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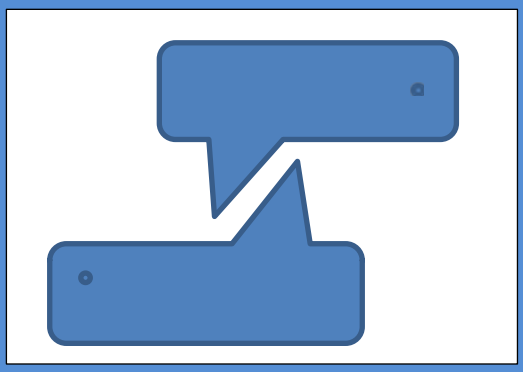

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Accuracy and syntactic measures of written language in biliterate children with Learning Disability

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Abstract

Research on written language has mostly focused on monoliterates. The results obtained for monolinguals cannot be readily generalized to biliterate children especially in a multilingual country like India. The aim of the present study was to investigate the accuracy and syntactic abilities of written language in fourth grade biliterate children with Learning Disability (LD). The participants included fifteen children with LD who were Kannada-English (K-E) biliterates studying in the fourth grade and thirty Typically developing children (TDC). The children were instructed to compose a written narrative in both Kannada and English in response to a pictorial prompt. The written samples were analyzed for measures of accuracy and syntactic complexity using the SALT software. Non-parametric statistics were used to statistically analyze the data. The findings indicated that children with LD performed poorer than TDC in both Kannada and English. Clause Density (TDC: $p<0.01$; LD:$p<0.05$) was higher in English compared to Kannada; Mean length of T-Unit (TDC: $p<0.01$; LD:$p<0.01$) was higher in English than in Kannada; Errors in Writing conventions (TDC: $p<0.01$; LD:$p<0.01$) were greater in English compared to Kannada; Percentage of spelling errors (TDC: $p<0.01$; LD:$p<0.01$) were greater in Kannada compared to English. The results have been discussed in terms of the differences in structure of the two languages and exposure of the languages. A comparison between groups revealed that children with LD performed poorer than TDC for most of the parameters in both the languages. The deficits in these biliterate children with LD on writing measures are explained with relevance to central processing deficit hypothesis.

Keywords: Biliteracy, Accuracy, Syntactic Complexity, Written Language, Children with Learning Disability.

1. Introduction

Written and spoken languages are two important means of communication for human beings. Writing is also a way of documenting information to be passed on to the future generations. It is a form of communication which is complicated in nature requiring a myriad of processing abilities (Bain, Bailet & Moats, 1991). While writing, several aspects such as text, subject and the reader need to be simultaneously focused upon. Writing not only involves the

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lower level skills such as transcription, but also involves higher level skills such as composition and a fine amalgamation of both the skills (Bain, Bailet & Moats, 1991). It is also well known that writing is an important prerequisite for academic success and is also crucial for social and behavioral wellbeing. This is because writing is a means for demonstrating knowledge and literacy i.e., students are assessed mostly based on their written performances in exams in educational settings (Hooper, 2002). Thus writing is an indispensible skill especially in the modern society.

According to the National Joint Committee on learning disabilities (Adopted 1990, updated 2016), "Learning disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span. Problems in self-regulatory behaviors, social perception, and social interaction may exist with learning disabilities but do not by themselves constitute a learning disability. Although learning disabilities may occur concomitantly with other disabilities (for example, sensory impairment, intellectual disabilities, emotional disturbance), or with extrinsic influences (such as cultural or linguistic differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences". "The term 'specific learning disability' means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage" (IDEA, 2004).

The identification of LD has shifted from a discrepancy based criteria to a Response to Intervention (RTI) Model after the discrepancy criteria was much criticized. Out of the many criticisms, the main reason of non-acceptance of the discrepancy criteria include later identification of LD since the properties of the standardized tests used does not help us identify children until the age of 9 or older (Vaughn, Linan-Thompson & Hickman, 2003). The goal of RTI is early identification and prevention of later literacy difficulties (Hood, 2012). In RTI, students are typically screened and those children with poor literacy skills are identifed and early intervention is provided (Kim, Apel & Al Otaiba, 2013). RTI looks at idenfication of LD from an "at risk" point of view (Vaughn, Linan-Thompson & Hickman, 2003). Vaughn, Linan-Thompson and Hickman (2003), further explain this process along these lines: all the children demonstrating academic difficulties would recieve treatment and those children who would respond less to the treatment would be identifed as LD. Hood (2012) also states that the specific assessment tools for RTI have not been specified but the assessment tools used must be valid, reliable and capable of detecting small improvements.

Research has found that children with LD show spelling impairments. Angelelli, Notarnicola, Judica, Zoccolotti and Luzzatti (2010) studied spelling errors in Italian children with dyslexia from grades 3 and 5. Their results showed that children at grade 3 produced higher spelling errors which included phonologically possible, simple and context-sensitive errors. In contrast, children in the fifth grade demonstrated phonologically possible errors. The authors conclude that children with dyslexia demonstrate extreme and longstanding deificits in spelling even while learning a shallow orthography. Tops, Callens, Bijn and Brysbaert (2014) in their study analyzed the spelling errors made by 100 high achieving students with dyslexia in comparison with 100 matched controls. All the participants had Dutch as their mother tongue and were studying in the first year of their bachelor's degree. The spelling errors were categorized as phonological, orthographic and grammatical. According to the results, students with dyslexia exhibited twice the amount of spelling errors made by controls. It was also found that phonological errors occurred more frequently in students with dyslexia. Saryu (2014) analyzed the spelling errors of children with Learning Disability (LD) in comparison to spelling errors of Typically Developing Children (TDC) using a linguistic pattern analysis. On qualitative analysis using Phonological, Orthographic and Morphological Assessment of Spelling (POMAS; Silliman, Bahr & Peters, 2006), it was found that children with LD produced more Phonological, Orthographic, Morphological and Phonological-Orthographic errors in comparison with TDC.

Several studies have demonstrated syntactic deficits in children with LD. Amoolya and Shanbal (2012) investigated the sentence comprehension abilities in 6 to 12 year old children with LD using a grammaticality judgement task in Kannada. They found that children with LD were both less accurate and slower to respond to the tasks when compared to age matched TDC. This study highlights the categories of grammar in which children with LD showed deficits which include tenses, conditional clauses, comparatives, causatives etc. The results of the study also revealed that children with LD exhibited lesser sensitivity to subject-verb agreement compared to age matched TDC. Abrahamsen and Shelton (1989) studied reading comprehension abilities in children with LD. They found that combined syntactic and semantic modifications as well as syntactic modifications to the text resulted in better comprehension whereas semantic modifications alone did not improve reading comprehension. This study demonstrates that the syntactic deficits in children with LD affect their literacy skills. Other studies have also shown that children with LD demonstrate difficulties with various other aspects of syntax such as passive voice, center embedded sentences (Huggins & Adams,1980), grammatical morphemes (McClure, Kalk, & Keenon,1980) etc. It is possible that a lot of children with dyslexia or LD could have deficits in writing because of deficits in reading and reading comprehension.

In conditions such as Learning Disability, research on written language difficulties has often taken a backseat compared to research on reading difficulties. Research on written language difficulties in children with Learning disabilities is evolving only since the past two decades (Hooper,

2002) and more research evidences are documenting the difficulties faced by these individuals. On assessment, both children and adults with learning disabilities were reported to manifest equal difficulties in both reading and writing (Berninger, Abbott, Thomson & Raskind, 2001). On follow up of participants of treatment studies it was found that children with dyslexia had persistent difficulties with writing even after their reading difficulties had resolved and they found it difficult to find access to appropriate intervention services for remediation of their writing problems (Berninger, 2006). According to DSM-V-TR, difficulties in these three particular domains of writing characterize Written Language Disorders which include spelling accuracy, grammar and punctuation accuracy, and clarity and organization of written expression. In studies involving children with LD, reading has been focused to a greater extent, while very little attention has been paid to the nature of written language difficulties faced by these children. Children who present with disorders of writing are at an increased risk of long term undesirable personal and economic consequences and lead to financial burdens on the entire society as well (Grigorenko, 2007; Hooper, 2002).

Exploring reading and writing deficits in such children with LD is a greater challenge when the children are exposed to more than two languages. Approximately two thirds of the world's children are growing up in an environment where they are exposed to two languages (Bhatia & Ritchie, 2012; Crystal, 2003). Bilinguals are those who use two or more languages (or dialects) in their everyday lives (Grosjean, 2010). The term biliteracy is used to describe children's competencies in two written languages, developed at varying degrees, either simultaneously or successively (Dworin, 2003). Research in the area of written language development has mostly concentrated on one language (Gort, 2006). Grosjean (1985, 1989), in fact, has condemned the application of monolingual research to bilingual children by suggesting that it is a fractional or monolingual view of a bilingual. De Silva (1998) suggests that we need to study the development of writing in both the languages of bilingual children so that we can develop evaluation and management strategies that are developmentally, linguistically and culturally appropriate.

Most of the research done in bilingual writing have focused on skills that develop early such as phonological processing, inventive spelling and word reading (Bialystok, 2007; Geva, 2006; Shanahan & Beck, 2006). There are fewer studies that have focused on the development of higher level skills such as composition skills in bilingual children. The studies conducted have focused on biliterate children learning many languages such as Spanish-English (E.g., Danzak, 2011; Escamilla, 2007; Gort, 2006; Lanauze & Snow,1989 etc.); Spanish- Swedish (E.g., Hedman, 2012); Japanese- English (E.g., Kabuto, 2011); Korean-English (E.g., Velasco & Garcia, 2014) and there is a dearth of such studies in the Indian context.

In the Indian context, children are primarily required to learn reading and writing in two languages with different scripts, one of the languages being regional and the other being English. Kannada is a Dravidian language spoken in the south Indian state of Karnataka. Most of the words in Kannada are bi-syllabic and tri-syllabic along with words having four, five and six syllables (Nag, Treiman, & Snowling, 2010). Nag, Treiman and

Snowling (2010) also noted that the symbols used in the written forms of alphasyllabaries such as Kannada, more or less represent syllables, but these symbols can also be decomposed to show the phoneme within them. For instance, the Kannada grapheme 'PÉ' (/ke/) consists of two components: the component 'Pï' represents the phoneme /k/ and the component ' ' represents the phoneme /e/. In Karnataka, the children are required to learn written language in Kannada (which is the regional language) and English simultaneously. The nature of Kannada and English scripts are very different. Kannada follows a semi-syllabic script with transparent orthography, whereas English follows an alphabetic script with opaque orthography (Shanbal, 2010). In alphabetic scripts such as English, symbols represent phonemes, whereas in alphasyllabic scripts such as Kannada, written symbols approximately represent syllables (Nag, Treiman, & Snowling, 2010). Alphasyllabaries are also known as abudigas demonstrate features of both alphabets and syllabaries (Bright, 1996; Daniels, 1996).

Sheetal and Sangeetha (2010) compared written language skills of typically developing Indian children and children with LD studying in the first to fifth grades. The children were Kannada-English biliterates and they were given an expository task of writing on the topic 'My school' in English. On analysis of their written compositions on SALT software, it was found that children with LD showed poorer performance on all the measures of productivity, accuracy and complexity. Children with LD exhibited lesser total number of words and number of T-units (i.e. a sentence with one main clause along with embedded subordinate clauses) calculated by the SALT software indicating deficiency in productivity and written fluency (indicated by lesser total number of words) along with deficits in syntactic complexity (indicated by lesser number of T-units). Thus the author concludes that children with LD might have difficulties in one or more levels of processing and production of written language. Though the participants were Kannada-English biliterates only the medium of instruction, English, was assessed in the study.

Shanbal (2010), in her doctoral research, investigated the process of acquisition of biliteracy in Kannada-English emerging bilingual-biliterate children studying in the fifth, sixth and the seventh grade. Listening comprehension, phonological awareness, rapid verbal naming, reading and written language skills were assessed. Assessment of written language skills through an expository writing task in Kannada-English biliterate children was one component of Shanbal's study. The topic given to the participants was 'My School'. The results of the study revealed that children of all the grades produced greater 'Total Number of clauses' (TNC) in English compared to Kannada. Shanbal (2010) attributed this finding to the structural differences between Kannada and English. The nature of English language is such that it requires more number of clauses to convey a particular meaning, while in Kannada the same meaning can be conveyed with a single clause. For instance, the sentence in English "I eat the lunch that my mother packs" has two clauses, whereas, the same sentence written in Kannada '£Á£ÀÄ £ÀªÀÄä CªÀÄä PÀnÖzÀ HlÄ¸ÀÄßvÉÛÃ£É' contains only a single clause consequently leading to higher Clause Density in English

compared to Kannada. With respect to spelling errors, it was found that children made errrors in English compared to Kannada. This result is explained again by the difference between Kannada and English. Spelling in Kannada requires the use of 'orthographic principles' (Prema, 1998), whereas English spelling requires the mastery of phoneme-to-grapheme correspondence. Thus Shanbal (2010) reasons out that children in the younger grades incorrectly applying the orthographic principles for spelling in English led to greater spelling errors in English compared to Kannada. Shanbal (2010) also found that the grammatical T-units were found to be greater in Kannada compared to Englsih. She attributes this result to the dependency of written language on the development of oral language. Kannada, being the native language of children had developed better compared to English, which was the academic language was probably taking more time to develop.

Sheetal and Sangeetha's (2010) study, though conducted on Kannada-English biliterate children, assessed expository writing only in one language i.e., English. Shanbal's (2010) study used an expository task to assess written language skills in Kannada and English. But the present study uses a narrative task for the assessment of written language skills in biliterate children. Narrative texts include those which describe events by providing details about when, where and how the event took place and the people involved in the event. Narrative texts require the presentation of events/experiences in a chronological order (Quellmalz & Burry, 1983). Expository writing involves presenting facts, ideas and opinions and supporting them by providing appropriate details and explanation along with logical presentation of thoughts (Quellmalz & Burry, 1983). Since expository tasks and narrative tasks use different mechanisms, the results obtained for expository tasks cannot be generalized to narrative tasks as well. Thus the present study was conducted to bridge this gap in previous research in Indian Kannada-English emerging biliterate children.

Thus, the present study aimed to investigate the accuracy and syntactic abilities of written language in the fourth grade biliterate children with Learning Disability (LD) in comparison to age and language matched Typically Developing Children (TDC). The research questions that directed the present study included:

a) Are there diffferences in the accuracy measures of written language in Kannada and English between emerging biliterate TDC and children with LD?

b) Are there diffferences in the syntactic measures of written language in Kannada and English between emerging biliterate TDC and children with LD?

2. Methodology

2.1. Participants

Fifteen children with LD and thirty TDC in the age range of 9-10 years (9.0 years ≤ A <10.0 years, where 'A' is the age of the child; Mean age: 9.5 years) studying in the fourth grade were selected as participants for the study. İn the TDC group, an equal number of males and females were included i.e., 15 males and 15 females. İn the LD group, only three of them were females and the rest, i.e., 12 were males. For all the children Kannada was the native

language/ first language (L1) and English was the medium of instruction (second language/L2) in academic settings. The participants were sequential bilinguals who learnt Kannada first at home and were gradually exposed to English mostly in academic settings. All the participants had about six to seven years of exposure to English. All the participants in the study, including those children with LD knew how to read and write Kannada. However, Kannada was taught only as a single subject whereas English was the medium of instruction for the rest of the subjects. TDC were chosen from a school in Mysore. They were screened using the WHO Ten Questions Disability Screening Checklist (Singhi, Kumar, Malhi & Kumar, 2007) and those with a history of delayed development, behavioral, neurological or sensory issues were excluded from the study. These children were also screened using the Tool for screening children with writing difficulties (ToSc-WD) (Shanbal, 2003) to ensure they did not have any written language difficulties.

Children with LD were selected among those who came to avail Speech and Language services at the Institute. They were diagnosed jointly by Speech Language Pathologists (SLPs) and Clinical Psychologists. SLPs assessed these children through their performance on Early Reading Skills by Loomba (1995) for Indian children. Those children who performed at least two Standard Deviations below their actual grade level on the Test of Early Reading Skills were selected as participants for the present study. The IQ of children was evaluated by Clinical Psychologists and all the children with Performance Intelligence quotient (PIQ) > 80 as per Ravens Progressive Matrices were included in the study. Children with LD included in this study did not have a speech and language delay, but they performed poorly in the syntax section of the Linguistic Profile test in Kannada (Karanth, Ahuja, Nagaraja, Pandit & Shivashankar, 1991) and their scores ranged from 55.95 to 69.07 indicating that they performed at the 7 to 8 year age range . Also, all the children included in the clinical group had reading and writing difficulties in both Kannada and English. All the participants in the study belonged to the middle socio-economic status which was ensured using the revised version of the NIMH Socio-economic status scale (Venkatesan, 2011). Language Use Questionnaire (Shanbal, 2010) was used for the present study to investigate the language use of children in each of the two languages. The questionnaires were given to the parents to rate their children's amount of exposure to the two languages and their abilities in the two languages. The results obtained from the questionnaire revealed that the participants obtained a higher score meaning higher exposure to Kannada (ranging from 75 % to 100%) compared to English (scores ranged from 25 % to 50%). The results also revealed that children had better abilities in comprehending and speaking Kannada (scores ranged from 75 % to 100%) compared to English (scores ranged from 25 % to 50 %).

