest. Children received measures of character reading, word reading, and word spelling before and after the parent coaching. Results showed that, compared to children without dyslexia, children with dyslexia performed significantly more poorly on all cognitive-linguistic skills. Analyses of the training effect demonstrated that the dyslexia with training group significantly improved their performances on word reading and word spelling following the intervention. In addition, those without dyslexia who experienced training performed significantly better on character reading and word spelling at posttest than pretest. These results suggest that parent coaching can be one potentially effective method of promoting literacy skills among children both with and without dyslexia.

Keywords Parent coaching · Literacy skills · Dyslexia · Cognitive-linguistic skills

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Introduction

Literacy acquisition is essential for children's academic, social development, and everyday settings. However, not all children can acquire literacy skills successfully. Dyslexia is one of the literacy disorders that manifests as poor word reading and word spelling abilities (International Dyslexia Association, 2002). Children with dyslexia have been found to have impairments in multiple cognitive-linguistic skills (e.g., Chung & Ho 2010). For example, studies have revealed that children with dyslexia performed significantly more poorly than children without dyslexia on tasks of phonological sensitivity and morphological awareness (e.g., Li & Ho 2011; Shu et al., 2006). It is important to develop effective interventions to facilitate literacy development, especially for children with dyslexia. The present study aimed at evaluating the effect of a parent coaching approach on the literacy skills of children with and without dyslexia and comparing the cognitive-linguistic skills among these children.

Children develop literacy competencies during interactions with more knowledgeable others, most often with their parents (Niklas & Schneider, 2017). However, the literacy interventions in previous studies were often delivered by teachers or researchers. In such interventions, one teacher/researcher works with groups of children simultaneously and the intervention is not adjusted according to specific situations of individual children. In contrast, parent coaching is in a one-on-one form, and the process of intervention can be tailored more suitably to each child and situation (Sylva et al., 2008). Some researchers have suggested that home-based intervention was more effective than classroom intervention in children's language and literacy development (e.g., Lonigan & Whitehurst 1998). Parenting practices at home play a unique role in children's literacy, language, and social-behavioral development (Sylva et al., 2004). Thus, training parents to assist children in reading and spelling might be an effective approach to improve children's literacy skills.

Cognitive-linguistic deficits in children with dyslexia

It is well established that word reading and spelling problems of dyslexia accompany deficits in multiple cognitive-linguistic skills. Many studies have found that children with dyslexia tend to show poorer performances in various cognitive-linguistic tasks as compared to age-matched children without dyslexia (e.g., Ho et al., 2002). These skills include phonological awareness, morphological awareness, rapid naming, and visual-orthographic knowledge. Phonological, semantic, and orthographic processing are essential for successful literacy acquisition. According to previous studies, children with dyslexia have difficulties in manipulating and accessing speech segments (e.g., McBride-Chang et al., 2008) as well as in manipulating and discriminating morphemes (e.g., Shu et al., 2006). They also have problems in extracting and producing orthographic patterns automatically (Ho et al., 2004). In addition, children with dyslexia might not be able to develop a strong orthographic representation of words in their minds, thus resulting in reading failures (Chung & Ho, 2010). However, there are

sometimes inconsistent results across studies. For example, Ho et al. (2004) showed that Chinese children with dyslexia have a dominant deficit in orthographic knowledge, while Yeung et al. (2014) did not find such a deficit in Chinese children with dyslexia. Therefore, it is important to compare performances on different cognitive-linguistic skills between children with and without dyslexia, especially for Chinese children, in order to understand consistent patterns. Research on cognitive-linguistic deficits can provide some implications for identifications of and interventions for children with dyslexia. Therefore, the present study compared performances on various cognitive-linguistic skills between Chinese children with and without dyslexia.

Parental influences on children's literacy development

Many parental factors have effects on children's literacy development. One important parent-related factor is the home literacy environment (HLE). HLE includes the frequency with which parents tell stories to their children, parents' reading activities, and other home environment elements that facilitate children's acquisition of literacy skills (Niklas & Schneider, 2015, 2017). Some studies have revealed that parents of children with dyslexia demonstrated lower rates of telling stories to children and in encouraging children to read extra-curricular books (e.g., Sun et al., 2013). In contrast, children who become literate at an early age often have parents who like reading at home and taking them to libraries and bookstores (Li & Rao, 2000).

A second parental factor is socioeconomic status (SES). SES, which includes parents' educational level and family income, is an important predictor of children's developmental outcomes (Davis-Kean et al., 2021). Studies have found that parents' educational level and family income play a role in children's literacy development (e.g., Niklas & Schneider 2017; van Bergen et al., 2011). Families with lower SES tend to provide less access to literacy resources and less frequent involvement in home literacy practices, thus resulting in disadvantages in children's literacy development (Aikens & Barbarin, 2008). In contrast, parents in higher SES families tend to provide more educational activities and higher quality talks to their children; they also demonstrate more knowledge about child development (Rowe, 2008).

HLE and SES are typically used to describe the child's overall family context (Dulay et al., 2019). Both factors indicate that parents influence children's literacy acquisition (e.g., Li & Rao 2000; Rowe, 2008). However, many parents do not realize that they can assist in children's literacy development or lack the skills of conducting literacy activities with children at home. Training parents in recognizing their parental roles and equipping them with literacy strategies might be an effective intervention for supporting the literacy development of children with and without dyslexia.

