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DIR/Floortime® Model for School Children with Language impairment: Training for Parents, Primary Caregivers and Teachers*

Abstract

The DIR/Floortime® model is a holistic framework developed to promote social-emotional and intellectual development in children with developmental disabilities. This quasi-experimental study with a one-group pre-test/post-test design was conducted to examine the effects of DIR/Floortime® intervention on the improvement of language abilities and the functional emotional development of 22 school children with impaired language ability, aged 6-7 years, at a public elementary school in a central province of Thailand. The intervention focused on training 15 parents, 7 primary caregivers and 8 teachers through a process of modelling, coaching and feedback. The intervention included group and individual sessions conducted over a three-month period. After implementing the intervention, the semantic development scores and proportion of children with normal Functional Emotional Assessment milestone increased significantly. The number of children at narrative development Stage 4: abbreviated episode (can describe character, setting, a kick-off event and a list of actions and a conclusion to the story/direct consequence of events) was also markedly increased. This study provides supporting evidence that training using DIR/Floortime® approach will help parents, primary caregivers and teachers create emotionally meaningful learning that promotes the functional emotional development and language abilities of children with impaired language ability, both at home and at school.

Keywords: Language impairment, DIR/Floortime® intervention, Functional emotional development, Semantic and narrative development, Parent, primary caregiver and teacher training.

Introduction

Children use language to express their emotions, feelings and thoughts to other people. When children play with their

friends and use language to share information and learn in the classroom, the ability to learn a language from a young age will develop into literacy, eventually developing into reading and writing in the

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future. However, there are many children who experience some degree of reading and writing impairment when entering school because they have delayed language development when compared to friends of the same or similar age. Some children have poor listening skill and issues in expressing images to others (Paul, 2007; Duff & Tomblin, 2018), so these children are diagnosed with language impairment (LI). In the United States and Canada, it has been found that, from the prevalence of students attending, approximately 10% of students have a LI of some kind (Norbury, et al., 2016). In fact, 25% - 27% of language impaired children will have serious impairments in reading (Catts, Adolf, Hogan & Weismer, 2005).

In Thailand, there has never been a serious survey of children with LI. Current data of students with special needs of the Thai Bureau of Special Education in 2015 – 2018 was obtained from check list screening by teachers. The number of students who had problems with reading and writing in school increased from 316,482 children in 2015 to 353,863 children in 2018, being equal to 82.59% - 85.05% of total students with special need, respectively (Thai Bureau of Special Education Administration, 2018). From the above data, we raise the question of whether these children may have hidden LI problems and have never been diagnosed to find the cause so that a solution can be found. Furthermore, there are shortage of special education teacher, most of hidden student study with regular classroom teacher in a public elementary school. Therefore, it is interesting to investigate the true problems of children with reading and writing problems in an effort to find a solution by providing intervention to parents and teachers. The parents of children play a critical role in their language learning and literacy, especially when children are young and have not yet entered a classroom (Petrie & Davidson, 1995; Carter, Chard, & Pool, 2009; Rashid, Morris, & Sevcik, 2005). Thus, a concrete approach must be selected for coaching parents and relatives one-on-one, while teaching children with LI to promote the language and functional emotional development of the child to reduce problems. If LI is allowed to persist, children may experience social difficulties with their peers,

emotional difficulties and literacy difficulties when they grow up, including both reading and writing impairment as well as reduced levels of academic achievement through adolescence and into adult life (Paul & Norbury, 2012; Lindsay & Strand, 2016).

The DIR/Floortime® model is a holistic framework developed to promote social-emotional and intellectual development in children with special education needs. The model deals with each child's profile in three areas that are crucial for fostering new learning: the development of functional emotional capacities (D), individual differences (I), and relationships and affective interactions (R) (Greenspan, DeGangi, & Wieders, 2001; Greenspan & Wieder, 2005; Greenspan & Greenspan, 2010). The model considers 6 developmental milestones that children must master for their intellectual and emotional growth (Greenspan, DeGangi, & Wieders, 2001). These capacities include: 1) Self-regulation and interest the world; 2) Forming relationships, attachments, and engagement; 3) Two-way purposeful communication; 4) Behaviour organization, problem solving, and internalization; 5) Representational elaboration; 6) Building logical bridges between ideas and emotional thinking.

These meaningful learning interactions between children and their parents as well as primary caregivers are guided by the Floortime® play approach. Parents and primary caregivers are encouraged to follow the child's emotions and interests to interact with them in a natural social environment. This fits well with young children's development (Mok, & Chung, 2014). The model's process emphasises: 1) using play and playfulness as the primary means to engage and teach; 2) responding to all communications; and 3) embracing a wide range of feelings (Harwell, Davis, & Isaacson, 2014). The following 4 steps of Floortime to interact with the children are; 1) to observe the child's body language, facial expression, tone of voice, and words 2) to joins the child's activity and match his/her emotional tone and 3) to reflect on what is she/he doing and follow the child's lead 4) to expand on the child's natural interest (Simpson et al., 2005).