2.2. Test material and Procedure

Children were asked to produce written narratives to a pictorial prompt depicting the story of a child falling from a tree. Pictorial prompts have been used earlier by researchers to assess narrative writing abilities in children

(Cain and Oakhill, 1996). They found that picture prompts produced causally related narratives than the verbal prompts. Hence picture prompts were used in the present study. The pictures used in the present study were adapted from a standardized Italian battery for the assessment of writing skills developed by Tressoldi and Cornoldi (1991) (See Appendix) after making appropriate modifications to suit the Indian context. These pictures were also previously used by Carretti, Maria Re and Arfe (2013) in the assessment of written language skills in children. The modifications done in the picture stimulus included: addition of an extra picture to show the branch breaking and the child falling, changing the colour of the white bedspread in the hospital scene to green so that Indian children would get a better idea that it is a hospital. Also, a blood stained band-aid was added around the child's head and a drip set was added in the background. The colour of the background walls were changed from pale orange to blue so that it contrasts with the plaster of the fractured leg and the plaster is highlighted better. Children were asked to write the story as if narrating to a friend. Children were given thirty minutes to complete the task. Children were asked to write in Kannada and English on two different occasions with counterbalanced order of presentation. The written narratives produced by children were analyzed using the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2001) software. The assessment protocol suggested by Puranik, Lombardino and Altmann (2008) was modified and used for the present study. The parameters included were divided into accuracy measures and syntactic complexity measures. The accuracy measures included Percentage of grammatical T-units (GRAM T-unit), Errors in writing conventions (CON) and Percentage of spelling errors (SPELL). The syntactic complexity measures included Total number of clauses (TNC), Clause Density (CD) and Mean Length of T-Unit (MLT-UNIT).

2.3. The Accuracy measures

1)Percentage of grammatical T-units (GRAM T-unit): A T-unit is a sentence which is one main clause with all the sub-ordinate clauses embedded within it (Hunt, 1965). This criteria proposed by Hunt (1965) was used to calculate T-units in the present study. Any violation of grammar in the sentences of the respective languages were considered as ungrammatical T-units. The T-units without any grammatical error were considered as grammatical T-Units. Percentage of grammatical T-units was calculated as the ratio of number of grammatical T-Units divided by the total number of T-units in the sample multiplied by 100.

GRAM T-Unit= Number of T-units without errors/ Total number of T-units* 100

2)Errors in writing conventions (CON): Written conventions refer to handwriting, writing letters in a line, correct use of punctuation, page setting, use of capital and small letters, writing words correctly, starting a paragraph (Kameenui & Simmons, 1990). In the present study, use of punctuation marks like initial capital letters, apostrophes, commas etc. in the text were considered under writing conventions. Any error in the appropriate use of the aforementioned writing conventions were

considered as Errors in writing conventions, and the number of such errors were coded and fed into the SALT software. The software provided the total number of errors in writing conventions.

3)Percentage of spelling errors (SPELL): Any error in spelling, whether it was a substitution, addition or omission was considered as a spelling error. Percentage of spelling error was calculated by dividing the number of spelling errors by Total Number of Words multiplied by 100.

SPELL= Number of spelling errors/ Total number of Words* 100

2.4. The syntactic complexity measures

1) Total number of clauses (TNC): A clause is a group of words containing a subject and a predicate. Clauses were coded into SALT and the Total number of clauses was calculated automatically by the program.

2) Clause Density (CD): This was calculated as ratio of Total Number of Clauses (TNC) by Number of T-Units (No T-Unit).

CD= TNC/No T-Unit

3) Mean Length of T-Unit (MLT-UNIT): It was calculated by dividing Total Number of Words (TNW) by number of T-Units.

MLT-UNIT = TNW/T-Unit.

Inter-rater reliability was also determined for the study, wherein 10 % of the samples were given to two other examiners who were experienced Kannada-English biliterate Speech-Language Pathologists. These examiners were familiarized with the SALT software and its conventions. The two examiners analyzed the data separately without mutual consultation. In case of discrepancy between the examiners for any of the parameters, the analysis was repeated and the results that were mutually agreed upon by all the examiners were noted as final. The inter-rater reliability showed moderate to good reliability (0.7-0.8)

3. Findings

The written samples were subjected to analysis using the SALT software. The parameters were examined for both languages in both the groups. Non parametric statistics were used for statistical analyses as the results of Shapiro-Wilk's test revealed that most of the parameters were following a non-normal distribution ($p<0.05$). The non parametric tests were administered to compare between the groups and across languages in both the groups. η^2 was used to calculate the effect size using the formula suggested by Field (2009) to calculate 'r'. The formula used to calculate effect size was

$$r = \frac{z}{\sqrt{N}}$$

Wilcoxon signed rank test was administered to check for differences in the performance of TDC in English and Kannada and to check for differences in the performance of children with LD in English and Kannada. Mann Whitney

test was administered to compare the performance of TDC and children with LD. Table1.1 and Table 1.2 show the Mean, Median and Standard Deviation values of the measures on SALT for TDC and LD in Kannada and English respectively.

Table 1.1
Mean, Median and Standard Deviation values of the measures on SALT for TDC and LD in Kannada.

Sl No.	Parameters	TDC			LD		
	Syntactic complexity measures	Mean	Median	SD	Mean	Median	SD
1.	TNC	9.10	9.00	2.52	6.40	6.00	1.68
2.	CD	1.18	1.11	0.25	1.18	1.00	0.25
3.	MLT-UNIT	5.39	5.15	1.35	5.62	5.00	1.33
	Accuracy measures						
4.	GRAMT-UNIT	88.21	95.84	15.11	52.03	60.00	25.51
5.	CON	1.07	0.00	1.78	4.13	5.00	2.07
6.	SPELL	19.52	13.08	15.86	54.34	57.14	15.62

Note- TNC: Total Number of Clauses, CD: Clause Density, MLT-UNIT: Mean Length of T unit, GRAMT-UNIT: Percentage of Grammatical T-Unit, CON: Errors in writing conventions, SPELL: Percentage of spelling errors.

Table 1.2
Mean, Median and Standard Deviation values of the measures on SALT for TDC and LD in English.

Sl No.	Parameters	TDC			LD		
	Syntactic complexity measures	Mean	Median	SD	Mean	Median	SD
1.	TNC	8.90	9.00	2.72	9.60	10.00	3.25
2.	CD	1.43	1.40	0.34	1.47	1.33	0.43
3.	MLT-UNIT	8.84	8.63	2.29	9.45	9.20	2.34
	Accuracy measures						
4.	GRAMT-UNIT	47.46	55.56	29.37	59.02	66.67	21.51
5.	CON	3.77	3.00	3.41	8.60	7.00	6.37
6.	SPELL	4.55	4.22	4.23	16.29	12.90	9.90

Note- TNC: Total Number of Clauses, CD: Clause Density, MLT-UNIT: Mean Length of T unit, GRAMT-UNIT: Percentage of Grammatical T-Unit, CON: Errors in writing conventions, SPELL: Percentage of spelling errors.

3.1. Comparison across languages for TDC

Analysis of results on Wilcoxon signed ranks test revealed a significant difference between the following parameters: Clause Density (|Z|= 3.178, p < 0.01, η^2= 0.58), with clause density being higher in English (Mean = 1.43, SD= 0.34) than in Kannada (Mean 1.18, SD= 0.25); Mean length of T-Unit (|Z|= 4.782, p< 0.01, η^2=0.87), with Mean length of T-Unit being greater in English (Mean = 8.84, SD= 2.29) than in Kannada (Mean = 5.39, SD = 1.35); Grammatical T-Units ((|Z|= 4.374, p< 0.01, η^2=0.80) – greater number of grammatical T-units in Kannada (Mean = 88.21, SD= 15.11) than English (Mean = 47.46, SD= 29.37); Errors in Writing conventions ((|Z|= 4.134, p< 0.01, η^2=0.76), with greater number of errors in English (Mean = 3.77, SD= 3.41) compared to Kannada (Mean= 1.07, SD= 1.78); Percentage of spelling errors ((|Z|=4.357, p<0.01, η^2=0.80) were higher in Kannada (Mean =19.52, SD= 15.86) compared to English (Mean = 4.55, SD= 4.23). The results also revealed that there was no significant difference between total number of clauses ((|Z|= 0.526, p > 0.05, η^2=0.10) between Kannada and English.

3.2. Comparison across languages for children with LD

The results of the pair wise comparisons using Wilcoxons signed rank test (see Table 3) revealed a significant difference between the following parameters in Kannada and English: Total number of clauses (|Z|=3.210, p < 0.01, η^2=0.83) with TNC being greater in English (Mean=9.60, SD=3.25) compared to Kannada (Mean=6.40, SD=1.68); Clause Density (|Z|= 1.978 ,p < 0.05, η^2=0.51) with greater clause density in English (Mean = 1.47, SD= 0.43) than in Kannada (Median = 1.18, SD= 0.25) ; Mean length of T-unit (|Z|=3.294 ,p < 0.01, η^2=0.85) with greater Mean Length of T-unit in English (Mean = 9.45, SD= 2.34) than Kannada (Mean = 5.62, SD= 1.33); Errors in writing convention (|Z|= 2.608 , p < 0.01, η^2=0.67) with greater number of errors in English (Mean = 8.60, SD= 6.37) compared to Kannada (Mean=4.13, SD= 2.07); Percentage of spelling errors (|Z|= 3.408,p <0.01, η^2=0.88) with greater errors in Kannada (Mean = 54.34, SD= 15.62) in comparison with English (Mean=16.29,SD=9.90).There was no significant difference between Kannada and English on the Percentage of Grammatical T-units (|Z|= 1.223,p > 0.05, η^2 =0.32).

3.3. Comparison between TDC and children with LD

The results of Mann Whitney test revealed that there was a significant difference between the performance of TDC and children with LD on the following measures in Kannada language : Total number of clauses (|Z|= 3.360, p <0.01, η^2=0.50), where TDC produced significantly higher Total Number of Clauses (Mean= 9.10, SD= 2.52) compared to children with LD

(Mean= 6.40, SD=1.68); Percentage of grammatical T-units (|Z|= 4.494,p<0.05, η^2= 0.67) where TDC (Mean = 88.21, SD= 15.11) exhibited greater percentage of grammatical T-units compared to children with LD (Mean = 52.03, SD= 25.51) ; Errors in writing conventions (|Z|= 4.045,p <0.01, η^2=0.60) where children with LD (Mean = 4.13, SD= 2.07) produced higher errors in writing conventions compared to TDC (Mean= 1.07, SD= 1.78) ; Percentage of spelling errors where children with LD (Mean = 54.34, SD= 15.62) produced significantly higher (|Z|= 4.539, p< 0.01, η^2=0.68) percentage of spelling errors in Kannada compared to TDC (Mean= 19.52, SD= 15.86) . There was a significant difference between the performance of TDC and children with LD on the following measures in English language: Errors in writing conventions (|Z|= 2.949,p< 0.01, η^2=0.44) where children with LD (Mean = 8.60, SD= 6.37) produced significantly greater number of errors in writing conventions compared to TDC (Mean = 3.77, SD= 3.41) and percentage of spelling errors (|Z|= 4.545, p<0.01, η^2=0.68) where children with LD (Mean = 16.29, SD= 9.90) produced significantly higher number of percent spelling errors compared to TDC (Mean = 4.55, SD= 4.23). There was no significant difference between the performances of children in the Kannada language on the following measures: Clause Density (|Z|= 0.203, p > 0.05, η^2= 0.03), Mean length of T-Unit (|Z|= 0.603, p> 0.05, η^2=0.09). The results also revealed that there was no significant difference between the performance of TDC and children with LD in the English language with respect to Total Number of Clauses (|Z|= 0.824, p> 0.05, η^2=0.12), Clause Density (|Z|= 0.048, p> 0.05, η^2= 0.01); Mean Length of T-Unit (|Z|=1.024, p> 0.05, η^2= 0.15) and Grammatical T-Units (|Z|=1.617, p> 0.05, η^2= 0.24).

4. Discussion

4.1. Comparison across languages

The results of the present study revealed that percentage of grammatical T-Units were greater in Kannada compared to English. In the present study, it can be understood that a better perfromance in syntax for Kannada language could be due to increased exposure in Kannada than English. Children used Kannada most of the time at home as observed on language use questonnaire Similar results were reported by Shanbal (2010) when she studied the written language of Kannada-English biliterate children. Though Kannada and English reading and writing were introduced to the participants at the same time, children might have performed better in Kannada due to greater language experiences they might have had with Kannada since it was their native language and hence had better language representation in Kannada. This result also supports the hypothesis that written language is dependent on the development of oral language abilities

in children (Shanbal, 2010). This indicates that the underlying proficiency in the languages could have contributed to a better performance in Kannada than in English in both TDC and LD, where number of grammatical T-units is indicative of better grammatical abilities in Kannada than English.

It was also found that errors in writing conventions were greater in English compared to Kannada. The reason for this finding may be the presence of initial capitalization errors in English. The nature of Kannada orthography does not involve capitalization of letters. Similar findings were found for children with LD also.

Further, Percentage of spelling errors were more in Kannada compared to English. The spelling errors made in Kannada were mostly with respect to geminates and mixed clusters. In Kannada, certain words are of the CCV (Consonant-Consonant-Vowel) type. The sequence of consonants can either be the same (as in 'CPÀÌ' /akka/ meaning 'sister') or different (as in 'JµÀÄÖ' /eʃTu/ meaning 'how much?'). The consonant sequences with the same consonants are referred to as 'geminates' and those with different consonant sequences are referred to as 'mixed clusters' (Nag, Treiman & Snowling , 2010). This finding is in consonance with the findings of Nag, Treiman & Snowling (2010) where they report that fourth and fifth grade children performed poorly in spelling complex aksharas such as geminates and mixed clusters. Further, in the present study, the spelling errors were found to be lesser in English compared to Kannada. This could be because children study all the subjects in school in English (which is the medium of instruction) , whereas Kannada is only one subject in school. It could possibly be that children in schools currently are taught with greater emphasis to rehearse spelling in English which may have led to lesser spelling errors in English when compared to Kannada. It could also be possible that children have not attained an understanding to use of geminates which require additional skill of conjugating two graphemes together to form one combined form. Similar pattern was observed for children with LD also, however children with LD performed poorer than TDC.

In children with LD, there was no significant difference between Kannada and English for the syntactic measure of percentage of grammatical T-units. This could be attributed to the syntactic and grammatical difficulties in children with LD which are manifested in both the languages. Several studies have demonstrated difficulties in various aspects of syntax and grammar in children with Learning disability (Amoolya & Shanbal, 2012; Abrahamsen & Shelton, 1989; Huggins & Adams, 1980; McClure,Kalk & Keenon, 1980). This finding can also be explained by the central processing deficit hypothesis. The central deficit hypothesis posits that if there are problems in reading, they should be manifested in both the languages since it is due to more of a central processing deficit. In other words, children who exhibit problems in reading second language must also exhibit similar problems in their first language. This theory suggests that children with linguistic and cognitive deficits would experience problems in reading

regardless of the language (Fontoura & Siegel, 1995). Writing problems could be a mere reflection of reading problems often seen in children with LD. In the present study, deficits in writing were seen in children with LD, which could be due to a reading deficit, which is probably more a central processing deficit. Hence, the children are showing problems in writing in both the languages.

In the present study, there was no significant difference between the TNC in Kannada and English. But, Clause Density was found to be higher in English. It would normally be expected that if number of clauses were almost equal in Kannada and English, then the Clause Density would also be nearly equal in Kannada and English. But in this particular study, the total number of sentences were more in Kannada. In English, due to lesser total number of sentences, the TNCs also decreased. But, the CD in English was higher since each sentence had more number of clauses in English compared to Kannada. A sentence such as "I eat lunch that my mother packs" has two clauses. The same sentence in Kannada /naanu namma amma kaTTida UTa tinnuttEne/ has only one clause. Therefore in Kannada , information through writing can be conveyed via lesser number of clauses. On the other hand, English requires the usage of more number of clauses to convey the same information (Shanbal, 2010). In case of children with LD, they showed both higher TNC and greater CD in English compared to Kannada. Also, children with LD showed significantly greater MLT-UNIT in English compared to Kannada similar to TDC indicating that English requires more number of words to convey the information, whereas Kannada would require lesser number of words to convey the same information.

4.2. Comparison between children with LD and TDC

In Kannada, TDC showed a higher percentage of grammatical T-units and greater TNC compared to children with LD. This finding could be attributed to the syntactic difficulties noticed in children with LD (Amoolya & Shanbal, 2012; Abrahamsen & Shelton, 1989; Huggins & Adams, 1980; McClure, Kalk & Keenon, 1980).

The results of the present study also revealed that children with LD showed more errors in writing conventions in both English and Kannada. In the present study, children with LD omitted the use of periods to mark the end of a sentence and also made capitalization errors in English more often than TDC. This finding is in consonance with several other studies which have found that children with LD make mistakes in the correct use of punctuation and the use of capital letters while beginning a sentence (Isaacson, 1987; Lerner, 1993).

It was also found that children with LD made more spelling errors in both English and Kannada compared to TDC. This finding is supported by several research studies which have demonstrated that spelling difficulties are a

common characteristic of children with Learning Disability for languages with both opaque and transparent orthographies (Angelelli, Notarnicola, Judica, Zoccolotti, & Luzzatti, 2010; Saryu, 2014; Tops, Callens, Bijn, & Brysbaert, 2014).