Effects of parent coaching on children's literacy skills in alphabetic language system

Studies exploring the effects of parent coaching on children's literacy skills have been widely conducted in the alphabetic language system. Among the various parent coaching approaches, parent-child shared book reading has received the most

attention and has been suggested to increase children's literacy skills (e.g., Piasta et al., 2012). For example, Niklas & Schneider (2017) developed an intervention for parents of kindergarten children. Parents attended one meeting that provided general information and an individual dialogic reading session that taught them to read books with children. Results were that children in the intervention group performed significantly better in phonological awareness after the program. Studies on children at risk of dyslexia have also indicated that participants who engage more in shared reading with their parents tend to develop better vocabulary skills (e.g., Laakso et al., 1999). However, another study found that children of Israeli mothers trained in interactive storybook reading did not improve in their linguistic competencies (Levin & Aram, 2012). Levin and Aram (2012) attributed this result to both assessment issues and a limited intervention time. They highlighted the fact that intervention gains are difficult to capture using general tests within a limited training period.

Other parent coaching studies focused on the more basic cognitive-linguistic skills have found good efficacy. One study conducted two 12-week parent-delivered interventions on shared storybook reading and cognitive-linguistic skills games separately in Filipino children (Dulay et al., 2018). In this study, the dialogic reading intervention helped children to gain more vocabulary knowledge, and cognitive-linguistic skills training improved children's letter name knowledge, phonological awareness, and print and word awareness skills. Another study explored the connections between parental instruction of print and children's literacy skills in Australia (Hood et al., 2008). Results showed that parental teaching of print was significantly correlated with letter-word identification in kindergarten and with reading and spelling in grade 1. Moreover, a meta-analysis on the effects of family-based literacy interventions revealed that parental tutoring of specific cognitive-linguistic skills had an impact on children's reading acquisition (Sénéchal & Young, 2008). However, a Dutch study explored the effectiveness of a home-based phonological awareness intervention in a sample of at-risk dyslexic children and found that parent coaching only improved children's phoneme awareness and letter knowledge but not word reading and spelling (van Otterloo & van der Leij, 2009). Most of these studies demonstrated that parent coaching showed a positive effect on improving children's cognitive-linguistic skills. However, whether this effect can be generalized to reading and spelling skills remains unclear.

Overall, studies in the alphabetic language system have revealed that parent coaching is a potentially effective method for facilitating children's literacy. However, many of these studies recruited children without dyslexia and used basic cognitive-linguistic skills as indicators. The present study extended these studies in both sample and indicators. We recruited children with dyslexia and included reading and spelling as intervention indicators.

Effects of parent coaching on children's literacy skills in Chinese writing system

Chinese is a script that involves complex structures. The basic unit of the Chinese writing system is the character, most of which comprise a phonetic radical and a semantic radical (Lin et al., 2011). The Chinese writing system involves many

strokes, homophones, and inconsistent correspondences between sound and symbol (Chow & McBride-Chang, 2003). Thus, Chinese is more difficult to learn to read and write than alphabetic orthographies (e.g., McBride 2016). In addition, Hong Kong children learn to read and write Chinese beginning at age three (Li & Rao, 2000). Parental scaffolding may play a critical role in the literacy acquisition of Hong Kong Chinese children due to the complicated nature of the Chinese writing system and their early initiation into literacy learning.

Several Chinese studies have explored the effects of parent coaching on children's literacy skills (e.g., Chow et al., 2008; Lam & McBride-Chang, 2013). For example, a parent coaching study provided parents with storybooks that contained prompt questions and recall prompts for conducting dialogic reading at home (Chow & McBride-Chang, 2003). Findings revealed that children in the dialogic group benefited significantly from the intervention in character identification and vocabulary knowledge. Another study found that children improved in their word reading after playing games related to Chinese morphological awareness with their parents for 8 weeks (Chow et al., 2008). Studies conducted in Mainland China also found that parents who assisted their children in learning pinyin knowledge positively affected children's subsequent reading skills (e.g., McBride-Chang et al., 2012). These studies highlighted the importance of parental involvement in children's reading acquisition.

Parent coaching has been found to enhance Chinese children's spelling skills as well. Lam & McBride-Chang (2013) investigated the effectiveness of stroke order training and radical knowledge training, which were delivered by parents, for enhancing the literacy skills of Hong Kong kindergarteners. Results were that children in both training conditions yielded greater improvements compared with the control condition without training in the dictation task. Some correlational studies have also examined the extent to which maternal mediation strategies used during the parent-child joint activities were uniquely related to children's word writing (Lin et al., 2011). These Chinese studies indicate that providing training for parents on strategies for fostering children's literacy skills at home might effectively promote children's spelling development.

Studies in the Chinese writing system have demonstrated that parent coaching can sometimes be an effective way to foster children's literacy skills. However, few studies have explored the effect of parent coaching on Chinese children with dyslexia. Little is known about whether parent coaching can be as effective in improving literacy acquisition of Chinese children with dyslexia as it is for typical children. Moreover, most previous studies have focused primarily on younger children at the level of kindergarten or preschool. In the present study, we tested whether school-aged children could also benefit from parental coaching as well.