Although the model can be applied to various groups of children with

special needs, most previous studies and applications that have proven the model to be useful have focused mainly on children with autism (Boshoff et al., 2020; Casenhiser, Shanker, & Stieben, 2011; Dionne & Martini, 2011; Pajareya, & Nopmaneejumruslers, 2011; Pajareya, & Nopmaneejumruslers, 2012; Liao et al., 2014; Mok, & Chung, 2014; Praphatthanakunwong, et al., 2018; Reis, Pereira, & Almeida, 2018; Sealy & Glovinsky, 2016; Solomon et al., 2014; Solomon, Necheles, Ferch, & Bruckman, 2007; Wieder & Greenspan, 2003).

Recently, Boshoff et al, (2020) conducted a systematic review on child development outcomes due to DIR/Floortime®-based intervention for children with autism spectrum disorder (ASD) found that 9 studies met the eligibility criteria with varying methodological quality. Mostly reported on positive outcomes in the area of socio-emotional development in children with ASD. Two studies also included language skills as one of the outcome measures. Language showed no improvements in the Preschool Language Scale IV (Casenhiser, Shanker, & Stieben, 2011) and Mullen Scales of Early Learning (Solomon et al, 2014), although the socioemotional improved significantly. From the literature review, there appears to be no previous study on DIR/Floortime® intervention in children with impaired language ability.

The present study evaluated the potential application of the DIR/Floortime® model in children with LI, in both home- and school-based environments, since children spend at least 7 hours at school each weekday. The DIR/Floortime® model could be used as a framework to enable parents, primary care givers, and teachers to provide better help children with LI develop their abilities with better insight, both in terms of each child's specific problems according to his or her developmental milestone, and appropriate interventions guided by the child's level of development and specific problems.

This study was conducted in a public elementary school in Kanchanaburi, which is a province in central Thailand. The principal of the school stated that she was unaware of the real causes of learning disorders or how to help children with these kinds of disorders. In the present study, the DIR/Floortime® model was used to assist

children with LI in this school. Training was given to parents, primary caregivers, and teachers how to use the DIR/Floortime® model and coached them to understand how to build basic thinking skills for children with LI. In the present study, a primary caregiver was defined as any person who provided the majority of care for a child in a role similar to that of a parent. Consequently, this quasi-experimental study with a one-group pre-test/post-test design aimed to address the following questions: 1) Does the intervention based on DIR/Floortime® model increase the language abilities (measured through semantic and narrative development) of school children with LI? 2) Does the intervention based on DIR/Floortime® model increase the functional emotional development [measured through the Functional Emotional Assessment (FEAS)] of school children with LI?

Method

Study design

This study used a quasi-experimental one-group, pre-test/post-test design. The design included a baseline evaluation and pre-intervention training sessions, as well as monthly coaching and evaluation of the children's language development and functional emotional development during the 3-month period of intervention.

Participants

The study participants comprised 32 students aged 6-7 years who had academic problems as identified by their regular classroom teachers, as well as 15 parents, 7 primary caregivers and 8 elementary school teachers. Hearing problems were excluded by an otolaryngologist and two audiologists from the Faculty of Medicine at Ramathibodi Hospital, Mahidol University. To make a diagnosis of LI, 30 children without hearing impairment were evaluated by 3 speech-language pathologists. Ten children were excluded from the study, two due to hearing impairment, and another 8 children due to parents' unavailability. In total, 22 children with LI were deemed eligible for this study. The diagnosis, recruitment, evaluation and follow-up process of participating children is shown in Figure 1. The inclusion criteria for

children were: 1) age 6-7 years; 2) diagnosed with LI; 3) studying at Kanchanaburi Municipality I Elementary School. Children with LI who had hearing impairment or any medical history of a serious genetic disorder, traumatic brain injury or seizures were excluded. Inclusion criteria for parents, primary caregivers and teachers of the eligible students were: 1) agree to attend all pre-intervention training, coaching and DIR/Floortime® intervention sessions as well as complete all required assignments that were part of the intervention, and 2) willing to participate in this study. Parents, primary caregivers, who are grandmother or grandfather or aunt, and regular classroom teachers with any history of chronic psychiatric or psychological illness were excluded.

Procedures

This study was approved by the Ethical Review Committee of the Faculty of Public Health, Mahidol University, Thailand (COA. No MUPH 2015-041; 10 March 2015). Permission to implement the DIR/Floortime® intervention was obtained from the Principal of the Kanchanaburi Municipality I Elementary School. Informed

written consent was obtained from all eligible parents, primary caregivers and teachers prior to participation.

The intervention was based on the DIR/Floortime® model developed by Greenspan and Wieder (Greenspan & Wieder, 1997) and 'The process of intervention in a child's development' protocol of Floortime® Thailand developed by Pajareya (2010). The principal investigator (PI) was a speech-language pathologist trained to use DIR/Floortime® with special needs children and adults by DIR/Floortime® Thailand, a non-profit institute approved by the Interdisciplinary Council on Developmental and Learning Disorders (ICDL) in America to organise DIR/Floortime® courses for healthcare providers, parents, primary caregivers and teachers. The pathologist had 8 years of experience in using the DIR/Floortime® approach with special-needs children. The three research assistants were speech-language pathologists who assessed the children's language development using language abilities tests. The intervention comprised 2 phases, as described below.