5. Conclusions

In a nutshell, when written compositions in Kannada and English were compared, the results showed that Clause Density, Mean length of T-unit and Errors in writing conventions were found to be higher in English compared to Kannada. These results have been explained by the differences in linguistic structure of Kannada and English, where English requires more number of words and clauses compared to Kannada to convey the same information. Percentage of spelling errors were found to be greater in Kannada compared to English. This result has been explained by greater academic exposure to English compared to Kannada therefore greater opportunities to rehearse spelling leading to poorer spelling abilities in Kannada compared to English. It was also found that syntax (GRAM T-UNIT) was better in the native language compared to the second language i.e., English. This shows that written language was dependent on oral language abilities and that syntax is a language independent measure which did not transfer from native language to the second language in terms of writing. This pattern was similar to both TDC and children with LD.

When the performance of TDC and children with LD were compared, it was found that children with LD performed poorer than TDC in the accuracy and syntactic measures of written language in both the languages. This can be explained by the central processing deficit hypothesis, which states that children with LD exhibit deficits which are common to both the languages. That is to say that the presence of syntactic deficits in one language makes it highly likely that similar deficits can be seen in the other language also.

The present study is the first step in documenting the written language skills of Kannada-English biliterate children with LD. The results of the present study stresses the importance of assessing both the languages in biliterate children so that we get a complete picture of children as emergent biliterate writers. Children with LD in the present study showed syntactic deficits in both the languages assessed, showing more of a central processing deficit. This may suggest that, during intervention, we may need to work upon certain matalinguistic strategies along with working on syntactic and or other skills in each of the two languages.

We have noted a few limitations of the present study, the most important one being less sample size. Also, usage of other measures to analyze the data would have yielded a better, complete picture of the writing capabilities of these children. The present study utilized a narrative task, utilization of an

expository task would also be beneficial in understanding how the nature of the task might affect the written language skills in these emerging biliterate children. Also, the present study was conducted only in one grade, conducting such studies in successive grades would help us uncover the developemental trend, if any, in the written language of these developing biliterate children.

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Appendix

Stimulus used for the study (Adapted from Tressoldi & Cornoldi, 1991)

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Producing and understanding conditionals: When does it happen and why does it matter?

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Abstract

Comprehending complex conditional sentences plays an integral part in understanding many aspects of learning at school, particularly in subjects such as science and history, where hypotheses and alternative explanations are important. While simple conditionals are produced by pre-school children, the acquisition of complex conditionals occurs later. This cross-sectional and longitudinal design investigated the trajectory for production and comprehension of type II and type III conditionals in two cohorts of children, one starting in January of year 1 (age 5-6; n=225), the second in January of year 2 (age 6-7; n=292), with three measurement points over a 9 month period. Production was measured using a repetition task, comprehension by providing conditional sentences and asking the children to say whether four statements about each sentence were true. Single word reading and verbal and non-verbal ability were also measured. Production occurred much earlier than comprehension. By the start of year 3, 71% of children could repeat type II sentences and 52% could repeat type III sentences. In contrast, at the same point, fewer than 20% of children could understand either type II or type III conditionals. Logistic regressions showed that while production of type III conditionals predicted comprehension of both type II and type III conditionals 9 months later, comprehension of type II was also predicted by single word reading while type III comprehension was also predicted by ability. Acquisition of conditionals is likely to play an important role in academic success.

The results are discussed with respect to the importance of understanding conditionals for academic success.

Keywords grammar, conditional, production, comprehension, ability, reading

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1. Introduction

Grammar is essential for learning, comprehending and producing a language. The development can be described as a child's ability to move from using single words to combining word structures and sequences based on a set of rules of a given language to create grammatically correct sentences. The early stages of the developmental process are well established and across typically developing children (Barrett, 1989). By age 5, the majority of children are grammatically fluent in their native language without explicit instruction (Brown & Hanlon, 1970; Brown, 1973; Devescovi & Marchione, 2006; Mellanby & Theobald, 2014, chapter 3). The apparent ease with which infants develop language, including simple grammar, has been at the centre of the long-standing debate into language acquisition: the nativist view (Chomsky, 1965) takes the position that language development stems from innate cognitive modules that allow us to acquire grammar through experience; that it would be impossible to develop as much and as quickly as we do relative to the amount of direct instruction without an inbuilt language module. The connectionist view (Plunkett & Juola, 1999) shows from computer modelling of the acquisition of grammar, such as the early regularization of the past tense followed by later acquisition of the correct form, that grammar can be acquired simply by extracting rules from the statistical frequency of regularities in the input. This view looks at grammar acquisition as a domain-general process, which would not depend on a pre-defined grammar module. The neuroconstructivist view of grammar acquisition also does not rely on the existence of a pre-defined grammar module but considers that structurally defined modules within the brain develop as the result of interaction with the environmental language input (Sirois et al., 2008).

1.1 Complex grammar – the conditional

Once children have acquired the simple grammar of their language, they might begin to develop more grammatically complex sentences such as those involving counterfactual conditionals for example, *if you had skipped to the Discussion, you would not have read this example*. A form whereby the relation between properties or events is absent but implied. Simple conditionals such as 'If you remember your shoes we will go to the park' are acquired quite early. Yet acquisition of the more complex forms of the conditional continues to be difficult for some older children (Amidon, 1976), and indeed, some adults never reach full acquisition (Evans, Handley, Neilens & Over 2008). However, the developmental trajectory for acquiring complex grammar is not much researched.

Conditional structures are used to express a condition on which something else depends; they are hypothetical, use the connective 'if', and are a way of communicating through words about past, present and future consequences. Syntactic structure is complex, including a

conditional clause and a main (result) clause, and the verb typically changes its form in either one or both clauses, increasing complexity. It has been identified as one of the most difficult aspects of English grammar to master (especially for English as a second language learners; see Celce-Murcia & Larsen-Freeman, 1999, chapter 27), but also an essential one for complete comprehension and production of the language (Tuan, 2012). There are many variations of conditional sentence, the names for which differ by discipline. This paper will focus on what are considered to be the two most difficult types of conditional sentence, firstly, one often referred to in the pedagogical literature as 'type II', which uses the conditional clause '*if* + *'past tense'* and the main clause *'would + infinitive'*, for example, *if you wanted to know more, you would continue to read.* Secondly, one often referred to in the pedagogical literature as 'type III', which uses the '*if + past perfect tense'* and the main clause *'would have + past participle'*, for example, *if you had stopped reading, you would have missed the most complex conditional of all.* Such a statement is counterfactual in that the first clause, the antecedent, is known or believed not to have been realized. Type III is the least frequently used of the conditional sentence types, therefore exposure to it is generally less (Hwang, 1979).

Being able to comprehend and produce conditional sentences is needed for communicating about actions and consequences. The conditional is used throughout schooling (increasingly so in secondary school), for example, 'Europe would have had a very different history if the Second World War had not taken place'. Lack of understanding of conditionals, particularly in history or science lessons, could lead to underachievement of otherwise bright children because of misunderstanding questions and information. A recent study of 101 children aged 7-8 found that those who were able to comprehend type III conditional sentences were significantly more likely to show comprehension of scientific hypothesis testing compared to those that had no acquisition (Svirko, Gabbott, Badger & Mellanby, in review). If a child transitions into adulthood without conditional comprehension, this could lead to general misunderstandings and reduced opportunities.

1.2 The relationship between production and comprehension

The development of language production and language comprehension with regards to simple grammar is well documented although until fairly recently, the two were studied separately. Even the more recent work combining and thus providing a framework of previous findings and theories is unable to explain fully the relationship between the two skills. Yet the relationship is an important one in language development: once fully understood it would aid "understanding of the

overall architecture of the cognitive system serving language" (Meyer, Huettig & Levelt, 2016, p. 3).

Overall, it is agreed that language production cannot simply be due to imitation of adult speech. Infants and children make sentence and grammatical mistakes that the adults surrounding them do not; infants may pick up vocabulary and accents from adults, but they must learn/understand a concept or the correct grammatical construction of a sentence before they can imitate it through production. Although it is important to note that comprehension of a sentence does not automatically result in a correct (re)production, for example, Mummy: "Jack, Mary's going outside now", Jack: "Yes, Mary go now". We could conclude from this that comprehension must precede production. However, it is clear that children are also able to reproduce words or short simple sentences without fully comprehending the meaning; they may later use the same words or short sentence contextually incorrectly. In fact, it does not always ring true that the words first understood by a child are the first produced by the child: a list of both of these could read very differently (Clark & Hecht, 1983). Furthermore, in real life interactions the speaker is likely to give cues such as gaze or gesture that make meaning accessible even if the actual language is not fully understood. There have been various suggestions and models trying to decipher the relationship between these two key language skills (see Meyer et al., 2016 for a review of recent work). Although under continued debate, the current consensus is that language production and comprehension of simple grammar are distinct skills but closely linked, activating one another in different situations, for example, error monitoring (a comprehension task) is most efficient when production is activated (Kittredge & Dell, 2016). One way of looking at the relationship is to follow the developmental trajectory of production and comprehension in a large group of children, as we report in the current study.

1.1.1. The development of conditional production and comprehension

There is limited research on the acquisition and development of the conditional and research conducted often involves small samples and limited type use. Bloom, Lahey, Hood, Lifter and Fiess (1980) followed the production of a wide variety of connectives in four children from age 2 to 3. Since the children were very young, the structure of the sentences they produced never went beyond simple forms, and the majority of the sentences were very short and grammatically incorrect (Bowerman, 1986). 'If' as a connective was found to emerge around age 2-and-a-half years. As part of a larger study, Amidon (1976) tested 48 children aged 5, 7 and 9 on their comprehension of sixteen simple conditional sentences (type I; eight 'if' and eight 'if-not', for example, 'if it rains you will get wet'), and found a dramatic reduction in the number of errors made between ages 5 and 7. Most recently, Svirko (2011) tested 128 children at two time points, on tests of type III

production: once when the children were aged 6-7 and again when the children were aged 8-9. She found that 32% of children aged 6-7 and 68% of children aged 8-9 were able to repeat at least one out of four such sentences correctly.

Experiments with young children using 'acting out' of conditional scenarios show that with this physical representation of conditional concepts, some children can understand these concepts at a remarkably young age (Harris, German and Mills, 1996) They showed that some children as young as 3 years of age were not only able to think about complex (counterfactual) scenarios when acted out using toys and props, but were also able to imagine alternative actions and outcomes. For example, when the 32 children were tested after hearing that "Sally chose to use a black pen instead of a blue pen or a pencil and her fingers got all inky" responded correctly to the question "What should Sally have done instead so that her fingers wouldn't get all inky? [prevention question]". In addition, a number of children also suggested alternative options that were not explicitly stated in the question such as "'Cos she should have done it with a crayon". Kahneman and Varey (1990) found that children as young as 2 years of age showed an appreciation of conditional/counterfactual scenarios through the use of the words 'nearly' or 'almost'. For example, children said "[that pitcher] almost fall" after the experimenter stopped a pitcher from falling off a ledge. This suggests that children as young as 2 can conceptualize something that has not actually happened, but that could have happened if the situation had played out differently. Therefore, it is possible that young children can think through conditional situations when provided with concrete cues before they can produce them. Although these studies are useful in starting to understand the development of the connective 'if', they use different conditional types, ages and methods which means that although together they show a continued growth in acquisition, they do not allow us to map a developmental trajectory for either production or comprehension of any conditional type. They also do not provide sufficient information about the *relationship* between conditional production and comprehension.

1.1.2. Measuring the acquisition of conditionals

1.1.2.1. *Production*

Conditional production was measured using the elicited repetition method first described by Lust, Flynn and Foley (1996) and elaborated for measuring conditionals and used extensively by Svirko (2011).

There are differing views as to what sentence repetition tests actually measure. On the one hand, Alloway and Gathercole (2005) have put emphasis on the involvement of a distinct memory system that is uniquely linked to language skills via the episodic buffer (Baddeley, 2000), plus some involvement of the phonological loop. They argue that this separate component of working memory would have a 'causal

influence in the development of language skills in children.' On the other hand, Klem et al., (2015) have shown by modelling the relation of sentence repetition to the development of other language skills, in particular vocabulary and grammar, that it is not a separate predictor of language development but is actually part of an 'underlying unitary language construct'. This view is supported by the findings that sentence repetition is impaired in children with developmental language problems such as SLI or dyslexia (Moll et al., 2015), and that sentence repetition involves conceptual processing and grammatical encoding (as discovered from studies using active, passive and embedded sentences with children speaking an inflectionally rich language (Kannada) (Nag et al., 2017). So what is going on when a child repeats a sentence? The reconstruction hypothesis of Lombardi and Potter (1992, Potter and Lombardi, 1990) proposed that the precise form of a sentence is not what is represented but actually the sentence is regenerated from a conceptual representation. Their research pointed to the importance of the verb in a sentence in dictating the structure of a remembered sentence, which makes it an excellent way of assessing the acquisition of complex grammar.

1.1.2.2. Comprehension

The well-validated Test for Reception of Grammar (TROG; Bishop, 2005) tests comprehension of increasingly complex grammatical constructs by asking a child to choose which of four pictures denotes a statement delivered by a researcher. This particular mode of testing cannot be used for conditionals since a construct such as 'If I had not forgotten my homework I would not have got into trouble at school' would be too complex to illustrate unambiguously in pictures. This means that the developmental trajectory of the conditional is not well researched in spite of it being an important component in language. Therefore, we have devised a new test for comprehension of complex conditionals which involves a statement read aloud to the child and/or presented in written form. The child is then asked four questions of the form 'does the sentence mean…?' and has to reply to each with yes or no. (We note that a somewhat similar test was devised by Berent (1985) to measure acquisition of comprehension of conditionals in adults learning English as a second language.)

1.2. Current study

The primary aim of the study was to explore the developmental trajectory of the most complicated conditionals – type II and type III – with children aged 5-8 years, by using a cross-sectional *and* longitudinal design (two cohorts of children: year 1 and year 2 tested at three points over one year). The secondary aim was to explore the relationship between production and comprehension of these types and investigate what may support or hinder development. Testing took place over 9 months with children being tested in January, April and September.

All children were tested on the production and comprehension of type II and type III conditional sentences. These two tasks are well matched in style and delivery. Measuring both of these language skills using well-matched tests enabled us to look at the relationship between the development of production and comprehension in complex grammar. The more we can understand about the developmental acquisition of the conditional, the better-targeted teachers can make the educational support for those who struggle.

2. Methodology

2.1. Participants

A total of 517 children, from six British primary schools, participated in the January testing session: 225 in the year 1 cohort (M = 5;11 years) and 292 in the year 2 cohort (M = 6;10 years); 264 were male. Of these, 490 children also participated in the May testing session, and finally, 462 also went on to participate in the September testing session: 199 from the year 1 cohort (M = 6;7 years, range = 6;1-7;1 years) and 263 of the year 2 cohort (M = 7;6 years; range = 7;0-8;1 years); 230 were male. The attrition was due to children moving schools or prolonged illness.

Across two consecutive days, an additional 53 year 1 and year 2 children (M = 6;8 years, range 6;3-7;3, of which 31 were male) completed all three production and comprehension sentence sets, used to measure acquisition of complex grammar at three time points in the main study. Repeated measures ANOVAs were conducted for each of the conditional test types (type II production, type III production, type II comprehension and type III comprehension) to ensure there were no differences between the test sets (i.e., to ensure difficulty on the production type II test was consistent across the three testing time points). The sets of sentences were well matched with only a couple of significant differences between the type II comprehension set scores F (2,104) = 6.53; p = .002. Post-hoc tests revealed that the difference was due to lower scores for set 2 (M = .34) than sets 1 (M =.55) and set 3 (M =.64).

2.2. Materials

2.2.1. Measure of Nonverbal Ability: Naglieri Nonverbal Ability Test – (NNAT)

The NNAT (Naglieri, 1997), is a 30-minute, nonverbal ability test. This test requires no spoken or written language; one must identify the missing pieces to complete the geometric patterns. Owing to time limits with each child and the number of assessments overall, children answered both practice questions and seven questions increasing in difficulty (Qs: 1, 11, 24, 29, 32, 35 and 36). Data from all 517 children showed that this selection resulted in a normal distribution (see Figure 1).

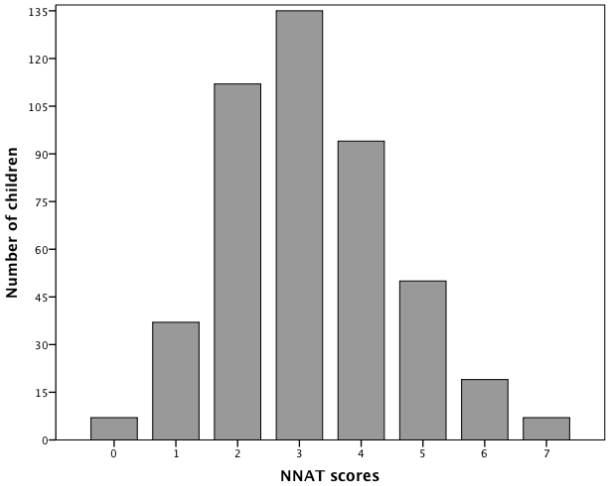

Figure 1. A normal distribution of NNAT scores for our seven chosen questions. Data presented is from the 517 children who took part at time 1.

