

# Effectiveness of Scaffolding Interrogatives Method: Teaching Reading Comprehension to Young Children with Hyperlexia in Singapore

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## Abstract

*Children with hyperlexia display spontaneous superior word decoding ability before the age of five but impaired listening and reading comprehension. They have direct phonological processing of any given text with apparent ease and often well beyond their vocabulary usage. Though they can recognise and read words, words appear meaningless. As a result, it has been suggested that the word recognition skills and the general verbal functioning employed in the reading process probably exist separately and apart from each other. It may co-exist with non-verbal learning disorders and autism. In this paper, the authors did an action research study on the effectiveness of using the Scaffolding Interrogatives Method (SIM) to teach reading comprehension to a group of 10 eight-year-old children with hyperlexia at a private learning clinic. Findings suggested that mands and tacts were essential functional verbal components of the SIM to aid in answering reading comprehension questions.*

## Introduction

*Hyperlexia* is a syndrome with various subtypes identified by three criteria (Chia, Poh & Ng, 2009; Kennedy, 2003; Richman & Wood, 2002): spontaneous word reading before the age of five; impaired comprehension on both listening and reading; and word recognition (decoding) skill above expectations. Research studies on hyperlexia can be categorised under psychological and psychogogic perspectives. By the term *psychological*, where *psycho* means “mind” and *logical* means “pertaining to the study of”, our focus here is on the scientific study of mind as affected by hyperlexia. The other term *psychogogic*, first coined by Oswald Schwartz (1925), where *psycho* refers to “mind” and *gogic* means “leading” or “teaching”, means “of leading or teaching the mind”. In this study, the term here means to lead or teach a learner with a hyperlexic mind.

### *Psychological Perspective*

The psychological perspective focuses on the symptomatic studies on the explicit traits of hyperlexia and etiological studies on the origin and causes of hyperlexia via psycho-educational, neurological, and medical diagnoses (Chia, 2002; Chia, Poh & Ng, 2009). Children whose “(measured) reading level was above their expected word recognition level by the

following amounts: 1.5 in grades 1 and 2, and 2.0 in grades 3 and up” (Silberberg & Silberberg, 1967, p. 236) were described as hyperlexic. When the definition was based solely upon the discrepancy between expected and actual decoding skills, some normal and superior readers had been labelled hyperlexic (Joshi, Padakannaya, & Nishanimath, 2010). However, hyperlexia was redefined as a severe comprehension deficit despite good decoding skills (Newman, Macomber, Naples, Babitz, Volkmar, & Grigorenko, 2007). Four predominant theoretical concepts of hyperlexia have been identified and are briefly described below.

*Theoretical Concept of an Accelerated Cognitive Ability.* Early research studies suggested that hyperlexia is a syndrome that manifests a unique and accelerated cognitive ability (Niensted, 1968). An extensive literature review of studies on hyperlexia undertaken by Grigorenko, Klin and Volkmar (2003) supports the view “that hyperlexia is a super ability demonstrated by a very specific group of individuals with developmental disorders rather than as a disability exhibited by a person of the general population” (p. 1079). Although children with hyperlexia are as skilled as the good comprehenders on measures of word and non-word decoding ability, they often perform badly on the measure of reading comprehension (Nation, Clarke, Wright, & Williams, 2006). They also perform badly on two measures of

oral language comprehension: a picture vocabulary test such as the Peabody Picture Vocabulary Test-Third Edition and the comprehension subtest of the Wechsler Intelligence Scale for Children-Third Edition. These children possess only a specific super ability in word and non-word decoding (Kennedy, 2003; Silberberg & Silberberg, 1967), but not comprehension of single words, compromising the subsequent text-level comprehension (Nation, 1999).

*Theoretical Concept of Bipolarity of Reading Disabilities.* According to this concept, reading is a complex process skill that depends on the integrity of two key components: decoding and language comprehension (Cardoso-Martins & da Silva, 2010). The understanding of this concept is based on the Component Model of Reading and the Simple View of Reading (Hoover & Gough, 1990). This concept describes dyslexia and hyperlexia as two different reading disabilities in decoding and language comprehension respectively that occur at opposite extremes of the reading continuum. Failure in any of these two components will result in poor reading. Based on this criterion, one would expect three types of reading problems: “those with poor decoding but good comprehension skills; those with good decoding but poor comprehension skills; and those with poor decoding as well as comprehension skills” (Joshi, Padakannaya, & Nishanimath, 2010, p.101).