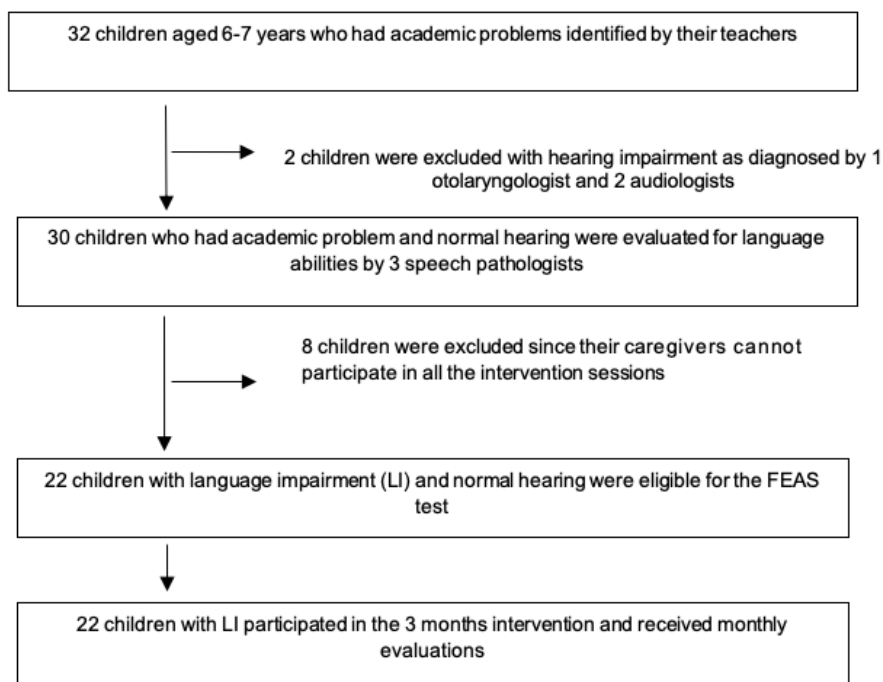


Figure 1.

Recruitment and evaluation of children at each stage of the intervention

Phase I Preparation phase (1 month)

The objectives of this phase were: 1) to recruit eligible school children for participation, 2) to prepare the course manual, lesson plans and instruments, 3) to evaluate the language abilities and functional emotional development of the child participants, 4) to collect baseline characteristics from all participating children, parents, primary caregivers and teachers, and 5) to train the parents, primary caregivers and teachers based on the DIR/Floortime® model. There were 4 sessions of DIR/Floortime® intervention in this study. Session 1 was started in this phase, which involved a one-day workshop concerning the principles and aims of DIR/Floortime® led by the PI, starting with a brief introduction to the DIR/Floortime® model (developmental milestones, individual differences and relationship with others), followed by a session of physical play with all participating children to demonstrate various processes such as visual-spatial processing, motor planning, auditory processing, sensory processing, that affect each child's abilities. Discussion was also conducted on how to conduct physical play at home and in the classroom. The parents, primary care givers and teachers also had a chance to observe and practice pretend play. PI' coaching was given to each parent or primary caregiver and teachers following the Floortime® principles to promote children's basic functional emotional development and language development towards the developmental milestone. The first day of the workshop was concluded with shared agreement among the parents, primary care givers, and teachers to give the children daily training and record the assigned activity in a logbook.

Phase II Implementation phase (3 months)

In training sessions 2-4, the parents, primary care giver, and teacher of each child were coached individually (1 hour/case) to examine and observe the child's behaviours as reflected by the three DIR domains and practiced Floortime® sessions, which focused on encouraging the child's initiative and purposeful behaviour, deepening engagement, lengthening mutual attention, and developing symbolic capacities through pretend play and

conversations, always following the child's lead, through a process of modelling, guided practice, feedback and self-reflection.

Individual assignment for semi-structured daily problem-solving exercises according to the child's current milestone of functional emotional development and problems was given to each parent, primary caregiver and teacher. Participants were asked to carry out their assigned DIR/Floortime® and semi-structured problem-solving activities for a minimum of 5.25 hours per week, 45 minutes per day, and 7 days a week, in order to achieve the identified goals.

The DIR/Floortime® techniques appropriate for each child were given to the parent, primary caregiver and teacher. For example, if the child would not calm down or could not be warm and loving, the adults were encouraged to do Floortime® level 1: joining their child in an activity that gave them pleasure and maintaining mutual attention and engagement. Floortime® level 1 contributes to functional emotional developmental milestones 1, self-regulation and interest in the world; and developmental level 2, forming relationships, attachments, and engagements.

If the child could not engage in two-way gestural communication, did not express a noticeable amount of subtle emotions, or could not open and close many gestural communications in a row, the parent, primary caregiver and teacher were encouraged to do Floortime® level 2: using simple communication through animated face-to-face interaction, with increasing back-and-forth communication. This achievement correlated with milestones 3, two-way purposeful communication; and 4 behaviour organisation, problem solving, and internalisation.