2.2.2. Verbal and Spatial Reasoning for Children (VESPARCH)

Verbal reasoning was measured using the online VESPARCH test (Mellanby, McElwee & Badger, 2016). It approximates to a measure of fluid intelligence (Badger & Mellanby, 2017). The whole tests consists of two parts, one measuring verbal reasoning and one measuring spatial reasoning. Both parts have an equal number of analogical and categorical questions (split into two sections), with five practice questions and comprehensive feedback at the start of each section. Children complete the test individually with headphones; there is no time limit, all words and instructions are read aloud (and can be replayed as many times as is needed), and the words and concepts are highly familiar. Raw scores are automatically converted to standardized age scores (SAS).

2.2.3. Single Word Reading Test (SWRT)

The SWRT (GL Assessment) consists of 60 single words increasing in difficulty from *see* to *pseudonym* (word card 1) or *yes* to *beguile* (word card 2). There are two word lists matched for difficulty and familiarity. Individually, children read through as many of the words as they can. If a word is sounded out phonetically, the child is asked to try and blend the sounds into a whole word. The raw score is converted into a standardized age score.

2.2.4. Measures of Complex Grammar

2.2.4.1. *Conditional production*

In order to test production of conditionals we used a sentence repetition test. The eight-sentence conditional production test design (Svirko, 2011) has two components: four grammatically simple sentences (control sentences), for example, *'Simon picked some lovely flowers and he gave them to his mum and dad'* and four grammatically complex sentences (type III conditionals), for example, *'If Peter had*

bought some ice cream, he would have shared it with his friends'. Control sentences were included because an inability to repeat simple grammatical sentences may be an indication of other language or memory difficulties beyond complex grammar. All the grammatically simple and grammatically complex sentences have 16-17-syllables. We included an additional four type II conditional sentences, for example, *'If Jen practised the piano, she would be ready for the show'*, to Svirko's well-established format taking the total number of sentences from 8 to 12. We designed three different sets of 12 sentences to be administered at each testing time point. Scores are given for the control sentences, the type II conditional sentences and the type III conditional sentences. Each sentence is either correct or incorrect, allowing for a maximum score of 4 for each set of sentence types at each time point. Owing to the limited range of potential scores (0-4), and in line with Svirko's conditional sentence repetition testing, we divided the scores into 3 categories: 0 = no development (acquisition), 1 or 2 = incomplete development and 3 or 4 = complete development.

2.2.4.2. *Conditional comprehension*

We used our conditional comprehension test to assess children on two grammatically simple (control) sentence-statement sets, two type II sentence-statement sets and two type III sentence-statement sets (see example below).

Type 3 Sentence: Paul would have gone to France if he had found his passport.

1. *Does the sentence mean that Paul did not go to France?*
2. *Does the sentence mean that Paul found his passport?*
3. *Does the sentence mean that Paul is going to France today?*
4. *Does the sentence mean that Paul likes America?*

Each single comprehension set is much longer to administer than each single production sentence, which resulted in our including fewer overall since we were restricted by the time available to test each child. The experimenter read the sentence and statements out loud regardless of whether the child could also read them so that the child always heard the sentence spoken correctly. This made certain that the answers they gave were based on correctly heard structures. Answers to each of the four statements (per sentence) were recorded as correct or incorrect and a score of 4 out of 4 per sentence-statement set would result in a pass for that sentence. This allowed for a maximum score of 2 for each type (control, type II or type III) at each time point. The scores were categorized as 0 = no development (comprehension), 1 = incomplete development and 2 = complete development.

2.3. Procedure

There were three testing phases. The children completed the NNAT in the first testing session, and all additional tests during all three testing sessions (note: due to a testing packet error, no comprehension type III questions were administered during time 1). All testing was completed individually and lasted about 10-15 minutes a session. Thirty-five children were unable to repeat or understand any of the control simple structure sentences at time 1. Therefore, they were removed from our complex grammar analyses, as we could not be confident of the interpretation of their data. This resulted in a final sample of 427 children (175 of which were from the Year 1 cohort). Verbal reasoning data (VESPARCH) was acquired for 149 of the children (25 year 1 and 124 year 2; 68 = male). This data was collected a year after our project data, but was age standardized. All data has been analyzed quantifiably using SPSS; specific tests are details throughout the findings section.

3. Findings

3.1. Developmental trajectory

Children were categorized into three developmental categories: 1) no development, 2) incomplete development, and 3) complete development (see methods), for each of the four conditional tests (type II production; type II comprehension; type III production; type III comprehension).

3.1.1. Production

Figure 2a shows that the development of type II production appears to have already reached a plateau by year 1 (age 5-6) of around 70% of children showing complete acquisition.

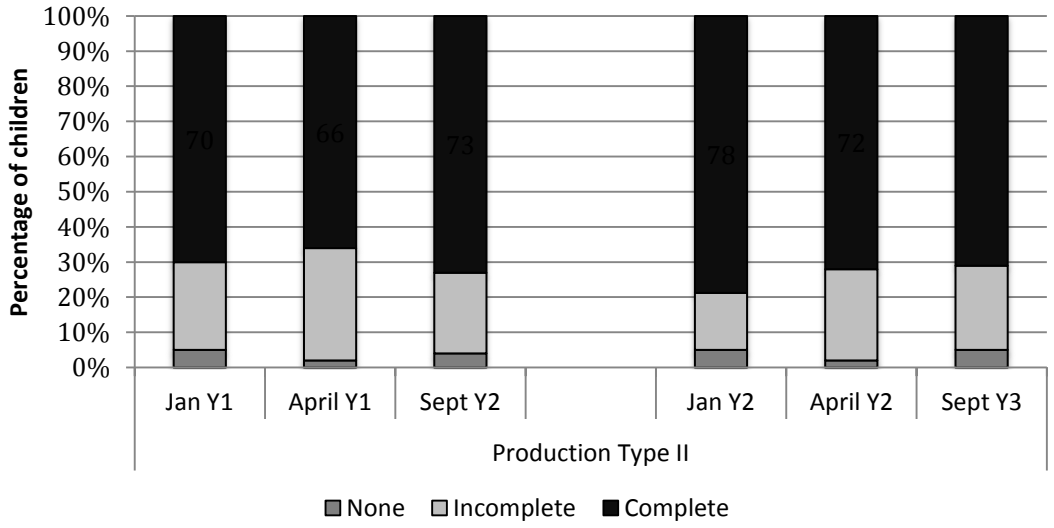

Figure 2a. Acquisition of type II production

The percentage of children categorized as either having none, incomplete or complete acquisition of type II conditional productions, presented developmentally from *January in Year 1 through to*

September in Year 3. The gap denotes the division between the two cohorts tested.

In comparison, Figure 2b shows a gradual acquisition of type III production, with just over 10% showing complete acquisition in the Y1 cohort January testing, increasing to just over 50% in the Y2 cohort September testing (at the start of their year 3, age 7-8).

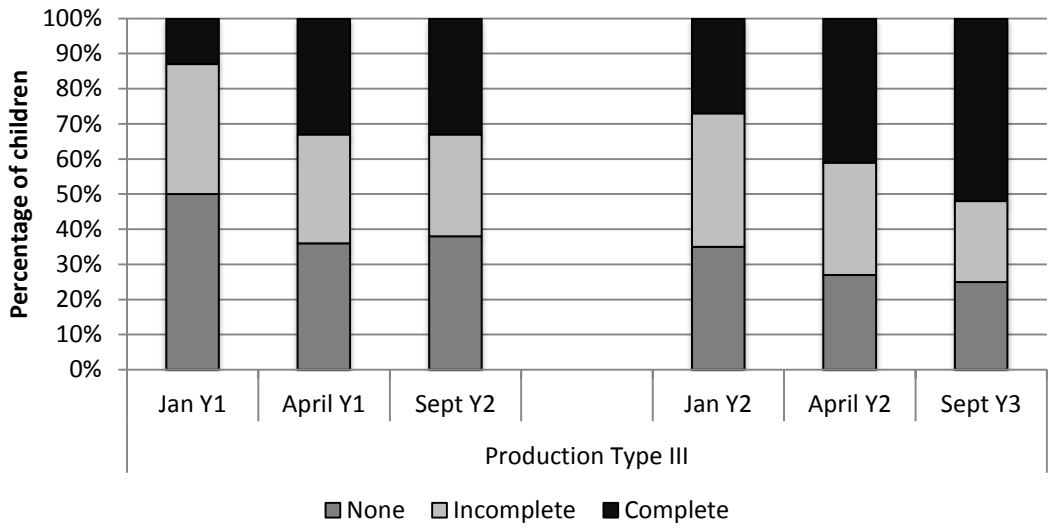

Figure 2b. Acquisition of type III production

The percentage of children categorized as either having none, incomplete or complete acquisition of type III conditional productions, presented developmentally from January Year 1 through to September Year 3. The gap denotes the division between the two cohorts tested.

3.1.2. Comprehension

Figures 3a and 3b show that very few children were scored as having complete comprehension, even by the start of year 3.

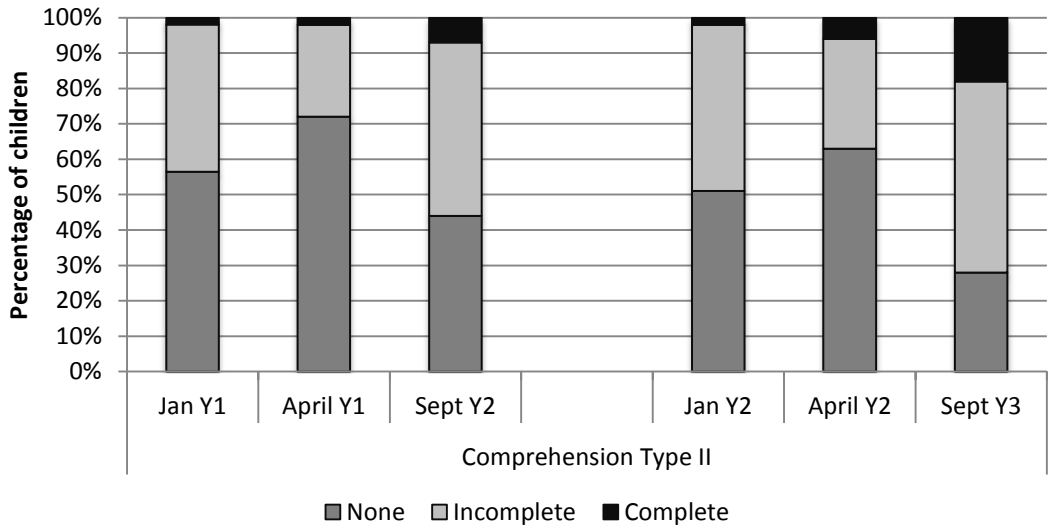

Figure 3a. Acquisition of type II comprehension

The percentage of children categorized as either having none, incomplete or complete acquisition of type II conditional comprehensions, presented developmentally from January Year 1 through to September Year 3. The gap denotes the division between the two cohorts tested.

There appears to be a gradual development of type II and type III conditional comprehension. Nevertheless, neither type shows more than 20% of children with complete comprehension (see Figures 3a and 3b).

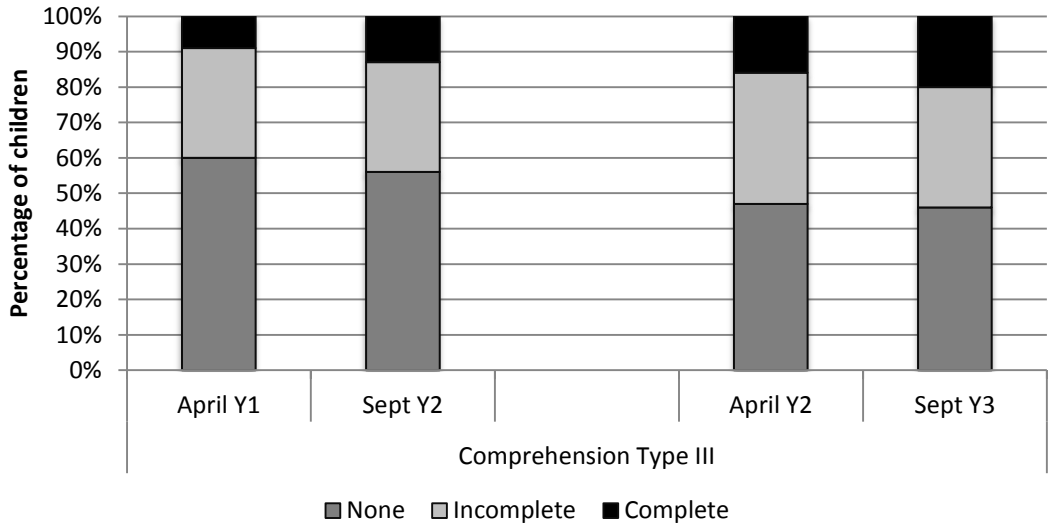

Figure 3b. Acquisition of type III comprehension

The percentage of children categorized as either having none, incomplete or complete acquisition of type III conditional comprehensions, presented developmentally from April Year 1 through

to September Year 3. The gap denotes the division between the two cohorts tested.

3.2. Stability of conditional development

Although our data show a gradual increase in the acquisition of the conditional, it must be noted that this development is not yet stable for all children.

3.2.1. Conditional production

Seventy-one percent of children in the year 1 cohort and 76% of those in the year 2 cohort who were categorized as having complete acquisition of type II production at time 1 remained in this category at time 3. For the type III production the percentages were 65% of the year 1 cohort and 83% of the year 2 cohort. The majority of the children whose competence with the conditional seemed to have gone backwards were now classified as having the conditional 'in development'.

3.2.2. Conditional comprehension

Only three children in the year 1 cohort were categorized as having complete acquisition of type II conditional comprehension at time 1; at time 3, two of these were in development and one showed no development. Of the four children in the year 2 cohort who had acquired type II comprehension at time 1, all four stayed within that categorization at time 3. (We are unable to provide comparative data for type III comprehension as this data was not collected at time 1).

3.2.3. Instability and 'ability'

There was no relationship between either the NNAT or the VESPARCH scores and unstable acquisition of type II conditional production. Scores remained equivalent between those children who were categorized as having complete type II production at time 1 and remained within this categorization or had reversed their categorization at time 3.

Those children who remained in the type III categorization from time 1 to time 3 were more likely to have higher NNAT and VESPARCH scores relative to the children who reversed their categorization. NNAT: average score of 4 (SD = 1.51) versus an average score of 3 (SD = 1.12). VESPARCH: average score of 108 (SD = 11.81) versus the four children who reversed: 85, 97, 106 and 106.

With regards to type II comprehension, NNAT data: only 7 children were categorized as having complete type II comprehension at time 1. Four remained within this categorization at time 3. VESPARCH data: Only 2 children were categorized as having complete type II comprehension at time 1. One remained within this categorization. We are unable to look at type III comprehension as this data was not collected at time 1.

3.3. What predicts conditional comprehension?

Children who had acquired type II comprehension at time 3 had significantly higher scores on word reading (SWRT: out of 60) compared to those children who had incomplete acquisition at time 3: t (425) = -6.02; $p < .001$ (M = 33.58, SD = 7.76 vs. M = 24.92, SD = 10.42, respectively). They also had better production of type III sentences: $p < .001$ (M = 2.93, SD = 1.31 vs. M = 1.62, SD = 1.46, respectively). Children who had acquired type III comprehension at time 3 had significantly higher scores on nonverbal ability (NNAT; scores out of 7) compared to those children who had incomplete acquisition at time 3: t (425) = -3.80; $p = .002$ (M = 3.76, SD = 1.72 vs. M = 3.09, SD = 1.28, respectively). They also had better production of type III sentences (scores out of 4): $p < .001$ (M = 2.62, SD = 1.42 vs. M = 1.62, SD = 1.47, respectively). Using the VESPARCH data we acquired for 149 children, we found that those we had categorized as having complete type II comprehension at time 3 (N = 23) had a significantly higher verbal VESPARCH score compared to those we had categorized as having incomplete comprehension (N = 126): t (147) = -5.24; $p < .001$ (M = 110, SD = 8.53 and M = 99, SD = 12.57, respectively). Similarly, those we had categorized as having complete type III comprehension at time 3 (N = 26) had a significantly higher verbal VESPARCH score compared to those we had categorized as having incomplete comprehension (N = 123): t (147) = -2.90; $p = .004$ (M = 107, SD = 11.25 and M = 99, SD = 12.57, respectively). The verbal VESPARCH scores were also moderately correlated with the NNAT scores overall: $r = .36$, N = 149; $p < .001$.

Two stepwise binary logistic regressions were conducted: the dependent variables were complete versus incomplete acquisition of type II or type III comprehension at time 3 (children fell within the incomplete category if they were originally categorized as either in development or no development). Age in months was entered into the regressions first, followed by NNAT (at time 1), SWRT (at time 2 due to fewer children being able to complete this at time 1), production of type II and production of type III conditionals (at time 1; see Table 1). For the type II comprehension regression there were 57 children with complete comprehension and 370 with incomplete comprehension. For the type III comprehension regression there were 72 children with complete comprehension and 355 with incomplete comprehension.

Table 1
Logistic regression identifying variables that may relate to conditional comprehension.