The present study

Training parents to assist children in their reading and spelling acquisition has great potential. However, most of the existing studies on the effect of parent coaching focus on typically developing children. We know little about whether this approach

has a good effect on children with dyslexia as well. In addition, some of the parental interventions require a long duration and greater expense (Niklas & Schneider, 2017). Many families might not be able to provide enough resources required by some burdensome parent-based interventions for their children. Therefore, developing cost-effective parent coaching programs for parents of children with and without dyslexia is necessary.

The present study addressed the following research questions:

1. Do Chinese children with dyslexia have deficits across a variety of cognitive-linguistic skills, including phonological awareness, morphological awareness, rapid automatized naming, and delayed copying?
2. Does parent coaching have positive effects on the reading and spelling skills of children with and without dyslexia?

The present study aimed at examining the effect of a parent coaching approach on the reading and spelling skills of children with and without dyslexia. We anticipated that parent coaching might facilitate the literacy skills of children with and without dyslexia. Evaluating the effects of parent coaching on children's literacy skills provides perspectives for fostering children's reading and spelling development. It has potentially important implications for developing effective parent-based literacy interventions for Chinese children.

Furthermore, we measured a variety of cognitive-linguistic skills in children at the pretest in an attempt to compare the differences between children with and without dyslexia. We predicted that children with dyslexia might show deficits in all measured cognitive-linguistic skills. This exploration helps to facilitate our understanding of Chinese dyslexia.

Method

Participants

Children and their parents were recruited mainly from four primary schools in Hong Kong. An invitation email with the descriptions of the project (i.e., the project aimed at investigating the dyslexia in Chinese and its predictors) was sent to the parents. We aimed at recruiting children who were diagnosed with dyslexia and those who were typically developing from Grade 2 to Grade 4. Parents decided whether to participate in the project or not. A total of 135 children from second grade to fourth grade took part in the study at the pretest. Children recruited to the study were native Cantonese speakers. After the 1-month intervention, 121 children remained. There were no significant differences on age ($t(133) = 1.54, p = 0.126$), pretested character reading ($t(133) = -0.38, p = 0.702$), word reading ($t(133) = -0.22, p = 0.826$) and word spelling ($t(129) = 0.01, p = 0.990$) between those who remained in the study and those who dropped out. We excluded six children who did not complete all reading or spelling measures before and after the intervention and five who

exhibited erratic testing performances at post-test. Therefore, the final sample in the present study consisted of 110 children (52 boys, 58 girls). Of them, 33 belonged to the dyslexia with training group (mean age = 8.55, SD = 0.87). Children without dyslexia were randomly allocated to two groups, 41 were in the non-dyslexia with training group (mean age = 8.32, SD = 0.76) and 36 belonged to the non-dyslexia without training group (mean age = 8.39, SD = 0.93). Children with dyslexia had received a professional diagnosis of dyslexia by educational or clinical psychologists using the Hong Kong Test of Specific Learning Difficulties in Reading and Writing for Primary School Students—Third Edition [HKT-P(III)] (Ho et al., 2015), which is a standardized test for diagnosis of dyslexia in Hong Kong. Among the participating families, the largest proportion of mothers reported that their highest educational level was secondary school (27.3%). Among the largest proportion of fathers, the highest educational level was secondary school as well (22.7%). Table 1 shows the distributions of the highest educational levels reported for parents in the present study and the overall population in Hong Kong. Most of the participating families had monthly incomes in the range of HKD 10,001–20,000 (30.9%). Table 2 shows the distributions of monthly family income for participants in the present study as well as the overall population in Hong Kong for reference. The participating families had various SES backgrounds. Table 3 presents the demographic information of the children and parents by group. Of the parents who were involved in the training, 63 were mothers, 8 were fathers, and 3 did not report this information. Informed consent forms were attained from parents before the pretest. This study was approved by the university's ethical board.

Measures

Parent Questionnaire. This questionnaire collected basic demographic information of the parent and children. Specifically, parents' educational level and the monthly

Table 1 Distributions of the highest educational level for parents in the present study and the overall population in Hong Kong (HK)

Highest educational level	Mothers (%)	Fathers (%)	Overall population in HK (%) ^a
≤ Primary school	20.0	20.0	23.9
Secondary school	27.3	22.7	17.3
High school	9.1	8.2	25.9
Post secondary education	11.8	12.7	10.5
Degree course education ^b	22.7	24.5	22.4
Did not report	9.1	11.8	NA

NA Not applicable

^aThe distribution data for the overall population in Hong Kong was retrieved from the population census report released by the Census and Statistics Department of Hong Kong (2022a)

^bDegree course education included bachelor's, master's, and doctoral degree educational levels

Table 2 Distributions of monthly family income for participants in the present study and the overall population in Hong Kong (HK)

Monthly family income	Participants in this study (%)	Overall population in HK (%) ^a
≤HKD 10,000	7.3	20.2
HKD 10,001–20,000	30.9	16.7
HKD 20,001–30,000	14.5	14.5
HKD 30,001–40,000	10.0	11.9
HKD 40,001–50,000	13.6	8.5
≥ HKD 50,001	10.9	28.3
Did not report	12.7	NA