*Theoretical Concept of Hyperlexia as a Subtype of a Disorder.* Another concept of hyperlexia describes the condition as a subtype of a disorder that can either be dyslexia or autism (Grigorenko, Klin, & Volkmar, 2003). In other words, hyperlexia can be a disorder of language development (Joshi, Padakannaya, & Nishanimath, 2010) or a disability of social imperception (Grigorenko, Klin, & Volkmar, 2003) or even both (Cardoso-Martins & da Silva, 2010). To understand this concept, Chia, Poh and Ng (2009) have argued the need to understand that hyperlexia is a syndrome that results in a breakdown in both inter-textuality and inter-subjectivity. Inter-textuality involves a reader’s ability to establish the relationship between the given text and other relevant texts that he has encountered to interpret the text. “In other words, hyperlexia is seen as a facility in word calling with inferior reading comprehension that represents a special instance within the larger category of dyslexia syndrome” (Chia, Poh & Ng, 2009, p.74). As for inter-subjectivity, it involves an individual’s ability to understand his social environment through recognition and control of cooperative intentions and joint patterns of awareness. A breakdown in inter-subjectivity will result in an inefficiency of social imperceptions that “ultimately contributes to immaturity and difficulty making routine judgements necessary to succeed in

everyday life” (Leavell, 1998, p.4). This in turn causes defective theory of mind resulting in autistic tendency (Baron-Cohen, 1999). Hence, it is not surprising to note that hyperlexia carries autistic traits and may represent an autistic subtype.

*Theoretical Concept of Hyperlexia as a Syndrome of Comprehension Disability.* Jackson and Colheart (2001) used the term hyperlexia strictly to refer to those “with general deficit in cognition and comprehension” (p.158). Nation and Norbury (2005) estimate that approximately 10% of the school-age children may be classified showing specific comprehension impairment. They further clarified that “most of the children with hyperlexia manifest autistic traits and show general impairments in reading comprehension accompanied by poor vocabulary and oral language comprehension although decoding is within the normal range” (p.26).

### *Psychogogic Perspective*

Chia and Ng (2011) define psychogogy as follows:

In this respect, we define psychogogy as the instructive theory that includes psychological influence on a learner’s mind in terms of his/her learning and thinking abilities (cognition), feelings (affect), and will (conation) to perform or act and whose behavioural traits interlinked by various senses through different sensory processes (sensation) in order to establish his/her own perception and belief through interaction with others within a given socio-cultural context.” (para.7)

Current intervention strategies to help children with hyperlexia rely heavily on language and speech therapies, whose goals are targeted in a variety of group contexts, including theme-related activities, stories, games, and group routines. These goals maximise motivation, functional communication, and generalisation (Kleiman, 1997). There is also a literacy-based strategy relying on concrete poems to teach word meanings to children with hyperlexia (Chia, 2006). These poems do not have line, meter, rhythm, stanza, or even a title, but are expressed in the form of pictures. Concrete poems help such children make associations between a target word (drawn in a certain way) and its referent (the thing it represents). Although concrete poetry works with content words and is useful for teaching single word recognition, it becomes extremely difficult to rewrite every word in sentences into concrete poetry (Chia, 2002). Another intervention strategy is the functional verbal behaviour therapy that has also been found to benefit children

with hyperlexia in their language development.

Although there are few studies on intervention strategies for children with hyperlexia, most adopt the following general intervention principles: “use of written and visual models; patterned language; open-ended sentences; use of examples rather than direct explanations to elaborate a point; and teaching specific pragmatic rules” (Chia, 2002, p.14).

### *Current Practices in Singapore*

Currently, in Singapore, children with hyperlexia are referred directly to speech and language therapists for intervention. In special schools, teachers used the Picture Exchange Communication System (PECS) (Bondy & Frost, 2002) to teach their children to form sentences using pictures and also to answer questions using them. The mainstream teachers are not familiar with the PECS. They use whatever comprehension strategies, such as story mapping and Know/Want to Know/Learned (K-W-L), they know to work with such children hoping that one day they would be able to comprehend what they read or listen. Most, if not all of these strategies are often not effective with these children.

### *Alternative Practice*

The authors chose the Scaffolding Interrogatives Method (SIM), which incorporates PECS, as a comprehension strategy to be taught by an educational therapist (ET) to a group of children with hyperlexia. The SIM uses the verbal operants of mands and tacts (see Skinner, 1957, for more details). Devised by Chia (2002) and trialled at a special needs clinic with children with poor reading comprehension, the strategy requires a child to read sentence by sentence, before charting each sentence in several columns of *what* interrogatives (*what*-mands) with sentential contents (tacts).