If the child could not engage in pretend play and/or use words to convey personal intentions or wishes, the parent, primary caregiver and teacher were encouraged to use Floortime® level 3: helping the child to express needs, wishes and feelings through pretend play and using their ideas in daily conversation. This achievement correlated with milestone 5, representational elaboration.

If the children could not organize personal thoughts logically or hold a conversation for a period of time, the parents,

primary caregivers and teachers were encouraged to use Floortime® level 4: helping their child become a logical and critical thinker. This achievement is correlated with milestone 6, building logical bridges between ideas and emotions. All parents and primary caregivers were advised to help their children exhibit these skills through a full range of emotions. At the same time, if the children needed to complete semi-structured exercises, the PI assigned homework to parents, primary caregivers and teachers in an effort to improve the children's development.

Twenty-two children were evaluated by the PI for their functional emotional development in session 1 and session 4 during interactions with their parents and primary caregivers. To reduce measurement bias by the researcher, the children's language abilities were independently evaluated by 3 speech-language pathologists after each session with the parents or caregivers.

For school-based DIR/Floortime®, the teacher assigned played with each child, after the last session of each school day, based on DIR/Floortime® principles for 45 minutes (3.75 hours per week). They also used a logbook to record their activity assignments, the same as what the parents and primary caregivers did at home.

Data collection

Data was collected according to the following measures:

Baseline characteristics

These characteristics were collected during the pre-intervention phase, which included the children's sex and age, as well as the parents' or primary caregivers' marital status, education, occupation and average monthly income, and the teachers' sex, age and education.

Functional Emotional Development Assessment Scale (FEAS)

The Thai version of FEDQ was developed based on the Greenspan's FEDQ by Pajareya et al., (Pajareya, Sutthritpongsa, & Sanprasath, 2014). The Thai version of the FEDQ had a satisfactory internal consistency (Cronbach's alpha = 0.83). Test-retest reliability was acceptable with the

intra-class correlation coefficient of 0.89 (95%CI 0.82 to 0.93). This instrument was used to assess the functional emotional development of the children with LI observed during interactions between the parents, primary caregivers and their children at the pre-intervention, and at the end of the 3rd month of intervention. The cut-off points of the 6 milestones (M) or levels of FEAS scores were: M1 self-regulation and interest in the world (11/14); M2 forming relationships, attachments, and engagement (13/16); M3 two-way, purposeful communication (7/8); M4 behaviour organisation, problem-solving, and internalisation (3/4); M5 representational elaboration (8/14); and M6 building logical bridges between ideas and emotional thinking (4/10). If the outcome score was less than the cut-off point of that milestone, the child was classified as 'impaired' for that milestone. If the outcome score was equal or greater than the cut-off, the child was classified as 'normal' for that milestone. The total for passing score was 46 out of 66 (Pajareya, Sutthritpongsa, & Sanprasath, 2014).

Language Development Skills Tests

The Thai Semantic Development Test for children aged 3-7 years 11 months was used to assess the children's language abilities. The children were assessed 4 times: at the pre-intervention, and at the ends of the 1st, 2nd, and 3rd months of the intervention. Assessment was carried out independently by 3 speech-language pathologists who did not otherwise engage in the interventions. The scores came from 3 subtests with a total of 103 items. Subtest 1: Picture vocabulary had 36 items and was designed to assess a child's ability to understand the meaning of words spoken by the examiner. The score ranged from 0-36. The Kuder Richardson (KR-20) coefficient was 0.95 (Onnak, 2000). Subtest II: Relational vocabulary had 33 items and was designed to assess a child's ability to understand and orally express the relationship between two words. The score ranged from 0-33. The Kuder Richardson (KR-20) coefficient was 0.93 (Onnak, 2000). Subtest III: Oral vocabulary had 34 items and was designed to assess a child's ability to give oral definitions to common Thai words that were spoken by the examiner. The score ranged from 0-34. The

Kuder Richardson (KR-20) coefficient was 0.96 (Onnak, 2000).

Narrative Development Skills

Narrative development was assessed by asking the children to provide a narrative for the picture book 'Frog, where are you?' (Mayer, 1969). The picture book is semi-structured and suitable for variable age groups of children. The children were assessed 4 times: at the pre-intervention, and at the ends of the 1st, 2nd, and 3rd months of the intervention. The outcome was the number of children at each stage of storytelling. The stages were decided by 3 speech-language pathologists based on the child's ability to narrate the picture book. There are 7 storytelling stages: 1 descriptive level; 2 action sequence; 3 reaction sequence; 4 abbreviated episode; 5 complete episode; 6 complex episode and 7 interactive episode. The higher stages refer to higher narrative development skills.

Data analysis

Descriptive statistics such as percentage, mean and standard deviation were used to describe the children's, parents, primary caregivers' and teachers' baseline characteristics. They were also used to describe the outcomes of FEAS, and the children's semantic and oral narrative development. Wilcoxon signed ranks tests were used to examine changes in the children's emotional function, semantic development, as well as oral narrative development. Cochran's Q-test was performed to examine changes in each stage of the children's oral narrative development. Cohen's effect size index (r) was calculated based on the Z score divided by the square root of the total sample to estimate the magnitude of intervention effect (large effect size: $r \geq 0.50$, medium effect size: $0.50 > r \geq 0.30$, low effect size: $0.30 > r \geq 0.10$ (Cohen, 1988). Significance level was set at $p < 0.05$.