NA Not applicable

^aThe distribution data for the overall population in Hong Kong was retrieved from the statistics released by the Census and Statistics Department of Hong Kong (2022b)

Table 3 Demographic information of the participants: M (SD)

	Dyslexia with training	Non-dyslexia with training	Non-dyslexia without training
<i>n</i>	33	41	36
Age	8.55 (0.87)	8.32 (0.76)	8.39 (0.93)
Fathers' age	44.27 (6.05)	43.79 (5.81)	42.56 (11.61)
Mothers' age	42.03 (4.61)	40.43 (4.20)	40.45 (6.06)
FEL	2.09 (1.69)	2.24 (1.71)	1.71 (1.51)
MEL	2.25 (1.69)	2.19 (1.60)	1.48 (1.75)
Family income ^a	2.50 (1.59)	2.37 (1.57)	1.93 (1.58)

FEL fathers' educational level; *MEL* mothers' educational level. Fathers' and mothers' educational levels were indicated on a scale of 0 to 6 (primary school to the doctoral degree)

^aFamily income is presented on a scale of 0 to 5 (below 10,000 HKD to above 50,001 HKD).

family income were collected. Educational level was coded as numbers from 0 to 6. Numbers from 0 to 6 represented the educational levels from primary school to the doctoral degree. The larger the number, the higher attained educational level. Family monthly income was coded as numbers from 0 to 5. Numbers from 0 to 5 represented the family incomes from below 10,000 HKD to above 50,001 HKD. The factor scores of parents' educational levels and family income were created to compose the values of SES.

Phonological Awareness. This task was adapted from the onset and rime detection tasks used in a previous study (Shu et al., 2008). It consisted of two parts, namely the onset awareness section and the rime awareness section. In both sections, experimenters presented children with recordings of three syllables for each item. In the onset awareness section, one syllable had a different onset from

the other two syllables. In the rime awareness section, one syllable had a different rime from the other two syllables. Children needed to choose the syllable that had a different onset or rime. There were seven items in the onset section and six items in the rime section. One point was awarded to each correct answer. The maximum score of this test was 13. The reliability of Cronbach's alpha was 0.71.

Morphological Awareness. A morphological construction task was used to measure morphological awareness. This test was adjusted based on the morphological awareness tasks from previous studies (e.g., McBride-Chang et al., 2003). Items were arranged according to different grades levels. Children began the task from the level corresponding to their grades. In this test, children needed to create a new word for an object or concept orally. For the first 27 items, children were given a scenario with hints before creating the new word for each item. For example, "When oil is made of peanuts, we call it peanut oil. What should we call it if the oil is made of mushrooms?" The correct answer should be "mushroom oil." For the remaining 19 items, children were not given hints anymore. An example is the following: "What would you call a cat that catches bugs?" The correct answer is "bug-catching cat." A stopping rule was applied when children answered four items incorrectly within the same level. One point was given for each correct answer. The reliability of Cronbach's alpha was 0.91.

Rapid Automatized Naming (RAN). A rapid digit naming task (Chung et al., 2008) was used to assess the RAN skill. This task used a number list consisting of eight rows. The Arabic numbers 2, 4, 6, 7, 9 were contained in each row in random orders. Children were required to name the digits row by row as quickly and accurately as possible. They needed to do the task twice. The average naming time across the two trials was calculated.

Delayed Copying. This test was adapted from a delayed copying task from previous studies (e.g., Lo et al., 2018). In this test, children were presented with a character for 2 s each time. They were required to remember the character so that they could rewrite it after the character disappeared. Each character comprised a different number of components. For example, the item "倭" consists of three components: "亻", "亡", and "女". Two points were given to each correctly written component. One point was given if a minor error was observed within a component. There were 15 characters in this test. The maximum score of this test was 82. The reliability of Cronbach's alpha was 0.83.

Character Reading. A Chinese character list was used. Similar tasks have been used in previous studies (e.g., Lin et al., 2019). These characters were selected from textbooks used in Hong Kong primary schools and they were arranged in order of increasing difficulty. Children needed to read out the characters one by one. One point was given to each correctly read character. There were 160 characters in this test. Testing was stopped if children read 15 consecutive characters incorrectly. The reliabilities of Cronbach's alpha were 0.99 at both pretest and posttest.

Word Reading. A Chinese word list consisting of 70 two-character words was used. Similar tasks have been used in previous studies (e.g., Chung et al., 2008). These words were selected from textbooks used in Hong Kong primary schools and they were arranged in order of increasing difficulty. Children needed to read out the

words one by one. One point was awarded to each correctly read word. The reliabilities of Cronbach's alpha were 0.96 at both pretest and posttest.

Word spelling. A dictation task was used to assess spelling ability. According to Ehri (2000), spelling can be defined as the act of spelling a word by writing it. Spelling recognition and spelling production tasks are commonly used to measure spelling ability (Ehri, 2000). The word dictation task is one type of spelling production task. The way in which children combine elements to reproduce characters indeed encompasses the essential ingredients of spelling as defined by Ehri (2000), including writing a word/character and checking to see that it looks correct. Similar tasks have been used in previous studies (e.g., Lo et al., 2018). In the present study, the experimenter presented a two-character word orally each time and asked children to write the word down. Every word was presented twice. Words used in this test were selected from textbooks for Hong Kong primary school students. One point was given for each correctly written character. There were 25 words in this test and the maximum score was 50. The reliability estimate (Cronbach's alpha) was 0.96 at pretest and 0.93 at posttest.