### *Research Question*

What are the learning processes involved in implementing Scaffolding Interrogatives Method (SIM) on ten students with hyperlexia and the effects the method had on them?

## **Method**

### *Research Design*

Practical action research design (Mills, 2007) was selected as this study involved an applied approach of SIM with contextualized understanding of each

subject. SIM uses a training-assessment approach that requires a great deal of intuitive, creative latitude from the researchers by providing the participants with the necessary principles, skills and techniques with visual modeling, followed by the opportunity to apply them to new tasks as in dynamic assessment (Feuerstein, Feuerstein, Falik, & Rand, 2002). The authors of this study adopted look-think-act (Stringer, 2007), a reiterative approach to dynamically and adaptively study and problem-solve for effectiveness. Over a period of six months, the ET’s monthly reflection reports on the participants’ improvements and their results were recorded. Effects of the SIM intervention were also determined by a pretest-posttest design of the six months intervention with paired *t*-test statistical analysis of the difference between expected maturity age difference of six months at posttest and the measured difference of reading comprehension age from pretest where significance level was set at  $p=0.05$ .

### *Participants*

With parental consent, ten male children, aged between eight and nine years old were selected from the Learning Disabilities Center, Singapore, based on convenience sampling (see Creswell, 2012, p.145-146, for more detail), to participate in the study for a period of six months from March to August 2010. They were chosen on the basis of a history of precocious word reading ability provided by their parents during initial case consultation. Literature (e.g., Grigorenko, Klin, & Volkmar, 2003) has frequently reported such early spontaneous onset of word decoding ability in children with hyperlexia. All the participants, previously assessed and identified to have hyperlexia with autistic symptoms by clinical psychologists from public hospitals, were first referred to the Children Autism Center for a two-year early intervention program using the first five phases of PECS. In the first year, they were taught how to perform basic exchanges with a wide range of pictures (Phase 1), to persist in getting an adult’s or peer’s attention and in moving across increasing distances (Phase 2), and to discriminate between a number of pictures in an array (Phase 3). In the second year, they were taught how to form sentences using pictures (Phase 4) and answer questions using pictures (Phase 5).

When they were in Primary 2, the ten children were referred to the Learning Disabilities Center, where they were assessed by the authors on the Neale Analysis of Reading Ability-Third Edition (Neale, 1999), to continue receiving specialized help in their studies. The psycho-educational profiles of the ten children are given in Table 1.

Table 1

*Participants' Psycho-educational Profile*

Subject (n=10)	Chronological Age*	WISC-IV	NARA-III	GARS-2 (Age Equivalent)	
		FSIQ	Reading Accuracy*	Reading Comprehension	Autism Index
S1	8:03	96	10:07	5:10	79
S2	8:04	92	10:04	5:06	81
S3	8:04	103	10:11	6:09	86
S4	8:05	97	11:02	5:10	77
S5	8:05	94	10:03	5:03	83
S6	8:06	101	11:04	6:06	75
S7	8:07	98	11:00	6:01	84
S8	8:07	104	10:07	6:04	82
S9	8:09	95	10:08	5:08	87
S10	8:10	102	11:02	6:11	83

*Note.* \* in years and months; WISC-IV = Wechsler Intelligence Scale for Children – Fourth Edition; NARA-III = Neale Analysis of Reading Ability-Third Edition; GARS-2 = Gillian Autism Rating Scale – Second Edition

*Instrument*

The Reading Comprehension (RC) subtest of the Neale Analysis of Reading Ability-Third Edition (NARA-III) (Neale, 1999) was selected as the standardized assessment (also the dependent variable) to measure the participants' RC ages before (pre-test) and after (post-test) intervention. It was administered to determine the participants' RC age-equivalent scores. The NARA-III Form 1 was used before intervention and Form 2 was used after it to avoid practice effect. According to Neale (1999), the test-retest reliability with testing conducted after an 8-week interval on a sample of 100 young children yielded coefficient of .93 for RC. The parallel forms reliability (Form 1 and Form 2) is high. The coefficients of Reading Rate, Reading Accuracy and Reading Comprehension were all in excess of .90 for whole-year age groups (N=140). Particularly high levels of reliability were obtained for the young age groups (Neale, 1999). The two sets of age equivalent RC scores were then compared to determine the participants' progress in RC and hence, the effectiveness of SIM as a RC strategy.