Results

Baseline characteristics of the study participants

Table 1 contains the baseline characteristics of the participants of this study. Of the

22 children aged 6-7 years, 13 were boys and 9 were girls. Of the 22 parents/ primary caregivers, 15 were parents of the children. Nine had finished elementary school. Six had finished senior high school. The average monthly income was 7500 Thai baht (1 USD = 30.34 baht). Of the 8 teachers, 7 were female. All teachers had completed a bachelor's degree.

The Functional Emotional Development Scale (FEAS)

At the pre-intervention, the FEAS results showed that the participating children had deficits in 4 FEAS milestones: M1, self-regulating and interest in the world; M2, forming relationships, attachments and engagements; M5, representational elaboration; and M6, building logical bridges between ideas and emotional thinking. None of the children had deficits in M3, two-way purposeful communication or M4, behaviour organisation, problem solving, and internalisation (data not shown).

Table 2 shows that mean scores for the 6 milestones increased over 3 months intervention. The effect size varied from 0.1. to 2.6 (low to large effect size). Differences were significant for 3 milestones: self-regulation and interest in the world ($Z = -3.96$, $p < 0.001$), forming relationship, attachment, and engagement ($Z = -3.97$, $p < 0.001$), and building logical bridges between ideas and emotional thinking ($Z = -3.54$, $p < 0.001$).

The Thai Semantic Development test was used to assess the children's language skills. It comprised of 3 subtests. The Picture vocabulary subtest was used to measure semantic comprehension while the Relational vocabulary and Oral vocabulary subtests were used to measure semantic expression. Table 3 shows the mean scores of 3 subtests increased every month after initiation of the intervention. Picture vocabulary increased from 22.8 (7.1) at pre-intervention to 28.8 (3.3) after 3 months of intervention. Relational vocabulary increased from 5.3 (4.1) to 16.7 (5.7). Oral vocabulary increased from 6.8 (3.9) to 16.0 (4.4).

Table 1.*Baseline characteristics of 22 children, their primary caregivers and 8 teachers*

Characteristic	Number (%)
Children's characteristics	
Sex: Male	13 (59.1)
Age (years)	
6	10 (45.5)
7	12 (54.5)
Parents/ primary caregivers' characteristics	
Relationship to the child	
Parent (14 mothers, 2 Fathers)	15 (68.2)
Relative (e.g. grandfather, grandmother and aunt)	7 (31.8)
Marital status	
Married	14 (63.6)
Single/divorced	8 (36.4)
Education	
Elementary school	9 (40.9)
Middle school/ Senior high school	10 (45.5)
Vocational school	3 (13.6)
Occupation	
Self-employed	11 (50.0)
Government official	1 (4.6)
Labourer	10 (45.4)
Average monthly income (Thai baht) ^a	
5,000-10,000	10 (45.5)
10,000-20,000	12 (54.5)
Median = 7500 baht Mode = 5000 baht Range 5000-20000 baht	
Regular classroom teachers' characteristics (n=8)	
Sex: Female	8 (100.0)
Age (years)	
30 - 44	5 (62.5)
45 - 59	3 (37.5)
Education	
Bachelor's degree	8 (100.0)

^a30.34 baht = 1 USD**Table 2.***Changes in Functional Emotional Assessment Scale (FEAS) at pre- and post-intervention by children with language impairment (n=22)*

FEAS Milestone (M)	Pre-intervention M(SD)	Post-intervention M(SD)	Z	p ^a	Effect size
M1 Self-regulation and interest in the world	9.2(1.5)	11.9(1.3)	-3.96	<0.001	1.8
M2 Forming relationships, attachments	10.2(1.6)	14.0(0.9)	-3.97	<0.001	2.6
M3 Two-way purposeful communication	8.0(0)	8.0(0)	na	na	na
M4 Behaviour organization, problem solving, and internalization	4.0(0)	4.0(0)	na	na	na
M5 Representational elaboration	9.1(4.5)	9.6(4.0)	-1.34	0.180	0.1
M6 Building logical bridges between ideas and emotional thinking	1.2(1.8)	4.3(2.2)	-3.54	<0.001	1.6

^a p-value from Wilcoxon signed ranks test; na = non-applicable, no change**Table 3.***Changes in children's semantic development at pre-, and during the 3 months intervention (n=22)*

Subtest	Pre-intervention M (SD)	End of each month during intervention		
		1 st M (SD)	2 nd M (SD)	3 rd M (SD)
Picture vocabulary	22.8 (7.1)	25.8 (4.1)	28.6 (3.3)	28.8 (3.3)
Relational vocabulary	5.3 (4.1)	12.1 (6.7)	15.9 (6.5)	16.7 (5.7)
Oral vocabulary	6.8 (3.9)	12.6 (5.3)	15.2 (4.6)	16.0 (4.4)

Table 4 shows changes in children's semantic development by subtest at pre-intervention and post-intervention. Mean scores for 3 subtests increased over the 3 months intervention. The effect size for 3 subtests varied from 0.9 to 2.2 (large effect). There were significant improvements in all subtests: picture vocabulary ($Z = -3.7$, $p < 0.001$); relational vocabulary ($Z = -4.1$, $p < 0.001$) and oral vocabulary ($Z = -4.0$, $p < 0.001$).