Intervention

A massive open online course (MOOC) booklet was sent to parents who were assigned to the training group. The contents of this booklet focused on strategies that can help to facilitate children's literacy skills from parents' perspectives. The course was designed to help parents and teachers to teach concrete skills that might help children to improve their reading. It was adapted from a MOOC entitled "Teaching Struggling Readers around the World," which has been successfully offered to individuals from different countries (Word Learning & The Chinese University of Hong Kong, 2019). The contents of the MOOC can be found from the website: <https://learn.canvas.net/courses/2763?invitation=GVUF1YD9p3LMao2SN8qcHekGpASbYnXQvHWDkooaq>.

The booklet included five units. All contents from the original MOOC were translated to Chinese. Table 4 lists the focuses and main contents of each unit of the booklet. Some additional information specific to Chinese literacy was also added based on previous work. This booklet provided detailed knowledge about literacy-related issues and clear instructions on applying strategies to help children with and without dyslexia. At the end of the booklet, several helpful online resources and games for struggling readers were provided. The booklet was easy to follow because many examples were provided in order for parents to understand particular concepts and strategies. The booklet also contained figures to help parents to understand the contents. In addition, we informed and encouraged parents to contact us once they encountered any problems related to the booklet. Parents needed to learn the content of the booklet within 1 month. They were encouraged to finish the learning as soon as possible and apply what they learned to help children to read and write at home during the period. Experimenters reminded parents to complete the learning at halfway of intervention and did a follow-up on the completion situation after the

Table 4 The focuses and main contents of the MOOC booklet

Unit	Focus	Content
One	Learning about struggling readers	*Introduction to different types of dyslexia and dysgraphia
Two	From visual symbols to word recognition	*The importance of phonics and orthographic processing in reading *Strategies that help children's reading and writing including phonics instruction, memorization, visualization, copying, and activities focus on word spelling
Three	Helping children develop phonological awareness	*Introduction on phonological awareness *Activities on phonological awareness to play with children *Testing the phonological awareness and tone *The benefits of dialogic reading and instructions on conducting the dialogic reading
Four	Dialogic reading story	*Providing a story and display how to apply PEER and CROWD to conduct dialogic story reading *Introduction on morphemes and morphological awareness *Activities on morphological awareness to play with children
Five	Memory, speed, and fluency	*Introduction on the relationship between memory and reading fluency *Strategies on improving children's fluency *Screening of reading difficulties

1-month intervention. All the parents in the training group reported that they had completed the learning after 1 month.

Procedure

Phonological awareness, morphological awareness, RAN, delayed copying, character reading, word reading, and word spelling tests were conducted with children prior to the parent coaching. Parents were required to complete the parent questionnaire before the pretest. After the pretest, parents in both training groups received the booklet. Parents in the without training group received no interventions. The duration of parent coaching was 1 month. Only character reading, word reading, and word spelling were assessed in children after the intervention because these are the skills that are of most importance for literacy success. After the posttest, parents in the without training group received the booklet for their reference.

Data analyses

Results of correlational analyses and group comparisons are presented first. Performances on the pre-test skills were compared between groups. The method of linear interpolation was used to impute the missing data of family income (12.7% missing) and parents' educational levels (9.1% missing for mother and 11.8% missing for father). Factor scores were generated for these variables to create a composite measure of SES. We then conducted repeated measures variance analyses on three

literacy measures to evaluate the effect of parent coaching. Nine separate paired sample *t*-tests were performed to compare the gains from pretest to posttest on the three literacy measures for the three groups, separately. Cohen's *d*s were calculated to determine the sizes of the intervention effects.

Results

Correlational analyses and group comparisons

The results of the correlational analysis with age and SES controlled showed that almost all cognitive-linguistic and literacy measures were correlated with one another significantly (*r*s ranged from 0.22 to 0.96, all *p*s < 0.05), except the correlations between word spelling and a few cognitive-linguistic skills. The detailed associations are presented in Table 5. The correlational results indicated that the included cognitive-linguistic skills were consistently at least moderately associated with literacy acquisition.

Group means, standard deviations, and reliabilities of Cronbach's alpha of all pre-test and post-test measures are reported in Table 6. A one-way ANOVA was performed to compare age and SES among the three groups. Results showed that children in the three groups did not differ in age ($F(2, 109) = 0.67, p = 0.513$) and SES ($F(2, 109) = 2.65, p = 0.075$). A univariate analysis of variance was conducted to compare pre-test measures between children with dyslexia and without dyslexia (all typically developing children in both training and non-training groups). Age and SES were controlled in the analysis. Results showed that the group with dyslexia performed significantly more poorly on tasks of morphological awareness ($F(1, 106) = 31.74, p = 0.000$), delayed copying ($F(1, 106) = 4.65, p = 0.033$), phonological awareness ($F(1, 106) = 3.17, p = 0.015$), character ($F(1, 106) = 24.65, p = 0.000$) and word reading ($F(1, 106) = 20.40, p = 0.000$) than the group without dyslexia. Their performances on RAN ($F(1, 106) = 3.19, p = 0.077$) and word spelling ($F(1, 106) = 3.09, p = 0.082$) were also marginally significantly poorer than those of the group without dyslexia.