*Validity and Reliability of the Study*

Validity is taken to mean the degree to which the observations actually measure or record what they

purport to measure (Mills, 2007). The validity will depend on researchers' subjective values, perspectives and degree of perception of learning taking place in the participants, which will inevitably involve researcher reflective bias. Researchers have attempted to mitigate the subjectivity by examining the degree the intervention 'ideas' conceived to address the perceived needs of participants do actually meet the expectations of the researchers (Greenwood & Levin, 2000) as well as by collecting quantitative data from an alternative set of testing forms from pretest at posttest.

Guba (1981) argues that trustworthiness of qualitative inquiry can be addressed by considering credibility, transferability, dependability and confirmability. Credibility refers to researchers' ability to take into account the complexities that present themselves in a study and to deal with patterns that are not easily explained. The authors of this study prolonged participation at the study site of three times a week for six months to test biases and perceptions. Moreover, persistent observations via dynamic assessments of learning propensity of the participants with mutual peer debriefing allowed both authors opportunity to test insight from each other addressing credibility of the action research. The use of principles of mediated learning experience as well as dynamic assessment addresses transferability, dependability and

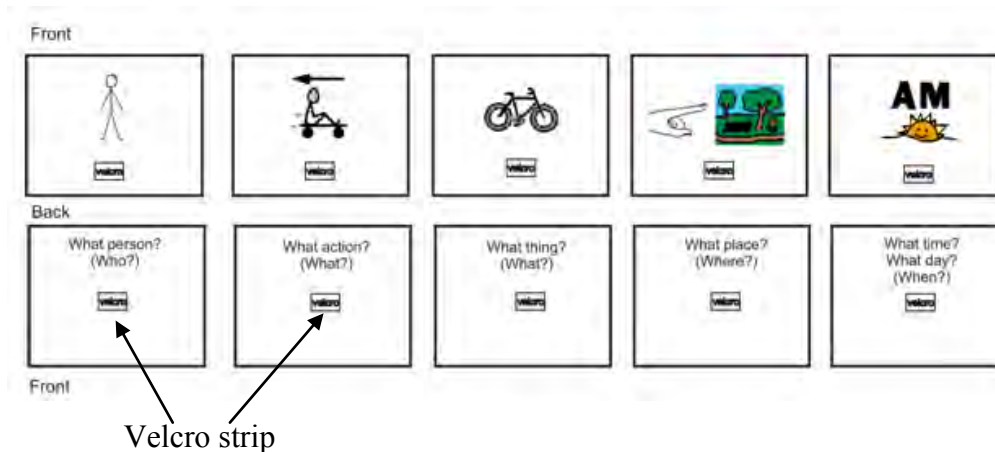


Figure 1: PECS cards with What-mands for what person (who), what action (what), what thing (what), what place (where), and what time and what day (when)

confirmability of the learning taking place by participants.

### Procedure

In the pre-test phase the NARA-III (Form 1) was administered to obtain participants' RC age equivalents. The participants were taught to use the SIM to answer RC questions by the same ET throughout the six-month intervention on Monday, Wednesday and Friday per 45-minute session. Below is a breakdown of the intervention phase:

*First Month.* During the first three sessions of the first week, the participants were introduced to the five *what*-mands with the aid of PECS cards: *what person* for *who*; *what action* and *what thing* for *what happened*; *what place* for *where*; and *what time* and *what day* for *when* (see Figure 1).

They would learn to differentiate one *what*-mand from the others using PECS cards (e.g., *what person* is different from *what action* and *what thing*). Each time, the participants also learned to match each of the *what*-mands with the correct *wh*-interrogative word (e.g., *what place* is matched correctly with *where*). In the subsequent weeks of the first month, the participants were taught to pick out the subject (*what person*) of a sentence using PECS cards as in the example, *Ali rode his bicycle in the park all morning*. *Ali* is the subject of the sentence that represents *what person* and was matched with the correct word card. All the PECS and word cards were stuck with a small strip of Velcro each. These cards were then pasted on a clip-board with two strips of Velcro so that the cards would not be easily misplaced or accidentally moved out of line. A worksheet containing 15 sentences was given to every participant to practice at the end of each session.