Type II comprehension						
	Beta	S.E.	Wald	df	Sig.	Exp(B)
Age in months	.035	.029	1.43	1	.231	1.04
NNAT (T1)	.050	.110	0.21	1	.648	1.05
SWRT (T2)	.059	.021	8.10	1	.004*	1.06
Type II production (T1)	.156	.178	0.77	1	.381	1.17
Type III production (T1)	.304	.122	6.17	1	.013*	1.36

Type III comprehension						
	Beta	S.E.	Wald	df	Sig.	Exp(B)
Age in months	-.016	.024	0.45	1	.504	0.98
NNAT (T1)	.252	.102	6.13	1	.013*	1.29
SWRT (T2)	.013	.016	0.65	1	.422	1.01
Type II production (T1)	.078	.137	0.32	1	.569	1.08
Type III production (T1)	.271	.108	6.27	1	.012*	1.31

** denotes statistical significance.*

4. Conclusions and Discussion

The results highlighted three main findings. Firstly, we observed that conditional production occurs before conditional comprehension. However, where type II comprehension and type III production and comprehension showed a continued gradual development, almost all children could already produce type II conditionals by January of year 1 (age 5-6). Secondly, the results showed some instability of acquisition, with a small number of children showing a reversal of acquisition across time points. Thirdly, we found that type III conditional production predicted both type II and III comprehension, while additional factors predicting comprehension differed between the two types.

4.1 Developmental trajectory

The finding that children's ability to repeat conditional sentences occurs substantially before conditional comprehension goes against the generally accepted observation in young children that comprehension of language in general precedes its production. Unsurprisingly, the production of the linguistically more complex type III conditional occurs later than the production of the type II conditional. Since Bloom et al., (1980) showed that children as young as 2 and a half can use the connective 'if', it follows that somewhere between then and age 5, 70% of children move from simply using the

connective 'if', to being able to reproduce type II conditional sentences. Further research needs to be conducted to show this intermediate trajectory. In contrast to the development of conditional production, the comprehension of these structures, as measured by our test, is only achieved by a very small proportion of the children even by the start of year 3 (age 7).

One reason for the production showing earlier success than comprehension could be the difficulty of the two tasks – simply repeating a complex sentence would appear to be easier than answering four questions about it. Still, the children did not have a problem with demonstrating understanding of control sentences of matched length but which were grammatically less complex. It would therefore appear that it is the complexity of the conditionals rather than the nature of the test that is making them difficult.

4.2 Stability of development

An interesting finding is that while the majority of children who can produce the conditional sentences correctly at time 1 (start of year 1), can still do so at subsequent test times, there is a small number of children in whom this development appears to have reversed at later testing. If we consider that success in the repetition test represents an unconscious automatic acquisition of the structure of the conditional, then the lack of complete stability over time suggest that such processing is not always consistently demonstrable. It can be noted though, that fewer children in the year 2 cohort showed this instability compared with the year 1 children, suggesting that this is part of the developmental trajectory of acquisition. We would expect to see a further increase in stability of acquisition of the conditional if we were to test older children. The early instability also mirrors the more general finding in some areas of research with children showing that development proceeds unevenly and also sometimes appears to reverse or dip (such as, Johnson, Dziurawiec, Ellis & Morton 1991, re face recognition).

4.3 Predicting conditional comprehension

Production of type III conditionals at time 1 was a significant predictor for both type II and type III comprehension. The predictive value of type III production for its comprehension 6 months later supports the expected interaction between production and comprehension as discussed in the introduction (Meyer et al., 2016). Additionally, word reading was predictive of type II comprehension (even after taking non-verbal ability into account), and non-verbal ability was predictive of type III conditional comprehension. Since it is well known that grammar and literacy are closely linked (Nation & Snowling, 2000), it is not unexpected that word reading and comprehension of conditionals are connected. That it is only a predictor of type II comprehension might be because this is the more commonly used conditional type of the two, and therefore more likely to have been experienced by children this age if they are good at reading. We

postulate that it is experience through reading more advanced books that has allowed those children who are better readers to have been exposed to this structure more often than those who are poorer readers and whose books are simpler in grammatical structure. In contrast, the type III conditionals are more conceptually complex than type II and therefore it is perhaps not unexpected to find a role for general ability (NNAT and VESPARCH). The lack of prediction of comprehension from type II production is probably a statistical artefact caused by the finding that almost all children had fully acquired type II production at the start of the study.

While few children could understand either type of conditional even at the start of year 3 (aged 7), there was a trend in the present work for type III conditionals to be understood earlier than type II. This might seem surprising, in view of the greater linguistic and conceptual complexity of type III conditionals, yet this is in line with the recent finding that comprehension of type II conditionals lags behind comprehension of type III in 13 year-old and 15 year-old school-children (K. Collis; A. Malhotra unpublished). So we have the situation that production occurs earlier for type II than type III while for comprehension the reverse is the case. It could be argued that this supports the view that production and comprehension are separate processes, but the finding that type III production in year 1 actually predicts type III comprehension 9 months later (having controlled for ability) supports an interaction between comprehension and production. This partial interdependence further supports the pattern discussed in the introduction.

The finding that production of both type II and type III conditionals precedes their comprehension appears to parallel what was found by Berent (1985) over 30 years ago in adults learning English as an additional language. However, pertinent to the general impression that with young children comprehension precedes production, he found that for simple conditionals (he called them 'real' as opposed to our type II 'unreal', and our type III 'past unreal') comprehension did precede production. This dissociation suggests that the relation between production and comprehension is different at different levels of complexity of language. Berent also found that for both production (using a substitution paradigm) and comprehension the scores were higher for those with a more advanced level of English acquisition. This suggests that comprehending complex conditionals may require integration with higher levels of general language proficiency. This would be achieved either by general development in children, or in adults learning a new language by further language teaching.

4.3.1 Socioeconomic factors

A central part of educational policy is to work towards removing the gap between the educational achievements of children from lower and

higher socioeconomic status (SES) groups. It is widely accepted that early language is acquired implicitly from exposure; studies into the complexity of the language used by mothers with their children has shown that language is actually simpler in homes of groups with lower SES (Hart & Risley, 1992; Hoff, 2006; for a summary see Mellanby and Theobald, 2014, chapter 3). Indeed, Svirko (2011) found that type III conditional production scores in year 2 were significantly related to SES of the children, as approximated by the IMD 2007 (Indices of Multiple Deprivation) on the dimensions of Income, Employment and Parental Education. By year 4, this relationship had markedly diminished, suggesting the influence of wider experience from reading, schooling and in the general community.

4.4 Educational Implications

The finding that so few children understood complex conditionals in year 1 and that this lack of understanding continued for most children at least until the start of year 3 needs to be taken into account with respect to the way in which teachers give information in the classroom. Since early acquisition of the conditional has been shown to be related to both reading and arithmetic (Svirko, 2011), as well as scientific reasoning (Svirko et al.), it also points to the possible value of attempting to increase the acquisition of conditionals in children. In the early years, where language acquisition is mainly implicit, extensive exposure to conditionals in the classroom might be an effective way of doing this. In support of this view, it has been shown that exposure to the passive in the classroom does indeed raise its acquisition in four year-old children who have not yet acquired it (Vasilyeva, Huttenlocher & Waterfall, 2006). Explicit teaching might be introduced in the middle primary years – rather than waiting as in the present primary school curriculum until year 6. Children who have mastered complex conditionals by the time they enter secondary school would be more likely to understand, and therefore enjoy, subjects such as history and science where hypothesis-making is important.

4.5 *Conclusion*

We report three main findings. First, we identified the developmental trajectories of type II and type III conditional production and comprehension in children aged 5-8. We showed that type II production occurs earlier than type III production. For both types of complex conditional, production, as measured by the repetition test, occurs before comprehension. Secondly, there was a certain degree of instability in conditional acquisition, although the acquisition was more stable with the older children suggesting that this instability is itself a feature of the developmental trajectory. Thirdly while type III production of both type II and type III conditionals is predictive of comprehension months later, additionally, single word reading is related to comprehension of type II conditionals, while non-verbal ability is related to the comprehension of type III.

The results support the view that production and comprehension of language, specifically complex conditionals, are to some extent independent. The predictive value of type III production for conditional comprehension though, suggests that the internalization of conditional structure tested by the production test supports the acquisition of comprehension. We propose that the relationship between production and comprehension is different for simple and complex language, as demonstrated by the acquisition of complex conditionals reported here compared with observations of the early stages of language acquisition, including simple 'if' sentences. We suggest that early intervention to accelerate the acquisition of complex conditionals could enhance later understanding, although the type and format of exposure needs to be appropriate to the age and language level of the child. Acquisition of such comprehension would be expected to aid understanding, and therefore interest, in important subjects such as history and science.

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Effect of phoneme-position on correct production of sounds in children with Speech Sound Disorder: A case study

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Abstract

Phonetic contexts are key environments to facilitate the acquisition of speech sounds according to phonotactic rules of languages. The literature on key environments is available in languages like English, Quebecois French, and Dutch, etc.for late acquiring sounds. These contextual effects are language specific, and research in this regard in Indian languages is sparse. Application of such language-specific data in assessment and intervention of children with speech sound disorders (SSD) fastens the prognosis by providing better guidelines. Hence, a preliminary attemptusing a single subject design with pre-post therapy comparison was conducted to examine the effect of phoneme position, initial or medial, in acquiring velarsand retroflexby six children with phonetic type SSD. Participants were provided articulation therapy using phonetic placement approach. Word level responses were audio recorded and transcribed using IPA. Percentage of correct response in each therapy session was analyzed and graphically represented. Phoneme position, the target sound was acquired faster was considered to be the most facilitating position. Graphical analysis revealed initial position to facilitate the acquisition of velars and medial position facilitating the acquisition of retroflexes. The salient finding of the present study is that even in a small sample of children with SSD, the positional effect was evident for different phonemes. However, validation of findings is mandatory using a larger sample size for serving as guidelines to speech-language pathologists for ensuring faster speech correction. This area of research is still in nascent stages in the Indian context and hence, warranted in various languages as coarticulation is language specific.

Keywords: Phonetic context, phoneme-position, velars, retroflex, Kannada

1. Introduction

Inconsistencies in articulatory productions are observed commonly during the stages of phonological development attributable to phonetic contexts such as position in a word or syllable, vowel context, etc. (Fleming, 1971; Spriestersbach & Curtis, 1951; Snow, 1963). These phonetic contexts are particular key environments that facilitate the acquisition and production of various speech sounds according to the phonotactic rules of the language.

Earlier studies in various languages on phoneme positions have established their facilitatory effects on acquiring speech sounds by typically developing children. Most of these studies are on the acquisition of late acquiring

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speech sounds such as /s/, /z/, /r/, etc. that frequently occur in English (Carterette & Jones, 1974; Dewey, 1923; French, Carter, & Koenig, 1930; Roberts, 1965). A majority of sounds in English, Quebecois French, and Dutch are acquired in the initial position than in final position of a word (Bleile, 2006; Dodd, Holm, Hua, & Crosbie, 2003; McLeod, Sutton, Trudeau, & Thordardottir, 2011; Smit, Hand, Freilinger, Bernthal, & Byrd, 1990; Stoel-Gammon, 1985; Watson & Skucanec, 1997b). Few reports document both initial (Gallagher & Shriner, 1975b) and final positions (Kent, 1982) to facilitate the acquisition of /s/. Similarly in the literature, both initial (Curtis & Hardy, 1959; Hoffman, Schuckers, & Daniloff, 1980; Magloughlin, 2016) and final positions (McGowan, Nittrouer, & Manning, 2004; Stoel-Gammon, 1985; Smit et al., 1990; Templin, 1957) are found to be facilitating contexts.
In the Indian context, most of the studies are confined to the acquisition of vowels and consonants. However in literature, the effect of phoneme positions on acquisition of speech sounds is discussed (Deepa & Savithri, 2010; Divya & Sreedevi, 2010; Neenu & Sreedevi, 2011; Shishira & Sreedevi, 2013; Sushma & Sreedevi, 2013). Acquisition of low-central vowels was in the medial position followed by initial and then final; vowels [i] and [o] in medial and final than initial position; bilabials and velars in initial position; palatals, dentals, and glottal sounds in medial position; and retroflex in both initial and medial positions in native Kannada** speaking toddlers of 12-to18- months (Shishira & Sreedevi, 2013). Whereas, in typically developing toddlers of 18- to 24- months produced both velars and retroflex more in the medial position than initial (Sushma & Sreedevi, 2013). Deepa and Savithri (2010) report of similar findings in native Kannada speaking children in the age range 2-to 6-years. Also reported that palatal /ʃ/ is acquired first in the initial position, whereas, dental /s/ in the medial position. In Malayalam, development of affricates /c/ and /ɟ/ was in the medial position earlier compared to initial and in contrast fricatives /s/ and /ʃ/ are acquired first in the initial followed by medial position (Divya & Sreedevi, 2010; Neenu & Sreedevi, 2011).

** India's two major language families include Indo-Aryan languages (75%) and Dravidian languages (20%). Kannada is one among the four Dravidian languages. The other three languages are Tamil, Malayalam and Telugu. Kannada is the official state language of Karnataka having an estimated population of 66.8 million (India population, 2017). Kannada has a fine grammatical tradition and a very complex range of regional, social and stylistic variations: the Mysore/Bangalore dialect, the coastal dialect (Mangalore), the Dharwar dialect and Kalaburgi dialect (Upadhyaya, 1976). In the current study, Mysuru/Bengaluru dialect spoken participants were considered. The Kannada lexicon has been enriched by uninhibited borrowing majorly from Sanskrit, Hindi-Urdu, and English. It has 49 phonemic letters (Swaragalu-vowels- 13 letters; vyanjanagalu-consonants- 34 letters; and yogavahagalu- neither consonant nor vowels- 2 letters, *anusvara* ◌ಂ and *visarga* ◌ಃ).

Each written symbol in the Kannada script corresponds with one syllable, as opposed to one phoneme in languages like English. Each consonant has an inherent vowel /a/ (Campbell & Moseley, 2012). The Kannada script is syllabic or alphasyllablary in nature. In Kannada, there are word initial syllables ending in consonants but not generally word medial codas. Hence in Kannada, word positions are generally addressed in terms of word initial or word medial. Appendix II depicts the consonant and vowel inventory of Kannada. Syllables in Kannada always contain vowels acting like a main stress bearing part. Words will have as many stresses as there are syllables in a word. Kannada has non-contrastive word stress and generally observed in the initial syllable of a word (Leonard, 1964; Steever,

1998). Duration is the cue for stress in Kannada (Savithri, 1998). In accordance, long vowel, geminates, aspirated phonemes, dipthongs, glides will have more stress compared to singletons be in any position of the word. Geminates occur only in word-medial positions. In Kannada, there is no influence of position of phoneme on allophonic variations of stops in regard to other phonemes (Leonard, 1964). So, stops have less allophonic variations and hence, considered consistent phonemes. Consistent phonemes are acquired before inconsistent phonemes and this phoneme consistency correlates with acquisition order of various positions (Cohen & David, 2016).

Contextual effect on acquisition of late acquiring speech sounds in school-aged children with speech sound disorder is also reported in English. Scott and Milisen (1954) documented phonemes /f, z, s, k, l, v, r, g/ to be produced more accurately in either initial or final position than medial positions in children with articulation problems. Curtis and Hardy (1959) reported liquid /r/ to be articulated more accurately in intersyllabic position than initial or final positions. Rockman and Elbert (1984) stated acquisition of fricative /s/ was in the final position followed by initial and then medial. Ghandour and Kaddah (2011) found Arabic speaking children with dyslalia are facilitated to produce fricative /s/ and liquid /r/ more in the initial than final positions showing similar findings as Scott and Milisen (1954).

An observation made during a study by Shalini and Sreedevi (2016) on the efficacy of non-words in articulation therapy for trill /r/ and fricative /ʃ/ found medial position facilitating even in non-words. A recent Indian study by Merin (2017) report acquisition of affricates and fricatives in Malayalam speaking children with hearing impairment is similar to typically developing children with affricates being facilitated in medial and fricatives in the initial position. In sum, these studies conclude their findings with key positions for different phonemes and are language dependent.

Reviewing the literature, it is apparent that phonotactics (phonotactics constraints) of languages differ. Due to such constraints few allophonic variations of phonemes are present only in particular position in a word (Cohen & Davis, 2016; Topbas, 2007); in a position manner and place of phonemes change (Dutch, Fikkert, 1998). Interaction between allophonic variations and positions is also a major factor for such language related differences. Such interactions are prominent in few languages like Turkish (Topbas, 2007), Hebrew (Cohen & David, 2016), etc. On the other hand, in Kannada allophonic variations of stops are not influenced by position of the phoneme (Leonard, 1964). Also, within a language results have shown discrepancies which could be due to age of subjects, tasks given, etc. Hence, findings in one language cannot apply to another. Age (Byun, 2012), perceptual aspects and stressed syllables (Echols & Newport, 1992) are also the reasons for variations across different language studies. Children frame their own constraints based on perceptual pressures, articulatory experience and motor planning (Hayes, 1999; Pater, 2002). All these aspects change over the course of anatomical and neural maturation (Byun, 2012) to become adult like. Also, even perceptual discrimination in children is not as sensitive as adult listeners (Byun, 2015). Typically developing toddlers attend and extract stress and final syllables generally (Echols & Newport, 1992).