Effects of the parent coaching

The performances on pre- and post-test literacy skills among the three groups were compared first. Three separate 3 (group) \times 2 (time) repeated measures analyses were conducted with age and SES controlled. The main effects of time for word spelling ($F(1, 105) = 0.73, p = .394, \eta^2 = 0.01$) and for character reading ($F(1, 105) = 1.47, p = .229, \eta^2 = 0.01$) were not significant. The main effects of group for word spelling ($F(2, 105) = 6.34, p = 0.003, \eta^2 = 0.11$) and for character reading ($F(2, 105) = 13.61, p = 0.000, \eta^2 = 0.21$) were significant. The results showed that the interaction effects of time and group were not significant for word spelling ($F(2, 105) = 2.01, p = 0.140, \eta^2 = 0.04$) or for character reading ($F(2, 105) = 0.23, p = 0.795, \eta^2 = 0.00$). The main effect of time for word reading was not significant: $F(1, 105)$

Table 5 Correlations among measures at pretest and posttest with age and SES controlled ($n = 110$)

	1	2	3	4	5	6	7	8	9	10
1. Delayed copying	1									
2. Morphological awareness	0.33***	1								
3. RAN	-0.15	-0.17	1							
4. Phonological awareness	0.39***	0.52***	-0.18	1						
5. Pre-word spelling	0.27**	0.15	0.07	0.18	1					
6. Pre-character reading	0.41***	0.60***	-0.26**	0.38***	0.41***	1				
7. Pre-word reading	0.35***	0.54***	-0.23*	0.33***	0.39***	0.89***	1			
8. Post-word spelling	0.52***	0.53***	-0.18	0.46***	0.51***	0.73***	0.73***	1		
9. Post-character reading	0.40***	0.62***	-0.22*	0.39***	0.33**	0.92***	0.90***	0.71***	1	
10. Post-word reading	0.35***	0.53***	-0.23*	0.33***	0.34***	0.87***	0.96***	0.69***	0.90***	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6 Pre-test and post-test means and standard deviations on all measures by group: M (SD)

Test	Time	Reliability	Dyslexia with training	Non-dyslexia with training	Non-dyslexia without training
Delayed copying	Pre	0.83	23.45 (10.60)	28.29 (10.43)	26.58 (10.98)
Morphological awareness	Pre	0.91	19.24 (7.78)	25.71 (6.63)	25.81 (6.36)
RAN	Pre		23.96 (5.88)	21.59 (6.22)	23.78 (6.53)
Phonological awareness	Pre	0.71	6.03 (3.14)	7.63 (2.80)	6.78 (2.90)
Word spelling	Pre	0.96	22.55 (11.25)	25.17 (13.63)	27.67 (11.96)
	Post	0.93	26.36 (10.30)	34.15 (8.88)	33.97 (8.71)
Character reading	Pre	0.99	61.61 (30.85)	93.44 (37.12)	91.36 (37.39)
	Post	0.99	64.09 (34.85)	97.27 (34.66)	94.03 (35.44)
Word reading	Pre	0.96	40.42 (12.88)	50.83 (13.80)	50.89 (12.24)
	Post	0.96	42.94 (13.49)	51.15 (13.93)	50.56 (12.32)

= 0.16, $p = 0.689$, $\eta^2 = 0.00$. However, for word reading, the main effect of group ($F(2, 105) = 8.29$, $p = 0.000$, $\eta^2 = 0.14$) and the interaction effect between time and group ($F(2, 105) = 4.73$, $p = 0.011$, $\eta^2 = 0.08$) were both significant. Further simple effects analysis showed that the dyslexia with training group performed significantly better as compared to the pre-test score on word reading after intervention ($p = 0.000$). The pre-test word reading mean score was 40.42, and the post-test mean score was 42.94 for the dyslexia with training group. This group also demonstrated poorer performances than the other two groups (both without dyslexia) at both time points. However, the gap between the groups with and without dyslexia showed a decreasing tendency following the parent coaching. The gap in word reading performance between the dyslexia with training group and the non-dyslexia with training group was 10.41 at pretest, and decreased to 8.21 at posttest. This gap between the dyslexia with training group and the non-dyslexia without training group was 10.47 at pretest; it decreased to 7.62 at posttest. These results suggest that the parent coaching resulted in some efficacy in improving the word reading of children with dyslexia. The improvement tendencies of three literacy measures in three groups are shown in Fig. 1.

To inspect the effect of parent coaching further, a series of paired sample t -tests were performed to examine the improvements in literacy measures for children in each group. The results show that the dyslexia with training group improved their performances on word reading ($t(32) = -2.82$, $p = 0.008$, Cohen's $d = 0.19$) and word spelling ($t(32) = -2.20$, $p = 0.035$, Cohen's $d = 0.35$) significantly after the parent coaching. However, their performance on character reading did not show improvement following the intervention, $t(32) = -1.37$, $p = 0.181$.