*Second Month.* In the second month, two *what*-mands were covered: *what action* during the first six

sessions of the month, and *what thing* in the next six sessions. In addition to revising and reinforcing what had been taught or learnt previously each session, the participants were taught to identify and pick out the action word (represented by an action PECS card) found in a sentence, normally after the subject (*what person*), as in the example, *Ali rode his bicycle in the park all morning*. The word *rode* is the action of the subject *Ali* in the sentence and it represents *what action* and matched with the correct word card. The participants were also introduced to *what thing*, i.e., the receiver or object of an action in a sentence, as in the example, *Ali rode his bicycle in the park all morning*. The phrase *his bicycle* is *what thing* and it was matched with the correct word. Practice worksheets on *what action* and/or *what thing* were given to every participant at the end of each session.

*Third Month.* Each session began with a revision on *what person*, *what action* and *what thing* as well as matching correctly the different *what*-mands with their respective *wh*-interrogative words with the use of PECS cards. In the third month, the participants were taught to identify and pick out *what place* (*what*-mand for *where*) using PECS cards from a sentence, as in the example, *Ali rode his bicycle in the park all morning* and was matched with the correct word. The prepositional phrase *in the park* is *what place*. At the end of every session, a worksheet containing 15 sentences was provided for more practice to reinforce learning.

*Fourth Month.* During the fourth month, the participants were taught to identify and pick out *what time* or *what day* (both *what*-mands are referring to the same *wh*-interrogative word *when*) from a sentence, as in the example: *Ali rode his bicycle in the park all morning*. If *Last Sunday* is added at the beginning of the sentence, it refers to *what day* (*when*) while *all morning* is *what time* (*when*) and was matched with the correct word. A practice worksheet was given to

Sentence Number		<i>What-mands</i>			
		Who?	What?	Where?	When?
		<i>What person?</i>	<i>What happened?</i>	<i>What place?</i>	<i>What time?</i>
Tacts	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				

Figure 2. An example of a blank SIM chart

1. Ali rode his bicycle all morning in the park. 2. He met his friend Bala at the park. 3. Bala skated beside Ali for an hour. 4. The two boys saw a *kacang puteh* man at the main gate of the park. 5. The *kacang puteh* man sold them each a cone of sugar-coated peanuts. 6. It was twelve o'clock noon when a park ranger told the boys to leave the park. 7. The park had to be closed for maintenance work. 8. The boys met their parents outside the park.

Figure 3. An example of a reading passage for SIM

Sentence Number		<i>What-mands</i>			
		Who?	What?	Where?	When?
		<i>What person?</i>	<i>What happened?</i>	<i>What place?</i>	<i>What time?</i>
Tacts	1	Ali	rode his bicycle	in the park	all morning
	2	He	met his friend Bala	at the park	
	3				
	4				
	5				
	6				
	7				
	8	The boys	met their parents	outside the park	

Figure 4. An example of SIM Chart partially filled

Example 1: Question: What time (When) of the day did Ali ride his bicycle in the park?  
 The *what-mand* is *what time* (when?) where the answer can be found. The prompts are: “Ali”, “did ride (rode) his bicycle” and “in the park”. These prompts help to zero-in on the tact, i.e., “all morning”, which is the answer to the question

Figure 5. Example showing how wh-question (When) prompts

Example 2: Question: What place (Where) did the boys meet their parents?  
 The *what-mand* is *what place* (where?) where the answer can be found. The prompts are “The boys” and “did meet (met) their parents”. These prompts identify the tact: “outside the park” as the answer to the question. For every correct answer, a colourful star sticker was given as a reward.

Figure 6. Example showing how wh-question (Where) prompts

every participant to reinforce learning at the end of each session.

*Fifth Month.* During the first two weeks of the fifth month, the participants were introduced to the SIM chart and shown how the PECS and word cards were used in filling up the chart. For example, using the same sentence again, this is how a SIM chart was completed with the PECS and word cards: *Ali rode his bicycle in the park all morning.* Using *Ali rode his bicycle in the park all morning* as the model sentence, other sentences were given to the participants to fill the words in the correct boxes in the SIM chart. For the last two weeks of the fifth month, the participants were given short passages with familiar simple sentence structures to complete their SIM charts until they became more familiar with using the SIM chart.