Narrative development skills

At pre-intervention, 9 (40.9%) of the 22 children were able to demonstrate their ability at narrative developmental stage 1 descriptive level, which was equivalent to that of normal children aged 1-3 years. 11 (50%) children had narrative ability equivalent to the narrative developmental stage 2 action sequence, which was the same level as normal children aged 2-3 years. 2 (9.1%) children could perform at the narrative developmental stage 3 reactive sequence, which was still lower than the normal level at which they should be able to demonstrate. No children could demonstrate at the narrative developmental Stage 4 abbreviated episode, which was the normal level for early elementary school children.

At the end of the 3rd month of the intervention, the oral narrative development of the children were improved, the number of children who had narrative performances at stage 1, descriptive level and

stage 2 action sequence were significantly decreased (Cochran's Q test: χ^2 (df) = 8.000(1), $p = 0.005$; χ^2 (df) = 5.000, $p = 0.025$ respectively) whereas, the number of children who had narrative performance at stage 3 reaction sequence and stage 4 abbreviated episode were significantly increased (Cochran's Q test: χ^2 (df) = 5.000(1), $p = 0.025$; χ^2 (df) = 8.000, $p = 0.005$ respectively).

Tables 6-7 show more details about the child's oral narrative development. As can be seen in Table 6, the mean (range) score of the children's oral narrative development stage increased from 1.68 (1 to 3) at pre-intervention to 3.00 (1 to 4) at 3 months after intervention. Table 7 demonstrates the number of children who changed their stage of oral narrative development at each month after intervention. At 1st month after intervention, oral narrative development of 7 children had changed to a better stage, while 15 children remain had no change in their oral narrative development. The results of Wilcoxon signed ranks tests show that there was significantly changed of oral narrative development at the end of 1st month of intervention ($Z = -2.46$, $p = 0.014$). Significant changes in the children's oral narrative development also found at the end of 2nd and 3rd month of the intervention ($Z = -3.53$, $p < 0.001$ and $Z = -4.09$, $p < 0.001$ respectively). However, at the end of 3rd month of the intervention, 2 children remain had no change in their oral narrative development (Table 7).

Table 4.

Changes in children's semantic development at pre- and post- intervention (n=22)

Subtest	Pre-intervention	Post-intervention	Z	p ^a	Effect size
	M (SD)	M (SD)			
Picture vocabulary	22.8 (7.1)	28.8 (3.3)	-3.7	<0.001	0.9
Relational vocabulary	5.3 (4.1)	16.7 (5.7)	-4.1	<0.001	2.2
Oral vocabulary	6.8 (3.9)	16.0 (4.4)	-4.0	<0.001	2.2

^a p-value from Wilcoxon signed ranks test

Table 5.

Changes in children's oral narrative by development stage at pre- and 3 months after intervention (22)

Narrative development stage (S)	Pre-intervention n (%)	3 months after intervention n (%)	Cochran's Q test	
			χ^2 (df)	p
S1 Descriptive level	9 (40.9)	1 (4.5)	8.000 (1)	0.005
S2 Action sequence	11 (50.0)	6 (27.3)	5.000 (1)	0.025
S3 Reaction sequence	2 (9.1)	7 (31.8)	5.000 (1)	0.025
S4 Abbreviated episode	0 (0.0)	8 (36.4)	8.000 (1)	0.005

Table 6.

Change in magnitude of children's oral narrative development stage at pre-and the end of each month during intervention

Group	n	Mean	Range
Pre-intervention	22	1.68	1 to 3
1 month after intervention	22	2.09	1 to 4
2 months after intervention	22	2.68	1 to 4
3 months after intervention	22	3.00	1 to 4

Narrative development stage code: 1 = descriptive level; 2 = action sequence;
3 = action sequence; 4 = abbreviated episode

Table 7

Overall changes in children's oral narrative development stage at pre- and the end of each month during intervention

Group	n=22	Mean rank	Sum of Ranks	Z ^d	p ^e
Pre-intervention- 1month after					
Negative ranks ^a	0	0.0	0.0	-2.46	0.014
Positive ranks ^b	7	4.0	28.0		
Ties ^c	15				
Pre-intervention- 2 months after					
Negative ranks	0	0.0	0.0	-3.53	<0.001
Positive ranks	15	8.0	120.0		
Ties	7				
Pre-intervention- 3 months after					
Negative ranks	0	0.0	0.0	-4.09	<0.001
Positive ranks	20	10.5	210.0		
Ties	2				