In literature, phoneme positions in different languages have been addressed variedly: initial, medial, and final; word-initial, word-medial, and word-final; pre-vocalic, inter-vocalic, and post-vocalic; and word-initial onset, word-medial onset, word-medial coda, and word-final coda. Kannada is a Dravidian language spoken in the state Karnataka, India. Kannada being a syllabic language, most of the words end in vowels and not consonants. Hence, it has only two phoneme positions namely initial (word-initial onset and medial (word-medial coda). In Kannada, the most frequently occurring and erred sounds are retroflex (Sreedevi & Vikas, 2013). Contextual effects on retroflex and velars have not been the focus in earlier Indian or western studies. Studies in English and other language are confining to late acquiring sounds. In other words, such studies are sparse, and the majority is observational reports.

Contextual effects play a vital role in assessment and intervention of children with speech sound disorders. Currently, the standardized tests do not assess a speech sound in all the contexts. Such in-depth assessment would provide better guidelines for intervention and expedite progress.

Hence, the present case study aimed to explore the contextual effects of phoneme positions on correct production of velars and retroflex in Kannada speaking children with SSD. The objective of the study was to examine the highly facilitating phoneme position, initial or medial, for correct production of velars, /k/ and /g/, and retroflex sounds, /ʈ/ and /ɖ/ by children with phonetic type SSD.

2. Methodology

All the ethical guidelines were followed as per Basavaraj and Venkatesan (2009). Written consent was obtained from parents of each participant before the commencement of the study. The present study has been approved by the ethical board of our institute.

The present study applied a case study method (observation study) as it did not involve the dependent variable to relapse to baseline; rather aimed to sustain it. Despite the limitations case studies in terms of generalization, replication, and researcher bias, it was employed as they provide rich qualitative information leading to further insights in the field of research (McLeod, 2008). Gibbert and Ruigrok (2010) have put forth four criteria with respect to internal validity, construct validity, external validity, and reliability to overcome the limitations of case study method. Accordingly, the method of the present study was designed. The method involved pre-intervention assessment of the dependent variable (phonemes) followed by intervention phase (independent variable, phoneme position was introduced) and then post-intervention assessment of the dependent variable.

2.1. Participants

Six children in the age range 4 years, 0 months to 6 years, 9months (mean age-5 years, 2 months) having SSD (DSM-V criteria, APA, 2013), phonetic type (Bowen's classification, 2011), were recruited as participants. The hearing, psychological, neurological, anatomical or cognitive abilities of all the participants were well within normal limits. All participants were native speakers of Mysuru dialect Kannada. Selection of participants was from the

out-patient department of an Institute providing service to children with communication disorders, Mysuru, India. Description of participants' are in table 1.

2.2. Data collection and processing

The entire procedure was carried out by the investigator (native Mysuru dialect Kannada speaking Speech-language pathologist). An audio recording of the individual assessment and articulation therapy sessions were made using the recorder, Olympus LS-100. All the recorded data were transcribed offline using International Phonetic Alphabet (IPA, 2015).

Articulatory abilities were assessed using Kannada Diagnostic Picture Articulation test, KD-PAT (Deepa & Savithri, 2010) in repetition mode. Either velars or retroflex sounds were absent in the phonetic repertoire of the participants. Substitution of dentals for both velars and retroflex sounds was found resulting in fronting errors.

Table 1
Participants' details

	Age	Gender	Substitution errors
S1	4 years 8 months	F	t/k/, d/,g, t/ʈ, d/ɖ
S2	5 years	M	t/k, and d/g
S3	6 years 9 months	M	t/k
S4	5 years	M	t/k, and d/g
S5	4 years	F	t/k, d/g, t/ʈ, and d/ɖ,
S6	5 years 3 months	M	t/ʈ, d/ɖ

Among the six participants, five had misarticulated production of velar /k/, four had velar /g/, and three had retroflex /ʈ/ and /ɖ/ each. These erred speech sounds were assessed in both phoneme positions using the Deep test of articulation - Sentence form (Rohini & Savithri, 1989). Facilitating phoneme position, if any, was documented for each speech sound. The wordlist for assessment is provided in Appendix II.

The existence of associated speech, language, neurological, psychological and cognitive deficits was screened using WHO ten disability screening checklist (Malhi & Singhi, 2002) and central auditory processing disorder, CAPD using 'Screening for central auditory processing disorder, SCAP' (Yathiraj & Mascarenhas, 2003).

All the six participants were enrolled for articulation therapy constituting phonetic placement approach at the word level. Duration of each therapy session was 45 minutes, and the total number of sessions varied across participants according to learning pace and age.

Stimuli for the present study considered stops, velars and retroflex, of Kannada. In Kannada, stops are classified into unvoiced and voiced which

are further classified as aspirated and unaspirated. Only unaspirated velars and retroflex stops were considered as target phonemes in the present study, /k/, /g/, /ʈ/, and /ɖ/. For each target phoneme, stimuli wordlist comprised of Kannada and loan English bi- or tri-syllabic picturable words. Despite high variability with respect to research, true words were considered as typical speech development occurs in usage of true words of age appropriate syllable structures and hence, provide factual information about correct production of speech sounds in children with SSD. The total number of stimuli for every target was 18, out of which 50% had target sound in the initial position and the rest in the medial position. For example, /k/ is the target; /*ka*ppe/ and /pu*kka*/ are the stimuli words with target sound in initial and medial positions respectively.

Presentation of picture stimuli was via Microsoft Office PowerPoint (2007) on a laptop, Acer Aspire 5738G, of 15.6 inches screen. Target word list was presented three times randomly with every word given a maximum of five attempts to produce accurately. Only the first production of the target word was considered for the scoring. The mode of response was repetition. Measurement of performance of the participants was by calculating the percentage of correct response (perceptually correct). The scores were tabulated and graphically represented using Microsoft Office Excel (2007). The phoneme position in which the target sound was first produced correctly was considered to be the most facilitating.

On every fourth session, participants' performance was evaluated using a randomized wordlist to rule out practice effect. Minimization of the effect of home training was by providing ready sentences. The criterion for termination of articulatory therapy was ≥90% PCC score for each target phoneme.

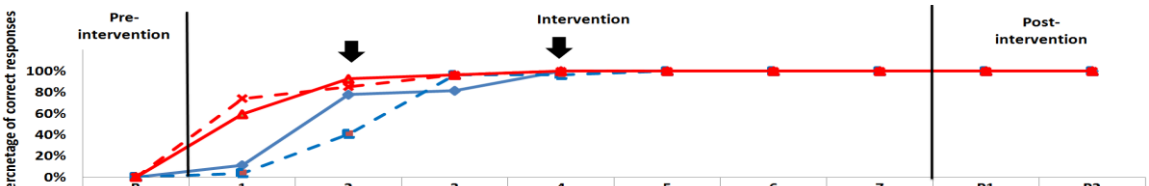
2.3. Data analysis

The sample size was small, and hence, visual analysis of data using graphs was carried out. In a case-study method, statistical significance does not support the investigator to get clear unequivocal experimental control over the behavior (Kazdin, 1976). In spite of that, Wilcoxon signed rank test was run and effect size (Andy Field, 2009) was calculated to explore the highly facilitating phoneme position and to inflexible the study. Furthermore using Cronbach's Alpha, the intra- and inter-judge reliability as obtained for performances across first, mid, and last sessions. For intra-judge reliability, the data was reanalyzed by the investigator. Two other native Kannada speaking speech-language pathologists served as judges for a blinded-offline process of inter-judge reliability. SPSS software version 17 was used to statistically analyze the results.

3. Findings

Intra- (α-.8) and inter-judge (α-.787) reliability were good (.8>α>.9) and acceptable (.7>α>.8) range respectively. Visual analysis of graphs (Figure 1-Figure 8) is based on the level of performance, the trend in performance, and variability in performance. The number of sessions to attain ≥90% accuracy in production and the PCC or percentage of correct reponse scores during and post intervention served as measures for the level of performance. All

the participants had an increasing trend in performance with various degrees of variability. Furthermore, PCC scores at P1 and P2 were also considered as a measure for finding the failitating phoneme position.

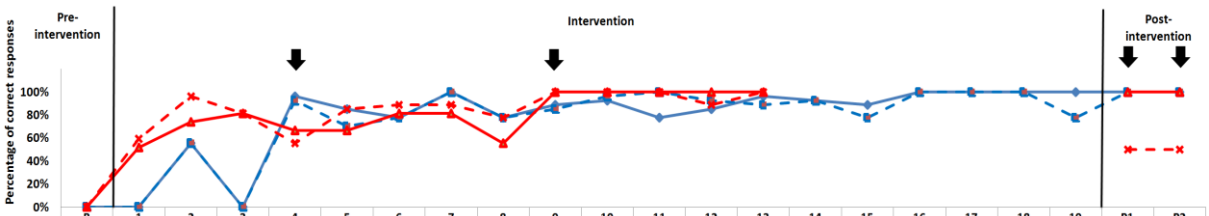


	B	1	2	3	4	5	6	7	P1	P2
S1Ik	0%	11%	77.77%	81.48%	100%	100%	100%	100%	100%	100%
S1Mk	0%	3.70%	40.74%	96.29%	96.29%	100%	100%	100%	100%	100%
S1Ig	0%	59%	92.59%	96.29%	100%	100%	100%	100%	100%	100%
S1Mg	0%	74.07%	85.18%	96.29%	100%	100%	100%	100%	100%	100%

(S1:Ik – Subject 1, /k/ in initial position; S1:Mk – Subject 1, /k/ in medial position; S1:Ig – Subject 1, /g/ in initial position; S1:Mg – Subject 1, /g/ in medial position; ⬇ - indicates session number, the phoneme position has shown an effect on /k/ and /g/)

Figure 1. Percentage correct response of velar production in both initial and medial positions by subject 1(S1)

S1 acquired velar /k/ with 100% accuracy faster (4th session) in the initial position compared to medial position (5th session). Similar findings are observed for velar /g/ also (92% by 2nd session in the initial position). S1 has 100% accurate production of velars in both the phoneme positions at P1 and P2 (table 2). Minimal variation in performance is observed (Fig. 1).

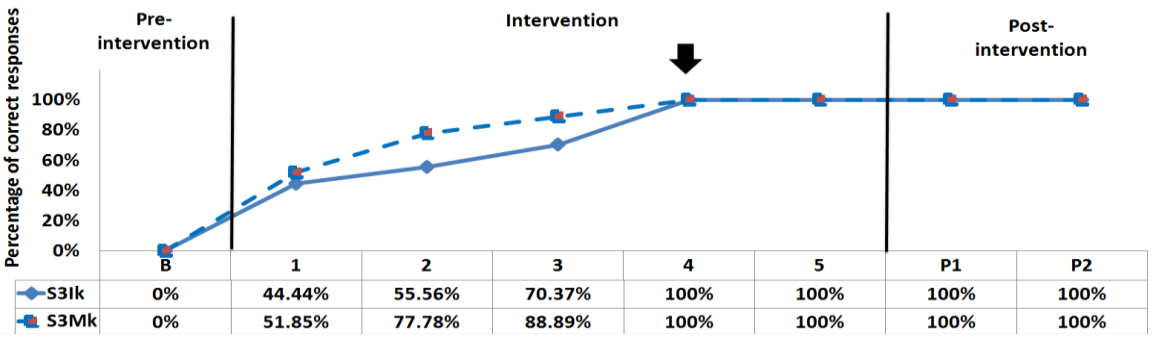


	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	P1	P2
S2Ik	0%	0%	55.56%	0%	96.29%	85.18%	77.78%	100%	77.78%	88.89%	92.59%	77.78%	85.18%	96.29%	92.59%	89%	100%	100%	100%	100.00%	100.00%	100.00%
S2Mk	0%	0%	55.56%	0%	92.59%	70.37%	77.78%	100%	77.78%	85.18%	96.29%	100%	92.59%	88.89%	92.59%	77.78%	100%	100%	100%	77.78%	100%	100.00%
S2Ig	0%	51.85%	74.07%	81.48%	66.67%	66.67%	81.48%	81.48%	55.56%	100%	100%	100%	100%	100%							100.00%	100.00%
S2Mg	0%	59.25%	96.29%	81.48%	55.56%	85.18%	88.89%	88.89%	77.78%	100%	100%	100%	88.89%	100%							50.00%	50%

(S2:Ik – Subject 2, /k/ in initial position; S2:Mk – Subject 2, /k/ in medial position; S2:Ig – Subject 2, /g/ in initial position; S2:Mg – Subject 2, /g/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /k/ and /g/)

Figure 2. Percentage correct response of velar production in both initial and medial positions by subject 2(S2)

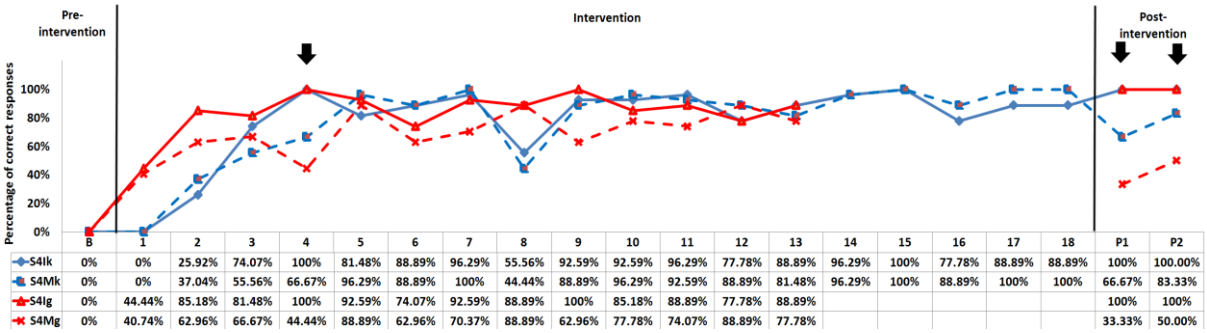
Although S2 performed similarly for velar /k/ in the contexts of both initial and medial position during intervention, relatively higher PCC scores were obtained first (4th session) in the initial position. Simililar to S1, PCC scores for S2 was 100% at P1 and P2 (table 2). During intervention, S2 performance for voiced velar /g/ was similiar to unvoiced velar /k/ in both the phoneme positions. The major difference was the presence of the reduced percentage of correct response for voice velar /g/ in medial position at P2 (fig. 2 and Table 2).



(S3:Ik – Subject 3, /k/ in initial position; S3:Mk – Subject 3, /k/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /k/)

Figure 3. Percentage correct response of velar production in both initial and medial positions by subject 3(S3)

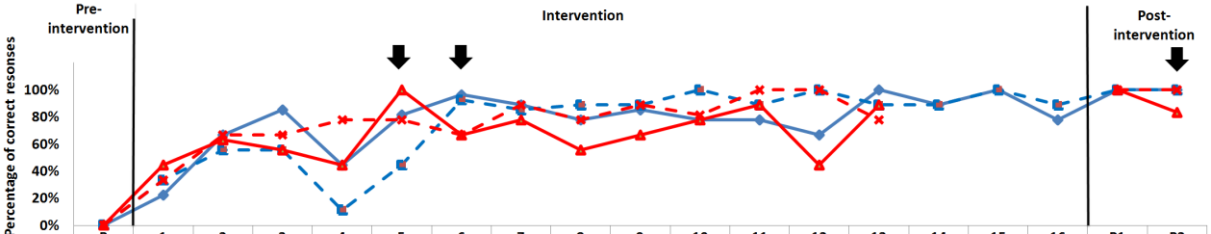
In contrast to S1 and S2, the PCC scores during intervention was relatively higher in the medial position compared to initial position (Fig. 3). PCC scores at P1 and P2 (table 2) was 100%, similar to S1, for velars in the context of both initial and medial positions.



(S4:Ik – Subject 4, /k/ in initial position; S4:Mk – Subject 4, /k/ in medial position; S4:Ig – Subject 4, /g/ in initial position; S4:Mg – Subject 4, /g/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /k/ and /g/)

Figure 4. Percentage correct response of velar production in both initial and medial positions by subject 4(S4)

Initial position favored the acquisition of velars in S4 with relatively higher performance scores during intervention and also post-therapy assessments P1 and P2 (Fig.4 and table 2). Relatively high variability in performance was observed during intervention in the context of medial compared to initial.



	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	P1	P2
S5Ik	0%	22.22%	66.67%	85.18%	44.44%	81.48%	96.29%	88.89%	77.78%	85.18%	77.78%	77.78%	66.67%	100%	88.89%	100%	77.78%	100.00	100%
S5Mk	0%	33.33%	55.56%	55.56%	11.11%	44.44%	92.59%	85.18%	88.89%	88.89%	100%	88.89%	100%	88.89%	88.89%	100%	88.89%	100%	100%
S5Ig	0%	44.44%	62.96%	55.56%	44.44%	100%	66.67%	77.78%	55.56%	66.67%	77.78%	88.89%	44.44%	88.89%				100%	83.33%
S5Mg	0%	33.33%	66.67%	66.67%	77.78%	77.78%	66.67%	88.89%	77.78%	88.89%	81.48%	100%	100%	77.78%				100.00	100%

(S5:Ik – Subject 5, /k/ in initial position; S5:Mk – Subject 5, /k/ in medial position; S5:Ig – Subject 5, /g/ in initial position; S5:Mg – Subject 5, /g/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /k/ and /g/)

Figure 5. Percentage correct response of velar production in both initial and medial positions subject 5(S5)

Higher PCC scores were obtained earlier for both the velars in the initial position (4th and 5th sessions, Fig.5). For velars, similar variability in performance was present in both the phoneme positions across therapy sessions. At P1 PCC scores were 100% in both the context for velars, whereas at P2 in all the contexts except /g/ in the context of initial position scored 100% (fig. 5 and table 2).