*Sixth Month.* During each session in the final month, the participants were given short passages and taught how to answer correctly questions using prompts (word cues) taken from each sentence found in the boxes of the SIM chart. These word cues helped the participants to locate the correct answer to the question by zeroing on the tact that could be found under the column of each *what*-mand. After six months of intervention, a post-test was done on the participants' RC using the same NARA-III but Form 2. This is to avoid practice effect. The pre-test and post-test results were compared to determine what difference, if any, the exposure to the intervention using SIM had impacted on the participants' RC performance. It was also the authors' attempt to verify the effectiveness of the SIM as a RC strategy.

### *Intervention*

The Scaffolding Interrogatives Method (SIM) uses the verbal operants of mands and tacts. Devised by Chia (2002) and trialled at a special needs clinic with children with poor RC, the strategy has a child read sentence by sentence, then chart each sentence in several column of *what* interrogatives (*what*-mands) with sentential contents (tacts). Figure 2 shows an example of the SIM chart. The child reads the text to create the textual meaning (see Figure 3 for an example). The completed chart provides a new format of reorganised ideas based upon the original text, to aid comprehension.

Figure 4 shows an example of a partially completed table where the first two and last sentences have been completed.

## **Results**

Results of this study are presented in two sections. The first section deals with the analysis of pre-test

and post-test data gathered from the administration the RC subtest of the NARA-III to compare the two sets of data as well as with the participants' chronological ages at the pre-test and post-test. The second section covers the ET's monthly observational feedbacks throughout the intervention phase. Her input was essential to the authors of this study to understand the procedural changes that might have taken place during the intervention process.

### *Analysis of Pre-test and Post-test Results of the Reading Comprehension (RC)*

Despite their normal intelligence, the ten participants continued to encounter challenges in RC (M=72.80, SD=6.58) as measured by NARA-III RC subtest Form 1 (See Table 2).

The SIM method intervention was carried out for six months. Table 3 shows the pre-test and post-test scores as obtained from the administration of the NARA-III RC subtest using Form 1 and Form 2 respectively. Post-test results using Form 2 for alternate forms reliability and paired samples *t*-test showed highly significant improvements difference (M=15.10, SD=5.31,  $p < .05$ ) (see Table 3) even after accounting for six months of maturational or developmental growth (M = 9.10, SD = 2.60,  $p < .05$ ) (see Table 3, Table 4 and Figure 7).

Table 4 shows the means and standard deviations for the ten participants on the NARA-III RC subtest. The mean score (in months) for RC increased from 72.8 (SD=6.58) at pre-test (Form 1) to 87.9 (SD=7.75) at post-test (Form 2) after six months of intervention. A paired samples *t*-test was carried out on the pre-test and post-test scores (in months) of the RC subtest of NARA-III to determine whether changes were significant. By conventional criteria, the results indicated that there was statistically significant difference between the pre-test and post-test scores (in months),  $t(18) = 4.697$ , 2-tailed  $p = 0.0002$ , with a standard error of difference = 3.215. The 95% confidence interval of this difference was from -21.8975 (lower limit) to -8.3025 (upper limit). The effect size ( $d$ ), which measures the magnitude of the intervention effect (Cohen, 1988) on the participants' RC performance, was computed using Ray and Shadish's (1996) Equation II, and  $d$  was 2.09, i.e., the size of effect was large.

The findings of this study show that there was a significant improvement in the RC performance by the ten participants with hyperlexia after they had been taught how to use SIM to answer comprehension questions. The positive impact (size of effect) of the intervention on the participants' RC was large according to Cohen's guidelines.



Table 2

Summary of Results

Variables	Abbreviations	M	SD	SE
Mental Age	MA	100.19	5.31	1.68
Chronological Age (Posttest)	CA(Post)	108.00	2.26	0.72
RCA Pretest Form 1	PreF1	72.80	6.58	2.08
Expected Maturity (+6 months)	ExPost+6m	78.80	6.58	2.08
RCA Posttest Form 2	PostF2	87.90	7.75	2.45
Measured Difference	MD	15.10	5.31	1.68
Expectation Exceeded	ExE	9.10	2.60	0.82

Note. All values are in months

Table 3

Paired t-test comparisons of NARA-III RC Subtests

	Paired Differences			95% CI		t	df	Sig. (2-tailed)
	M	SD	SE	Lower	Upper			
Pair 1 Pretest-Posttest	-15.00	2.60	0.82	-16.96	-13.24	-18.36*	9	0.00
Pair 2 Expected Posttest-Posttest	9.10	2.60	0.82	7.24	10.96	11.06*	9	0.00
Pair 3 Expected Growth-Actual Growth	9.10	2.60	0.82	-10.96	-7.24	-11.06*	9	0.00