^a = Children's oral narrative development changed to a poorer stage

^b = Children's oral narrative development changed to a better stage

^c = No change in children's oral narrative development stage

^d = Based on negative ranks

^e = Wilcoxon signed ranks test

Discussion

The findings of this study provide preliminary evidence that DIR/Floortime® model intervention had a significant impact on both the improvement of the children's functional emotional development as measured by the Functional Emotional Assessment Scale (FEAS) and on the children's language abilities as measured by semantic and narrative development. At the end of the study, the children had significantly improved ($p < 0.001$) in 3 milestones of FEAS, namely M1 Self-regulation and interest in the world, M2 Forming relationships, attachments, and engagements, and M6 Building logical bridges between ideas and emotional thinking. The effect size was large (1.6 to 2.6). The possible explanations were that most parents, caregivers and teachers have high engagement with DIR/Floortime® activities. Monthly coaching also increased parents' and caregivers' awareness of the individual differences which enabled them to better understand his/her child's profile of strengths and weaknesses. This confirmed the findings of previous studies (Pajareya & Nopmaneejumrulers, 2011; Praphatthanakunwong, et al., 2018; Reis,

Pereira, & Almeida, 2018; Sealy & Glovinsky, 2016; Solomon et al., 2014;).

In this study, M5 Representation elaboration milestone of the children was not significantly improved ($p = 0.18$) and the effect size was low (0.1). The possible explanation was that two parents have poor socio-economic status and have to take care more than one child. They have to spent most of the times working to earn money for supporting his/her families. They have less time to play with his/her children. For these 2 cases, the children's regular teacher and physical education teacher volunteered to act as the children's parents and play with them at school (average of 3.75 hours per week). The less intense of intervention period may cause the children cannot pass this milestone.

The children semantic development was also significantly improved ($p < 0.001$). The effect size in 3 semantic subtests was large (0.9 to 2.2). Relational vocabulary and Oral vocabulary (measured semantic expression) had better improvement than Picture vocabulary (measured semantic comprehension) since at baseline the children have less impairment in semantic comprehension than semantic expression.

This is quite understandable since semantic comprehension is less complex than semantic expression. Although semantic comprehension of the children was only mildly impaired, the DIR/Floortime® intervention still had a large effect size (0.9) to improve in this area. This considerable improvement in semantic and vocabulary that occurred without very intensive intervention indicated that a certain number of children with LI were not really impaired but needed a little help to bring out their potential.

Another area that children had significantly improved was narrative development both at each development stage after completing the intervention ($p < 0.025$) (Table 5) and at the end of each month during intervention ($p < 0.001$) (Tables 6-7). Most children (20/22) had narrative development changed to a better stage. Only 2 children had no changes in narrative development stage. They were the same cases of children who had poor improvement in functional emotional development.

Most of the children in this study had quite serious narrative development deficits at the outset because a narrative task required a rather complex set of understanding like the time sequence of events and cause-effect that were interrelated in some way. Both the teller and the listener have to understand temporal and cause-effect relationships. Accordingly, DIR/Floortime® intervention was an effective tool to promote narrative language development. In previous studies (Dionne & Martini, 2011; Liao et al., 2014; Pajareya & Nopmaneejumrulers, 2011; Praphathanakunwong, et al., 2018; Reis, Pereira, & Almeida, 2018) DIR/Floortime® found to be effective to improve social communication of children with ASD. However, some studies (Casenhiser, Shanker, & Stieben, 2011; Solomon et al., 2014) reported no changes in the children language after implementing DIR/Floortime® intervention. This might be due to the fact that sometime language impairments interpreted isolated language impairment in the context of otherwise normal development, whereas in autism there are lot of impairments beneath the language problems; self-regulation and intimation.

The DIR/Floortime® model provided a clear structure for both evaluation and intervention with children with special needs,

in this case children with impaired language ability. Firstly, the model provided a detailed developmental framework (M1-M6), which could be used both as a guideline to evaluate the developmental status of each child and as a guide to plan appropriate interventions to bring the child forward along the developmental milestones. Secondly, the individual differences emphasised in the model provided distinct understanding of each child's specific disabilities (such as sensory integration, visual-spatial, and motor planning dysfunction). The third aspect of this model, relationship with others, also provided a clear guideline to observe the child's problem in this area, which could lead to appropriate interventions to improve the child's ability to form relationships with others.

The training and coaching provided based on the DIR/Floortime® model enabled the parents, primary caregivers and teachers to understand each child's problems and potential more easily and much clearer. This understanding provided them with newly-gained confidence and enthusiasm in working with each child. During the programme, the parents/primary caregivers and teachers learned to wait, listen, engage, and expand the children's interaction through specific techniques, such as playful obstruction. They learned to engage with their children, to respond when the child-initiated interaction instead of ignoring, to expand the child's interaction and to challenge the child to solve emotional and logical problems during play and daily life. The parents and primary caregivers also learned to narrate their children's thoughts and actions and to provide opportunities for the children to understand their emotions. They also helped the children learn how to use language to express their needs and emotions in various situations. Furthermore, the DIR/Floortime® intervention appeared to have a strong impact on the relationship between parents, primary caregivers and teachers and their children. They began to recognise the importance of playing with their children and tried to arrange activities to match each child's individual profile.

The parents' behaviours changed noticeably. They spent more time playing and doing activities with their children, such as helping with the assignments from school and chores. Significantly, the

parents/primary caregivers and their children also decreased the amount of time spent using/playing with their mobile phones.