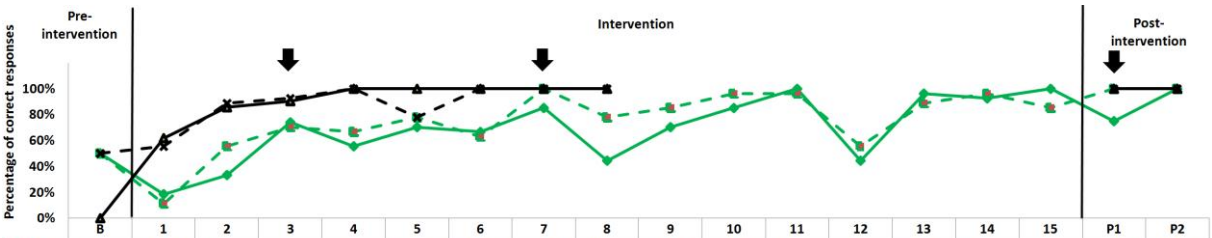
In sum, initial position facilitated the correct production of velars compared to medial position.

Table 2

Raw scores for substitution and correct responses; and PCC scores for target phonemes in each phoneme position for pre- and post-intervention

Phoneme	Participant	Pre-intervention						Post-intervention											
		Initial B			Medial B			Initial P1			Initial P2			Medial P1			Medial P2		
		R-S	R-CR	PCC	R-S	R-CR	PCC	R-S	R-CR	PCC	R-S	R-CR	PCC	R-S	R-CR	PCC	R-S	R-CR	PCC
/k/	S1	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%
	S2	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%
	S3	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%
	S4	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	2/6	4/6	66.67%	1/6	5/6	83.33%
	S5	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%
/g/	S1	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%	0/6	6/6	100%
	S2	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	3/6	3/6	50%	3/6	3/6	50%
	S4	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	0/6	6/6	100%	4/6	2/6	33%	3/6	3/6	50%
	S5	6/6	0/6	0%	6/6	0/6	0%	0/6	6/6	100%	1/6	5/6	83.33%	0/6	6/6	100%	0/6	6/6	100%
/t/	S1	4/4	0/4	0%	4/4	0/4	0%	1/4	3/4	75%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%
	S5	4/4	0/4	0%	4/4	0/4	0%	3/4	1/4	25%	1/4	3/4	75%	4/4	0/4	0%	1/4	¾	75%
	S6	4/4	0/4	0%	4/4	0/4	0%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%
/ɖ/	S1	4/4	0/4	0%	4/4	0/4	0%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%
	S5	4/4	0/4	0%	4/4	0/4	0%	2/4	2/4	50%	2/4	2/4	50%	1/4	3/4	75%	1/4	¾	75%
	S6	4/4	0/4	0%	4/4	0/4	0%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%	0/4	4/4	100%

(In the table, PCC refers to Percentage Consonant Correct; S1to S6 participants; B –pre-intervention baseline; P1 – first post-intervention evaluation; P2 – second post intervention evaluation; R-S – number of substitutions/number of targets; R -CR – number of correct responses/number of targets).

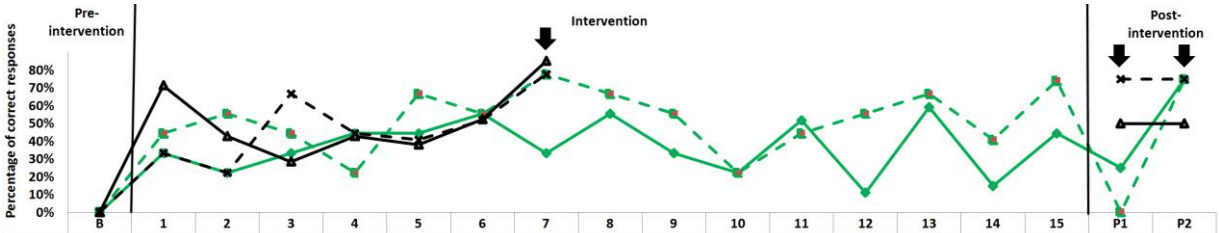


	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	P1	P2
S1:Iʈ	50%	18.51%	33.33%	74.07%	55.56%	70.37%	66.67%	85.18%	44.44%	70.37%	85.18%	100%	44.44%	96.29%	92.59%	100%	75.00%	100.00%
S1:Mʈ	50%	11.11%	55.56%	70.37%	66.67%	77.78%	62.96%	100%	77.78%	85.18%	96.29%	96.29%	55.56%	88.89%	96.29%	85.18%	100.00%	100.00%
S1:Iɖ	0%	61.90%	85.71%	90.47%	100%	100%	100%	100%	100%								100.00%	100.00%
S1:Mɖ	50%	55.56%	88.89%	92.59%	100%	77.78%	100%	100%	100%								100.00%	100.00%

(S1:Iʈ – Subject 1, /ʈ/ in initial position; S1:Mʈ – Subject 1, /ʈ/ in medial position; S1:Iɖ – Subject 1, /ɖ/ in initial position; S1:Mɖ – Subject 1, /ɖ/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /ʈ/ and /ɖ/)

Figure 6. Percentage correct response of retroflex production in both initial and medial positions by subject 1(S1)

For S1, percentage of correct responses or PCC scores were higher in the medial position for both the retroflex during intervention. Higher scores were obtained faster in the medial position by 4th session for voiced / ɖ / and 7th session for unvoiced / ʈ / (fig. 6). At P1, PCC scores was higher in the medial postion for / ʈ /, whereas it was 100% in both the contexts for / ɖ / (fig.6 and table 2). On the other hand at P2, S1 had 100% accurate production of retroflex in both the phoneme position (fig. 6 and table 2).

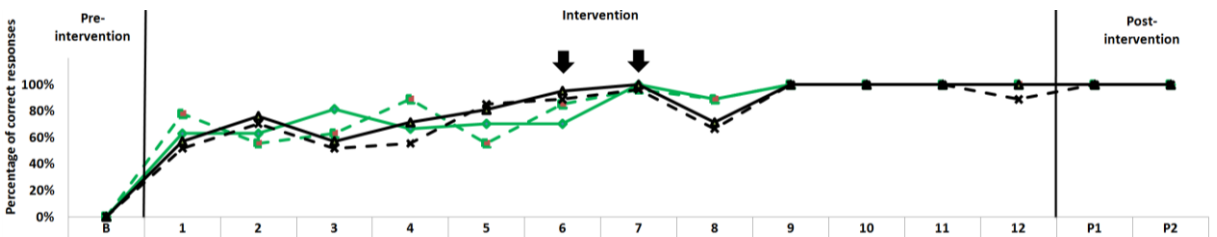


	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	P1	P2
S5:Iʈ	0%	33.33%	22.22%	33.33%	44.44%	44.44%	55.56%	33.33%	55.56%	33.33%	22.22%	51.85%	11.11%	59.25%	14.81%	44.44%	25.00%	75.00%
S5:Mʈ	0%	44.44%	55.56%	44.44%	22.22%	66.67%	55.56%	77.78%	66.67%	55.56%	22.22%	44.44%	55.56%	66.67%	40.74%	74.07%	0.00%	75.00%
S5:Iɖ	0%	71.42%	42.85%	28.57%	42.85%	38.09%	52.38%	85.17%									50%	50%
S5:Mɖ	0%	33.33%	22.22%	66.67%	44.44%	40.74%	51.85%	77.78%									75.00%	75.00%

(S5:Iʈ – Subject 5, /ʈ/ in initial position; S5:Mʈ – Subject 5, /ʈ/ in medial position; S5:Iɖ – Subject 5, /ɖ/ in initial position; S5:Mɖ – Subject 5, /ɖ/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /ʈ/ and /ɖ/)

Figure 7. Percentage correct response of retroflex production in both initial and medial positions by subject 5(S5)

S5 produced unvoiced / ʈ / relatively better in the context of medial posiiton during intervention. However at P1, PCC score was comparatively more in the initial position and at P2, same scores were observed in both the contexts (fig.7 and table 2). The major distinction was observed in PCC scores at P1 and P2 and not during intervention for voiced retroflex depicting medial position to be more facilitating than initial (fig. 7 and table 2).



	B	1	2	3	4	5	6	7	8	9	10	11	12	P1	P2
S6:Iṭ	0%	62.96%	62.96%	81.48%	66.67%	70.37%	70.37%	100%	88.89%	100%	100%	100%	100%	100%	100.00%
S6:Mṭ	0%	77.78%	55.56%	62.96%	88.89%	55.56%	85.18%	96.29%	88.89%	100%	100%	100%	100%	100.00%	100.00%
S6:Iḍ	0%	57.15%	76.19%	57.14%	71.42%	80.95%	95.23%	100%	71.42%	100%	100%	100%	100%	100%	100%
S6:Mḍ	0%	51.85%	70.37%	51.85%	55.56%	85.18%	88.89%	96.29%	66.67%	100%	100%	100%	88.89%	100%	100%

(S6:Iṭ – Subject 6, /ṭ/ in initial position; S6:Mṭ – Subject 6, /ṭ/ in medial position; S6:Iḍ – Subject 6, /ḍ/ in initial position; S6:Mḍ – Subject 6, /ḍ/ in medial position; ⬇ - indicates session number at which phoneme position has shown the effect on the target sounds /ṭ/ and /ḍ/)

Figure 8. Percentage correct response of retroflex production in both initial and medial positions 6(S6)

In contrast to S1 and S5, S6 performed similarly in both initial and medial contexts for retroflex sounds during intervention. Also, higher PCC scores were obtained in the context of initial position than in the medial during intervention. At P1 and P2, S6 had 100% accurate production of retroflex sounds (fig. 8 and table 2).
Overall, considering the results of all the three participants, retroflexes are facilitated in the context of medial position than initial. The depiction of the order of facilitating phoneme position is in table 3 as per graphical inference.

Table 3
Order of facilitating phoneme position

Sound classes	Facilitating phoneme position
Velars	İnitial > medial
Retroflex	Medial > initial

Graphical inference is subjective leading to bias and inconclusiveness. Hence, Wilcoxon signed rank test was run with SPSS version 17. Significant differences were established for velars only as the sample size was relatively high (n=6) and not retroflex (n=4). Hence, effect size was calculated only for velars using the formula by Andy Field (2009): $\frac{|z|}{\sqrt{n}}$ to determine the facilitating phoneme position. An effect size of 0.5 and 0.8 depicts medium and larger effect sizes respectively. The results are presented in table 4.

Table 4
Effect size for velars in the two phoneme positions

Phonemes	Baseline-Post evaluation 1	|z|	Effect size – r	Baseline-Post evaluation 2	|z|	Effect size – r
/k/	Initial B-Initial P1	2.236	0.91*	Initial B-Initial P2	2.236	0.91*
	Medial B-Medial P1	2.121	0.86	Medial B-Medial P2	2.121	0.86
/g/	Initial B-Initial P1	2.000	0.81*	Initial B-Initial P2	1.841	0.75
	Medial B-Medial P1	1.890	0.77	Medial B-Medial P2	1.857	0.75

* relatively highest effect size; B – baseline; P1- post evaluation 1; P2- post evaluation 2

From table 4, the effect size (0.91) was relatively higher in the initial position for /k/ at both P1 and P2. Larger effect size (0.81) was found only in the initial position at P1 for /g/. This result is in accordance with graphical inference. Hence, initial position is relatively highly facilitating the correct production of velars compared to medial position.

4. Discussion

The present results are slightly in consonance with the study by Shishira and Sreedevi (2013) and Sushma and Sreedevi (2013) who report that during normal speech development initial position favors the acquisition of velars whereas, both initial and medial position facilitate the acquisition of retroflexes according to the age. This differences are attributed to the anatomical and neural maturation during the course of speech development (Byun, 2012). The motor-control over the differential movements of various parts of the tongue are not acquired completely in typically developing children and hence, have ballistic movements (Kent, 1992; MacNeilage & Davis, 1999). This illustrates that children with SSD (phonetic type) follow the same course of speech development but delayed due to slower neural maturation and poor motor-control. The salient observation of the study is that even in a small sample of children with SSD, the positional effect was evident for different phonemes. Hence, such investigations are warranted on frequently erred phonemes on a larger sample for generalization.

In the current study, initial position is favoring correct production of Kannada velars. This can be because, initial position acts as a testing ground for the acquisition of new sounds as they receive the first neural commands with least influence by preceding positions of articulators (Branigan, 1976). In addition, generally initial syllables in Kannada are relatively more stressed. Such stressed syllables are attended to extracted perceptually by toddlers (Echols & Newport, 1992). Hence, initial position may have facilitated the production of velars. The medial position is relatively facilitating the correct prodcution of retroflexes than initial position. This can be due to the minimal influence by the articulatory requirements of adjacent sounds in medial position (Kent, 1982). Also, this result can be attributed to the syllable structure of stimuli words considered. In the present study the stimuli words for medial position context constituted target phonemes more as geminated medial clusters which are relatively more stressed compared to singletons in the initial position. This is one of the major limitation of the study that syllable structure was not maintained acorss the stimuli to get an accurate inference. Perceptability of retroflexion is another major issue to consider which supports the results of the present study. The word coda retroflex are reliably identified compared to word onset retroflex (Steriade's, 2001).

Physiologically and neurologically, retroflexes are difficult to produce compared to velars. During the production of velars, only back of the tongue rises and constricts at the palate with less neural commands. On the other hand production of retroflexes involves an upward movement of the tongue tip and constriction of the tongue blade at the palate for a narrow stretch with the requirement of more neural commands in Kannada (Kochetov, Sreedevi, Kasim, & Manjula, 2012). This might be the reason for the easier

production of velars in the initial position compared to retroflexes, and the influence of other articulatory movements might facilitate the articulatory gesture for retroflex in medial position.

5. Conclusion

Phoneme positions do have facilitatory effects on the acquisition of speech sounds. The present results reveal that initial position facilitates the acquisition of velars and medial position facilitates retroflexes in children with speech sound disorders. These results have to be validated on a larger sample size to have improved generality. Such studies would provide essential intervention guidelines for speech-language pathologists for ensuring faster improvement. This area of research is still in its nascent stage, and more controlled studies in this area are warranted in various languages as coarticulation is language specific.

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Declaration of interest

The authors report no declarations of interest.

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Rhymed stories and vocabulary input in first language acquisition

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Abstract

The present study is an effort to focus on Iranian infants' vocabulary learning in their first language (Farsi) acquisition. It is going to show how by the aid of rhymed stories as a source of input, the enhancement of prosodic skills in children is to affect the formation of a broader knowledge of vocabulary in them. To this aim, the sample of 12 Iranian (Farsi Speaking) children between (24-36 months) were selected and divided into two groups each one consisting of six– three girls, three boys. The experimental group – by the help of their parents – were provided with some vocabulary items through rhythmic or prosodic stories designed by the researchers of the study for this specific purpose. The comparison group were given the same vocabulary material through the same stories but told in everyday language and not foregrounded by rhythmic language or explicit prosodic features. They received the input for several times within a week through their parents and finally in-depth interviews were held to collect the data of the present study; what revealed that the children in the experimental group had a greater knowledge of the new vocabulary items they were exposed to through rhymed stories.

Keywords: first language acquisition, vocabulary, input, story, prosody and rhythm

1. Introduction

Reading story books to young children might be taken to have many benefits for them as it can be helpful in getting familiar with new vocabulary items. Research has shown the fact that pre- school children can recall the specific rhyming words of the story more easily than the other details (Hayes et al., 1982), as they gradually develop the ability to "sustain their attention" alongside with enhancing their "active imagination" through wining mastery over "narrative conventions" (British Colombia Health Link BC, q.t.d in Mullen, 2017, p.47) and sound patterns of their mother tongue. As a matter of fact, such an enhancement is to be witnessed because music is engaging and attention-grabbing (Tierney and Kraus, 2013) and can function as mental stimuli, able to foreground: the very characteristics which in consequence might effectuate positively the vocabulary learning context

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provided for the learners through stories. This viewpoint can be claimed to be favored by several researchers who believe that children have a double capacity, in comparison to adults, and pick up much from the input (Doughty & Long 2003) exposed to them and can make use of it in their attempt to gain mastery over the complex system of language (Saffran et al. 1996). Briefly stated, it may be deduced from their assumptions that children can rely on the vocabulary input highlighted through rhythmic stories as contextualized lexicons or encyclopedic sources; what they have the ability to expand analogously to broader contexts for usage as they go on improving their vocabulary knowledge.

Drawing on all the above-mentioned assumptions, it is not hard to infer why in recent years researchers have found the necessity of focusing on the issue of the relation between phonemic awareness in children – made possible by a series of complex mental and auditory syntheses – and the 'phonological' properties of language (Kay, 2016); what can help them improve their vocabulary knowledge in advance. For instance, in a study by Katherine Stover, it has been tried to answer "whether exposure to rime or repetition strategies would enhance children's ability to correctly pronounce novel words and non-words (2015). Similarly, another research has concentrated on the degree to which everyday plays and games for children; games like singing songs, listening to stories and telling stories to others , as well as making rhythmic units (NYS Education Department, 2016), can help them concretize phonological patterns of their language and sequentially a broader knowledge of the vocabulary items. Relatedly, to reaffirm the validity of such a viewpoint it can be pointed to a more recent study by Robin O'Leary in the field (2017) which has revealed much about the subject by focusing on how the "memory for vocabulary words" might be improved when the knowledge of the sound or rhythm associated with the constituent letters of each word is enhanced in children.