\*  $p < 0.05$

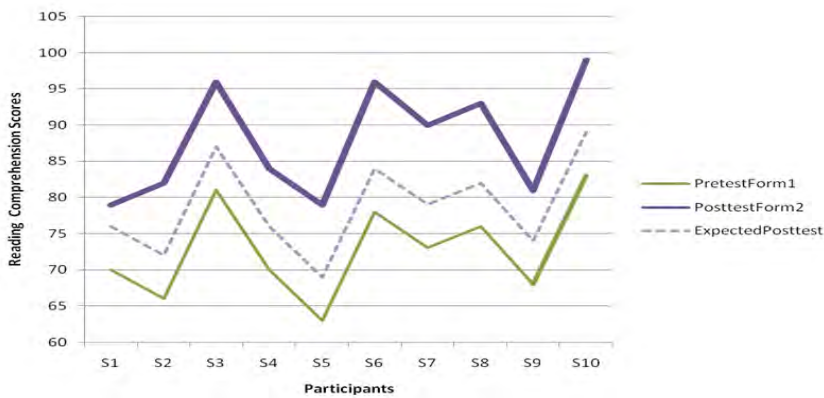


Figure 7. Results of RC Scores (in months) before and after SIM Intervention



Table 4

Performance in NARA-III RC Subtest

Phase	Paired Differences								
	Mean (in Months)	SD	Variance ( $\sigma^2$ )	SEM	95% CI of the difference		t (df)	Sig. (2- tailed <i>p</i> )	Effect size (d)
					Lower limit	Upper limit			
Pretest (Form1)	72.8	6.68	43.29	2.11	-21.90	-8.30	4.67	0.0002	2.09
Posttest (Form 2)	87.9	7.75	60.1	2.45			(18)		



The marble is in the box.

The marble is in the bowl.

The marble is in the basket.

The ball is on the table.

The ball is on the floor.

} Box, bowl and basket can be visualized as containers; *in* is used with such things when a smaller thing is placed in these containers.

} Table and floor can be visualized as open flat surfaces; *on* is used with them instead of *in*.

Figure 8. Selected PECS Cards on Prepositions

Monthly Observational Feedback from the Educational Therapist (ET)

Monthly observational feedbacks on the participants' responses in terms of their learning and behaviors were provided by the ET to the researchers at the end of each month during the conference session. It was also during these sessions that the ET informed the researchers of any changes he had made to the intervention procedure in order to meet the participants' needs. This allows the intervention procedure to be improved in the future.

*First Month.* Despite having been taught using the PECS cards previously at the Children Autism Center, four of the 10 participants were not keen to work with the four *what*-mand PECS cards: *what person*, *what*

*happen*, *what place*, and *what time*. By the second session, the ET had to prepare some extrinsic motivators (e.g., colorful stickers of Thomas the train for their sticker albums) to gain their cooperation. Another challenge encountered was the confusion with some of the *what*-mands, especially *what happen* which could refer to *what action* and/or *what thing*. Initially, *what happen* was used for both action and thing as in this sentence: *Ali rode his bicycle*. *Ali* is *what person* while *rode his bicycle* refers to *what happen*. Since *rode* and *his bicycle* are two separate PECS cards, all the participants failed to recognize that *what happen* refers to both the action *rode* and the thing (object) *his bicycle*. As a result, the *what happen* PECS card was removed and replaced with two other *what*-mand PECS cards: *what action* and *what thing*.

*Second Month.* More time was spent on teaching the *what action* and *what thing*, as the participants seemed to be confused between them. The educational therapist used a lot of examples to illustrate *what action* and *what thing* where *what action* was followed by *what thing*. All the participants were able to differentiate between *what action* and *what thing* by the end of the second month. Practice exercises given to the participants helped to reinforce what they had learned.

*Third Month.* Teaching the *what place (where)* was easy and straightforward if a picture of a place was shown on the PECS card as well. However, prepositions like *in*, *on*, and *at* are functional words that the participants found meaningless unless these words were taught in a given context that could be easily visualized, and with as many examples as possible to help them to grasp the concept. For instance, as illustrated in the following sentences by the ET using PECS cards (see Figure 8):

According to the ET, only one participant was unable to grasp the concept of prepositions. This particular participant kept confusing *in*, *on* and *at* as well as *beside*, *below* and *behind*. Practice exercises were given to the participants in all sessions to reinforce their learning.