In the typically developing children, the results showed that the training group significantly improved their performances on word spelling ($t(40) = -4.71$, $p = 0.000$, Cohen's $d = 0.78$) and character reading ($t(40) = -2.39$, $p = 0.022$, Cohen's $d = 0.11$) following intervention. Typically developing children who had not received training improved their performance on word spelling only ($t(35) = -3.68$,

$p = 0.001$, Cohen's $d = 0.60$) over the period, but the effect size was smaller than that in the training group (Cohen's $d = 0.60$ vs. Cohen's $d = 0.78$).

These results together suggest that the parent coaching had some effect in improving the reading and spelling abilities of children with and without dyslexia.

Discussion

The present study compared the performances of cognitive-linguistic skills between dyslexia and non-dyslexia and evaluated the effectiveness of parent coaching in promoting children's literacy skills. Results showed that children with dyslexia performed significantly more poorly on various cognitive-linguistic and literacy skills than children without dyslexia did before the intervention. Children with and without dyslexia in the training groups significantly improved their performances on two literacy skills after the intervention, though admittedly the improvements were small. In detail, the children with dyslexia in the training group significantly performed better on word reading and word spelling after the intervention. Children without dyslexia in the training group significantly improved their performance on character reading and word spelling skills. Findings highlight the potential importance of parental scaffolding in facilitating children's literacy skills.

Comparisons between children with and without dyslexia

The present study first examined the extent to which second to fourth grade children with dyslexia manifested difficulties in tested cognitive-linguistic and literacy skills

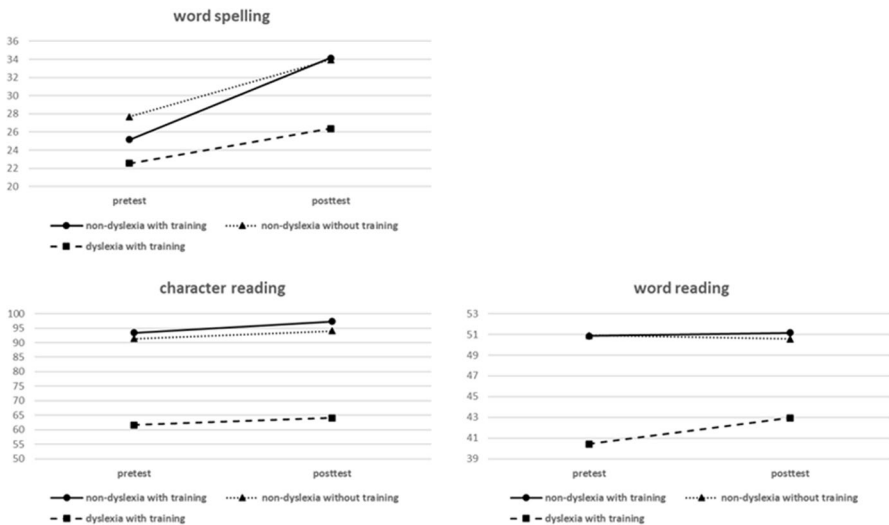


Fig. 1 The improvement tendencies of three literacy measures in three groups

prior to parent coaching. Children with dyslexia have been found to have deficits in several important basic skills involving phonological, fluency, morphological, and orthographic processing; these are often linked to their difficulties in reading and spelling (e.g., Li & Ho 2011). As in previous research, these skills were clear in distinguishing children with and without dyslexia (e.g., Shu et al., 2006). The multiple deficit model or multifactorial causal model of developmental dyslexia posits that dyslexia is multifactorial and involves the interaction of multiple risk factors (Catts et al., 2017; McGrath et al., 2020). Our results are in line with many previous studies on the profiles of those with dyslexia in Chinese (e.g., Zhou et al., 2014) and highlight the idea that dyslexia is often a multiple deficits disorder (e.g., Ho et al., 2002; Pennington, 2006). However, although the cognitive-linguistic and reading skills of the children with and without dyslexia differed, their differences on spelling skills were only marginally significantly different ($p = 0.082$). This finding might be attributable to the fact that word spelling was a relatively difficult task for all children before training. Spelling is the process of encoding, which requires generation of the orthographic structure given auditory input (Tong et al., 2017). It might be challenging for children to grasp and automatize the complex orthographic rules in Chinese.

Effects of parent coaching on children's reading and spelling skills

This study found that children with dyslexia significantly improved their word reading and spelling performances following the parental coaching intervention. Typically developing children in the training group improved their character reading and word spelling significantly after the parent coaching in paired sample *t*-tests. These results indicate that parent coaching may be an effective way for promoting literacy skills of both children with and without dyslexia. Our results were in line with several studies that have examined the efficacy of parent coaching on children's literacy skills (e.g., Sénéchal & Young 2008). Training parents to facilitate their children's literacy skills is thought to be effective because the training can improve parent-child interactions and increase the quality of the home learning environment (Niklas & Schneider, 2017). In addition, training parents might help them to realize their roles in children's literacy acquisition and increase parental involvement in children's literacy learning. Parents might need encouragement from professionals to provide children with specific support and effective strategies to enhance competencies in fostering children's literacy skills (Leyva et al., 2017). All of these factors are possible mechanisms leading to an effective parent coaching intervention. Particularly for parents of children with dyslexia, some researchers have suggested that providing specific training about children's literacy development for these parents can effectively reduce parenting stress levels and feelings of guilt, and increase parenting competencies (Multhauf et al., 2016).