This study supports that the DIR/Floortime® model for parents, primary caregivers and regular classroom teacher is effective. All the children's language abilities displayed improvement, which were the picture vocabulary, relational vocabulary and oral vocabulary as narrative development also. The language skills were improved, subsequently impacted their academic learning in a positive way (personal communication with the teachers). The results confirmed previous studies that found the more parents or primary caregivers interacted and played with their child in varied contexts and usage, the more the children showed positive language and literacy outcomes (Barrueco, Smith, & Stephens, 2015; Boshoff et al., 2020; Pajareya, & Nopmaneejumrulers, 2011; Landry et al., 2012; Liao et al., 2014; Praphatthanakunwong et al., 2018; Reis, Pereira, & Almeida, 2018). Bloom, 1998 also stated that the language and literacy practiced in the home environment impacted the school performance of children. In addition, parental or primary caregiver support and warmth are associated with children's language ability and literacy (Arnold, Kupersmidt, Voegler-Lee, & Marshall, 2012; Edwards, Sgeridon, & Knoche, 2008). FEAS were increased in M1 Self-regulation and interest in the world, M2 Forming relationships, attachments and M6 Building logical bridges between ideas and emotional thinking after implementation the DIR/Floortime® model for parents, primary caregivers and regular classroom teacher. The results were presented that the relationships and attachments between parents/ primary caregivers and regular classroom teachers and the child more increased. A loving parent or primary caregiver-child relationship that provides positive affection, playfulness, emotional and socio-behavioural support, and rich verbal input during quality interactions can expand and maintain a child's interests, serving as crucial factors that facilitate multiple aspects of the child's learning and influencing the child's life at school as well as academic learning (Arnold, Kupersmidt, Voegler-Lee, & Marshall, 2012; Landry et al., 2012). Communication that occurs in a naturalistic context, such as

during free play, book reading, mealtimes, bath-time or leisure time, will enable a child to generate expanded meanings and gain a better understanding of their experiences (thoughts, desires, and feelings in various circumstances (Kaiser & Roberts, 2013; Poland & Chouinard, 2008). The more children can elaborate their thoughts, perceptions, feelings and needs, the more they will be able to use both linguistic and non-linguistic expressions to strengthen their communication.

Strengths and Limitations

The design of the study involved parents, primary caregivers and teachers in the DIR/Floortime® intervention from the beginning, which strengthened the intervention in numerous ways. Firstly, it increased the sense of ownership and belonging in the programme. It became their work rather than the investigator's experiment. Secondly, the intervention was integrated into the children's daily life, both at home and school. This integrative intervention proved to effectively influence the children's social interaction, adaptive behaviours and academic performance. During the study period, there was no other intervention in the study area. Therefore, the results of this study are likely to be due to the intervention alone.

This study involved four limitations: first, this study used a quasi-experimental design without control groups. This was because it seemed unethical to recruit children with LI, but offered no intervention or only a basic intervention such as information leaflets. Second, the amount of time that parents, primary caregivers and teachers spent doing DIR/Floortime® with the children was self-reported by them. Third, some confounding variables, such as the child's baseline developmental status and the severity of symptoms that could affect the response to the intervention, could not be controlled. Fourth, this study was conducted in a public elementary school in central Thailand. Thus, it used a relatively small sample size. This means it would be difficult to generalise the results to other private elementary schools in Thailand. However, this study provides a way to remind educators to change their tools when conducting

assessments of children who have/may have learning disorders.

Implications

The DIR/Floortime® model is a very effective tool for developing enhanced interactions. It can be applied in both home and school environments at the same time for children with impaired language ability. However, the Floortime® activities at school need one-to-one child and teacher interaction. This can increase the teacher's workload. Thus, it could be challenging to integrate this type of intervention into the current Thai public elementary school curriculum.

Presently, there is a shortage of health professionals trained to help children with special needs, especially those children with learning disorders in Thailand. Therefore, the administrators in the Thai Ministry of Public Health should cooperate with professionals in universities and non-governmental organisations who have expertise in this field to provide various levels of DIR/Floortime® training courses for health care providers, teachers, parents and primary caregivers.

In this study, the DIR/ Floortime® model was found to be effective for children with LI. No adverse events were reported. A recent review on the application of the DIR/ Floortime® model in children with autistic spectrum disorders also showed it to be effective without any record of adverse events and involving very little coercive activity (Mercer, 2017). For further study, randomised controlled trial studies with sufficient sample size and valid outcome measures should be conducted. The samples should be followed up for one year after intervention to identify any long-term effects of the DIR/ Floortime® model on improving a child's social interactions, adaptive behaviours and academic performance. A qualitative study should be conducted with children's parents, primary caregivers, teachers and school administrators to elicit their perceptions concerning the benefits, barriers, satisfaction levels and feasibility of the sustained integration of the DIR/Floortime® model into the Thai public elementary school curriculum.

Conclusion

After implementing the intervention, the participating children made significant improvements in their language abilities in terms of semantic and narrative development. Functional emotional development in terms of self-regulation and interest in the world, forming relationships, attachments and engagements, and building logical bridges between ideas and emotional thinking was also increased.

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