*Fourth Month.* Teaching *what time (when)* was challenging too. It also could mean *what day*, *what month*, *what year* and so on. In this study, only *what day* and *what time* were taught. The *what day* was taught in terms of the seven days of a week (e.g., Sunday, Monday, Wednesday). The *what time* was taught two ways: Firstly, it was introduced in term of clock time (e.g., seven o'clock, 2:30 pm). Next, it was taught as different parts or periods of the day (e.g., morning, noon). The participants were introduced to the following sentence structure using PECS cards: *what time* follows by *what day*. All of them were able to distinguish between *what time* and *what day* in their practice exercise.

*Fifth Month.* The participants were able to complete the SIM chart using the PECS cards to form sentences. Word cards that matched with the respective PECS cards were also used to form the exact sentences on the chart. These words were copied in the next row just below row for pasting the word cards on the Velcro strips. By the end of the month, all participants were able to complete the task with ease except for the last column on the *what-mand* for time/day (*when*). The ET suggested to have two separate columns under the headings *what time* and *what day*, which the participants had been taught in the previous month, rather than one column for the two *what-mands*. The reason was to avoid confusing the participants should they have to make a choice

deciding whether to place *what time* or *what day* PECS card in the one given box/column.

*Sixth Month.* Without using PECS and word cards, the participants completed the SIM chart by filling the words taken from sentences in a passage in the correct boxes. Questions asked of the passage were presented with PECS and word cards as prompts to help the participants find the correct answers to the respective questions. Although the participants were not able to answer all questions correctly all the time, they were close to getting the right answers. Through more practice, the ET noted that all the participants were able to cope with their reading comprehension using the SIM.

In this study, all possible care was taken to control for extraneous variables. However, there is no assurance that SIM is the only major factor in the pre-test/post-test difference. Moreover, other probable errors include the testing effects (i.e., the experience of pre-test) by itself, may increase motivation, alter attitudes, induce learning sets, or stimulate self-pacing, and maturation (i.e., the participants are also growing older and, therefore, more matured and experienced than before).

#### *Limitations of the Study*

The small sample size of ten participants quantitatively limits interpretation of the findings to the study participants. However, as individuals with autism are generally unique due to differential degrees of perception and response to sensory stimuli with varied challenges (Tomcheck & Dunn, 2007) it is not possible to have homogenous samples in any case.

In addition, there are also three other threats to the single-group action research design but the authors have taken precaution to avoid them: Firstly, there is a threat of history. It refers to something other than the intervention causing the post-test mean to increase (Soh & Tan, 2008). The authors made an informal check with the parents of the participating students to confirm that all the ten participants did not go for other treatments except the SIM intervention. Secondly, there is a threat of maturation. According to Soh and Tan (2008), it refers to the normal growth or maturation of the participants causing the increase in post-test mean. The authors have already factored this into their data analysis to account for six months of maturational or developmental growth ( $M=9.10$ ,  $SD=2.60$ ,  $p<.05$ ) (see Table 5). Lastly, there is a threat of test instrumentation. This concerns the practice effect if the participants become more experienced when the same test is used in the pre-test and post-test (Soh & Tan, 2008). Although the NARA-III RC subtest was administered in the pre-test and

posttest, the test uses parallel forms (Form 1 and Form 2) that allow for retesting while avoiding practice effects on the passages. The test-retest reliability of the NARA-III RC subtest is .92 (Neale, 1999).

### Conclusion

Children with hyperlexia process texts superficially, failing to process information at a story level because they are less able to integrate new information with general knowledge when reading (Nation, 1999). Results of the present study suggest SIM as an effective RC strategy to aid such children in their reading comprehension. It uses two of six elementary verbal operants identified by Skinner (1957): mands, which are important for early language development and daily verbal interactions of children and adults, and tacts, which are necessary for vocabulary development to name or identify objects, actions and events (Sundberg, 2007).

Findings of this study also show that children with hyperlexia gradually learnt to replace *what*-mands with appropriate *wh*-mands in answering comprehension questions. With print prompts provided in each question to match those found in the SIM chart, the correct tact was easily located to answer the question. Moreover, the findings of the study also suggest that the RC difficulties manifested by children with hyperlexia may be due to the way they go about processing the written texts. These children can make sense of what they best understand the texts read through the use of the SIM as RC strategy. However, there still remain many unanswered questions concerning the RC skills of children with hyperlexia such as the early onset and unusual preoccupation with reading in hyperlexia and the nature of RC skills in such children.

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