According to the triangle model of literacy acquisition developed by Seidenberg & McClelland (1989), reading and spelling words involve the computation of three types of codes, namely, orthographic, phonological, and semantic. Mastering

the basic skills of these three interrelated aspects is essential for successful literacy acquisition. Disruption or inefficient processing in one or a combination of these skills would result in word reading difficulty (Kim, 2022). Our results of multiple deficits manifested in the dyslexic sample prior to intervention support these points. In this study, a large part of the coaching content in the booklet focused on training the basic cognitive-linguistic skills belonging to these three aspects. For example, Unit 3 focused on helping children develop phonological awareness (phonological code), and Unit 4 focused on morphological awareness strategies (semantic code). These cognitive-linguistic skills are closely associated with reading and spelling acquisition (e.g., McBride 2016). The correlational results of the present study also underscored the importance of cognitive-linguistic skills in literacy acquisition (Table 5), at least at a broad level. Therefore, the parent coaching in the present study showed potential efficacy for children's reading and spelling skills. However, when compared with the no training group, children without dyslexia in the training group performed significantly better on character reading but not word reading after the intervention. This might be because word reading and character reading involve some different processes. Chinese children tend to use an analytic strategy to learn characters but perhaps apply a somewhat more holistic strategy to learn multi-character words (Yang et al., 2022). In addition, the same character tends to be recognized more easily in the context of a word than in isolation because some helpful information can be extracted from the surrounding character(s) (Wang & McBride, 2016; Yang et al., 2022). Typically developing children in the present study appeared to have comparable proficiencies in word reading skill before intervention. However, there was evidence for improvement in their character reading skill, perhaps because the parental intervention fostered attention to character detail. This can be further explored in future studies.

Results of the present study suggest that parent coaching has potentially positive effects on children's literacy skills. However, there were some factors in the present study that might have influenced the intervention efficacy. First, the children's age in this study was older than in many previous studies. For example, Chow et al., (2008) included kindergarteners with a mean age of 63.8 months as their participants. Some researchers assert that the contribution of parental support decreases with the increase of children's age because older children are usually able to process reading and spelling materials independently (Mol et al., 2008). Second, the training period of the present intervention might have been too short. Parents might not have been able to apply what they had learned fully to facilitate children's literacy within such a short time interval. Some researchers have suggested that training that does not achieve strong results could be attributable to an inadequately implemented treatment (Troia, 1999). Nevertheless, our results did demonstrate that parent coaching appeared to make some differences in children's literacy skills, despite the fact that only a booklet was given out and the training period was short.

Implications

This study extends previous studies in several ways and contributes some new knowledge to this domain. One strength of this study is that the intervention provided requires very little vis-a-vis cost of time and it is easy to implement. This approach is helpful for parents who might not be able to provide many resources in participating in long-duration and expensive programs for helping their children. Our results underscore the fact that a multicomponent coaching booklet for parents might have some positive effects in supporting them in helping with children's literacy acquisition. Furthermore, the COVID-19 global pandemic has caused many changes in our traditional activities. One of them is that many children are being forced to complete their online learning at home. Hence, our study provides some implications for parents who wish to facilitate their children's literacy learning at home during the still ongoing pandemic.

Another important aspect of the present study is that we included a sample of children with dyslexia. The present study generalized the findings to this sample. Results of this study suggest that parent coaching can play an important role in the literacy development of children with dyslexia as well. This helps provide perspectives for developing effective interventions for children with dyslexia.

Limitations and future directions

The present study had some limitations. First, although we believed that most parents were active in helping children's development, the fidelity of the intervention in this study was not thoroughly documented. In this study, we followed up on parents' completions of the intervention only based on parents' self-reports, and no other measures were gathered to monitor the completion of the intervention. In addition, parents learned the coaching materials on their own, which might have led to asynchronous progress among participating families. Some researchers have highlighted the fact that parents often find it hard to catch up with others once they have missed some sessions during training (Scott et al., 2010). Moreover, the teaching quality of each parent was not well monitored, which might influence the efficacy of the coaching. Future studies can consider using different measures, such as videotape, to improve the fidelity of the intervention.

Second, the sample size of the present study was rather small and we did not explore the role of HLE and SES in influencing the efficacy of parent coaching. Future studies are encouraged to include larger samples and variables related to HLE and SES. With comprehensive measures, more sophisticated statistical analyses might be carried out to test the complete relationships among SES, HLE, and parent coaching effects.

Third, our training materials combined different elements that might be helpful for scaffolding children's literacy acquisition. Thus, we could not determine whether it is some specific elements or the combination of each of these elements that contributed to the efficacy of the intervention. Further investigations could make comparisons among different training elements to help examine various mechanisms of parent coaching. Adding active control groups can be a good design for this research direction.

Finally, other directions, such as the long-term effect of parent coaching and other potential benefits brought by parent coaching, are worth exploring in future research as well.

To conclude, the present study demonstrated that children with dyslexia had great deficits in many cognitive-linguistic and literacy skills. The parent coaching intervention appeared to manifest potentially positive effects on facilitating the literacy development of Chinese children with and without dyslexia.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Conflict of interest The authors have no conflicts of interest to disclose.

Ethical approval The study protocol was approved by the Survey and Behavioral Research Ethics Committee of the Chinese University of Hong Kong.

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