Despite all that have been done up to know in case of studying the matter of 'rhymed vocabulary input and infants', it might be claimed that many gaps are still be traced in the field. As once a critic asserted the existence of such gaps can be said to be caused by the fact that much is yet unknown about the process of the first language acquisition itself (Lust, 2006); what is in reality caused by the impalpability of the internal co-relative mental syntheses bringing about such a process as well as the innate features of each language and its phonological characteristics. Furthermore, there is another important factor which shall not be ignored: the existing differences between learners and various potentials in them affecting the output in consequence. Taking into account these facts, it can be postulated that in order to fill those gaps a researcher needs to avoid overgeneralizations at many points; presumably, something to be possible when the provided vocabulary inputs are managed carefully based on the nature of each language. To be precise, it shall be defined how and why the items provided to be exposed to each group of learners as input are come along with.

According to the aforementioned explanations, and in an attempt to bridge the existing gaps in dealing with the issue of 'rhymed vocabulary input in first language acquisition', this study is an attempt to draw on some of the less investigated aspects of the field. Briefly stated, it is going to be examined

how the familiarity of Farsi speaking infants with prosodic skills or better to say prosodic competence and receiving input through stories equipped with rhymes and meter can affect the formation of a broader knowledge of vocabulary in infants in the process of learning Farsi, their first language.

1.1. Research Questions

The purpose of this study is to find how by the aid of rhymed stories as a source of input, the prosodic skills in children are going to be enhanced and how this factor by consequence is going to affect the formation of a broader knowledge of vocabulary in the first language acquisition process. These questions then can be introduced as the research questions:

1. To what extent can rhyme and prosody (prosodic competence) act as important factors in the process of first language acquisition for Iranian (Farsi speaking) children?

2. How can the type of input (vocabulary exposed through rhymed stories) affect the infants in the process of the acquisition of their first language (Farsi)?

2. Methodology

2.1. Participants

Participants included 12 Iranian children (6 females and 6 males) between (24-36 months) who were all learning Farsi as their first language. They were chosen from among a group of 18 infants. The study occurred at a mean age of 30 months and all the participants had both cognitive development in the normal range– six were excluded after the analyses. It is necessary to highlight at this point that in the way of grasping a valid and reliable sample some factors were taken into account: Initially, so as to check the homogeneity of the participants, an IQ test according to Raven's Progressive Colored Matrices (Raven, 1998) was hold before grouping. Additionally, a T-test was performed based on the results and the upcoming Standard Deviations. Furthermore, those children's knowledge of vocabulary was examined in separate interviews by the presence of their parents in order to decide on the vocabulary material for the study. Taking into consideration all these factors, the participants were categorized into two groups of six – each one consisting of three boys and three girls to control the probable heterogeneity of sampling: caused by gender.

2.2. Instrumentation and Data Collection Procedures

To collect the data, the experimental group was provided with certain vocabulary input through rhymed stories in form of poems or prosaic texts. The comparison group members were exposed with the same vocabulary input through the rewritten material of the rhymed stories provided for the experimental group but in ordinary non-rhythmic language.

In order to make the children ready for an interview containing vocabulary test items, the instrument chosen for conducting the present study, some issues had to be controlled at the beginning: Primarily, it was necessary to check if optimal exposure to the vocabulary items are allotted to each infant

or not. Additionally, it had to be found that the answers provided by them is not the outcome of recall, a kind of conditional response or from another perspective, and the result of their reliance on their short-term memory. Having in mind these matters – plus the fact that the role of "parents and home experiences" cannot be denied in fostering readiness in children when it comes especially to phonological recognition and understanding rhyme (Orillosa, 2014) – before the interview the parents were provide a one week period for exposing the new vocabulary items to their children. To enhance the validity of the procedure, the frequency of vocabulary exposure was controlled: parents were had to read the vocabulary items twice a day to their children – with at least eight to ten hours distance – within the period of the experiment week.
Getting to know about the frequency and format of exposure, it is also necessary to find about the content of the input. Here is a sample of the song – translation of the original Farsi one – parents were asked to expose to their children in the experimental group:

Banana, Banana on tree grow, Banana yellow and mellow
Mellow is Ripe, Ripe, mellow, Child honey the Banana show!
Banana, Banana on tree grow, Banana yellow and mellow
A tree with big leaves ….. , Green, Green
Banana first Green, Yellow then Slow
Banana, Banana on tree grow …., If Sick, Banana Good, you shall Know

After Each exposure, the parents were then to ask some 'fill in the blank' questions in order to check the output. For example, in case of the above-mentioned story:

A. Banana grows on --------.
B. Banana is ripe. It is ---------.

The comparison group had the exposure to the same vocabulary item, as well as the same kind of 'fill in the blank' questions, but this time the story was not highlighted by rhyme and was close to everyday language in tone:

Banana is a fruit that grows on a tree with big leaves. Child, you know, Banana is first green and gets yellow when ripe or mellow. Banana, which grows on tree is a good fruit to take when you are sick.

A. Banana grows on --------.
B. Banana is ripe. It is ---------.

The experiment continued for a week. However, by its end, three days of intentional pause or non-exposure to the input material were planned. It was in fact intended to lessen the effect of short term memory. Therefore – on the tenth day after the first exposure – each infant was separately put into an interview. Each interview was then designed to last for about 15 minutes – with the presence of parents that aimed at reducing the anxiety level in children. The parents had an active role in the performance of the

experiment (interview), themselves as they were required to give the provided tests to their child. For the experimental group, the parents had been given some semi- questions to ask from their child about the vocabulary materials they had been exposed to through rhymed stories. For example, one item was based on the very story about Banana. After reading a story about 'Banana', each child was asked to answer some 'fill in blank' questions, already familiar with during the week of the experiment. Secondly, to make for another test item, which was new, the children were given two cards one with picture of a green banana on a tree and the other of a ripe banana. Each child was then asked to choose the ripe banana. Two series of tests for each item were then prepared for each infant.

The children in the comparison group were provided with the same kind of tests by their parents. The only difference was that in the same manner as the week of exposure the new material prepared for tests was not in form of prosaic texts, poems or songs: They were in fact, new versions of the same stories but not this time with no dominant rhythm or metric feature.

Here at this point, it seems rather necessary to highlight a matter: In case of the interview, the tests were designed based on the same vocabulary items exposed to the children by their parents: with rhyme and meter for the experimental group and in ordinary everyday oral language for the comparison group. However in order to guarantee the reliability of the results and in order to reduce the probable effects of 'recall' brought about by contextual similarities, vocabulary materials exposed earlier by parents to their children were blended at different levels. For example, the test item 'the story of Banana' – mentioned above – which was in the first instance the rewording of the part of the very story about fruits they had heard during the week of exposure was merged into another story about animals, exposed by parents to children later than the former story in a consequent session. To clarify the matter more, it is good to refer to some part of the English translation of the Farsi song used in the interview for the experimental group based on the story of 'Banana' and 'Monkey':

A ripe ripe banana I had picked
Picked from a --------, I had picked
A -------- with a long tail, naughty animal
Came and stole what I had picked

Taking into account what went on above, it is to be inferred that simply each infant's responses to the tests, designed in accord with the vocabulary items exposed to them, were taken to be the defining criteria for data collection in the present study. However, in order to authenticate the validity of the data collection process, conducted through vocabulary test items, they were checked based on Messick's 'Validation Theory' (1989). Additionally, all of the interviews were recorded by sound recorder as well as a camera so as to make the documentations more authentic and reliable. The whole interviews were then fully transcribed according to MacWhinney's (1991) *Child Language Data Exchange System* (CHILDES) format as the transcriptions were necessary to be at hand during the analyses. Furthermore, to decide about the effective factors or criteria to be put into evaluation, some recent

studies – e.g Mudawi, G. H. H. (2015), and Liza Lee and Shu-Chuan Lin (2015) – were checked. Additionally, it shall be noted that these studies were also much illuminating regarding their data collection procedures as well as their adopted approaches to define necessary evaluation factors. As a result, some categories or factors were inferred on a deductive basis; factors like: the degree to which each child was able to fill in the blanks, his or her speed, confidence and assurance in answering. Relatedly, the pauses, repetitions, corrections plus the attempts by each infant in order to take feedback or reassurance from his or her parents were also found as necessary factors to be put into consideration in the process of data analysis.
The data collected based on the above-mentioned criteria were then tabulated in this format:

Table 1
Experimental Group, Test1

Children Number	Accurate Answers	Speed/Pause (Seconds)	Partial Answers	Self-Correction	Feedback /Reassurance	Wrong Answers
1	✓	0	✕	✕	✕	✕
2	✓	10	✓	✓	✓	✓
3	✕	35	✕	✕	✕	✕
4	✓	18	✓	✓	✕	✕
5	✓	16	✓	✓	✕	✕
6	✕	26	✕	✓	✓	✓

Table 2
Experimental Group, Test 2

Children Number	Accurate Answers	Speed/Pause (Seconds)	Partial Answers	Self-Correction	Feedback /Reassurance	Wrong Answers
1	✓	20	✓	✓	✓	✕
2	✕	32	✓	✓	✓	✓
3	✓	27	✕	✕	✕	✕
4	✓	25	✓	✓	✕	✕
5	✓	8	✕	✕	✕	✕
6	✓	18	✓	✓	✓	✕

Table 3
Comparison Group, Test1

Children Number	Accurate Answers	Speed/Pause (Seconds)	Partial Answers	Self-Correction	Feedback /Reassurance	Wrong Answers
1	✓	20	✓	✓	✓	✕
2	✕	35	✓	✓	✓	✓
3	✕	35	✕	✕	✕	✕
4	✓	23	✓	✓	✓	✕
5	✕	40	✓	✓	✓	✓
6	✓	28	✓	✓	✓	✕

Table 4
Comparison Group, Test 2

Children Number	Accurate Answers	Speed/Pause (Seconds)	Partial Answers	Self-Correction	Feedback /Reassurance	Wrong Answers
1	✕	30	✕	✕	✓	✓
2	✓	19	✕	✕	✕	✕
3	✓	28	✕	✕	✕	✕
4	✕	18	✕	✕	✓	✕
5	✓	24	✓	✓	✓	✕
6	✓	16	✓	✕	✓	✕

2.3. Data Analysis

In order to examine the application of rhymed vocabulary input, in the formation of a broader knowledge of vocabulary in the process of the first language acquisition in infants from 24 months to 36 months old, the tabulated raw data gathered through comparing the records of the interviews, were analyzed through descriptive analysis.

3. Results

The garnered (tabulated) data was in consequence statistically analyzed and the results showed that 75% of the test answers provided by the children of the experimental group were correct while 58.3% of the answers by children in the comparison group were accurate. Additionally, in case of "the Pause", the "Mean" for the experimental group was 21 seconds in comparison to 26.3 seconds for the other one. Sequentially, concentration on the average percentage of the 'partial answers', provided by the infants in the two groups indicated the fact that they were not different in this case. Further analysis revealed that the children in the experimental group needed the parent's feedback or reassurance so as to come up with an answer, in 41.6% of the whole tests while in the other group the percentage was 75%. Finally,

focusing on the issue of "the Corrections", the numbers revealed that in 66.7% of the whole tests children in the experimental group tried to correct themselves and the percentage of success in correction was 41.6% while for the comparison group the former was 75% and the latter was 33.3%. Taking into consideration the gathered data, the following charts (figures) were provided to represent the findings of the study:

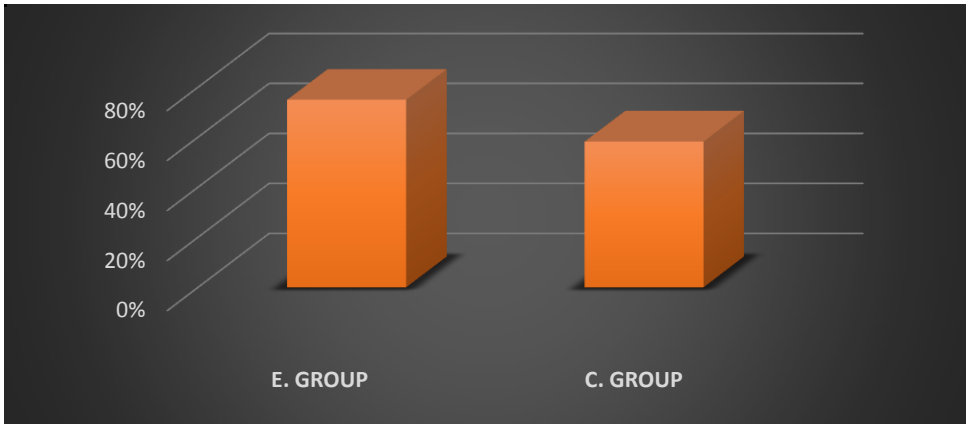

Figure 1. Correct Answers

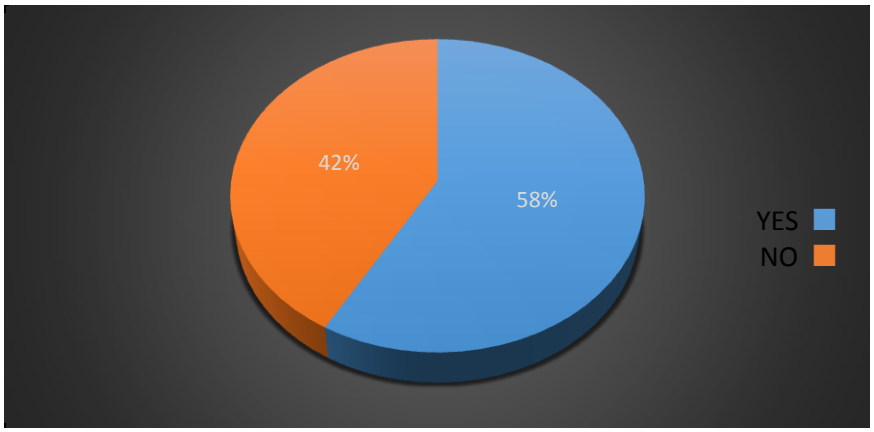

Figure 2. Partial Answers (E. Group)

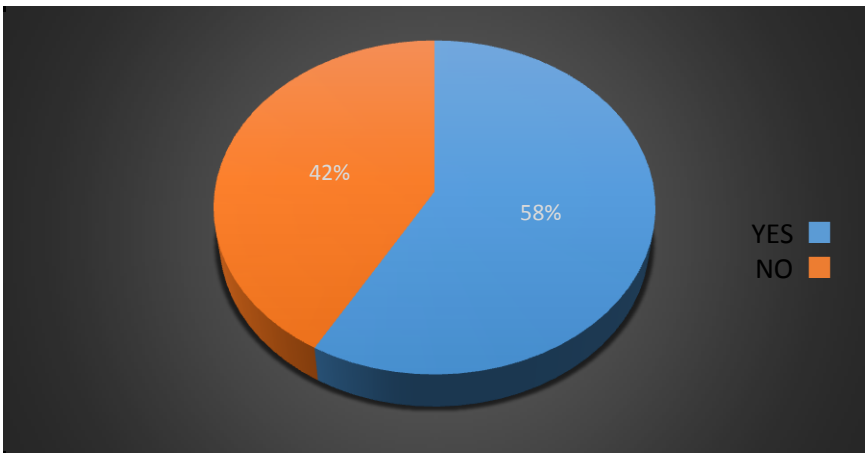

Figure 3. Partial Answers (C. Group)

Figure 4. Means (of pauses)

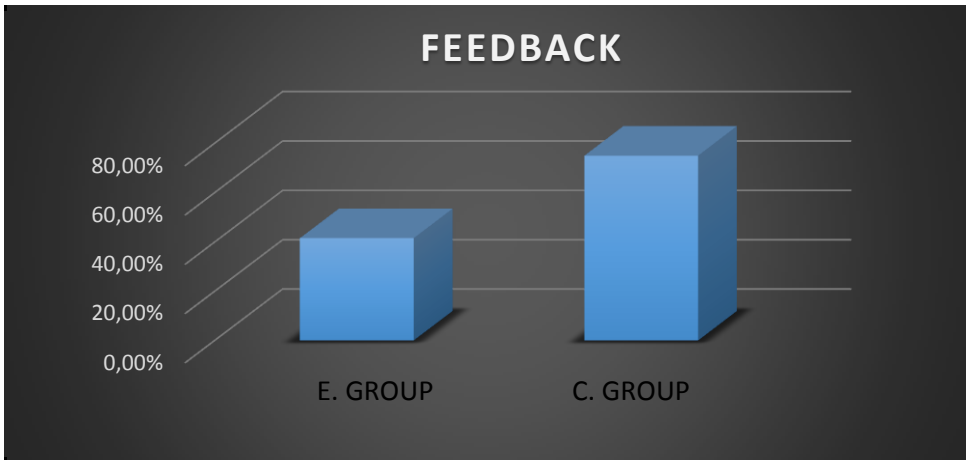

Figure 5. Feedback

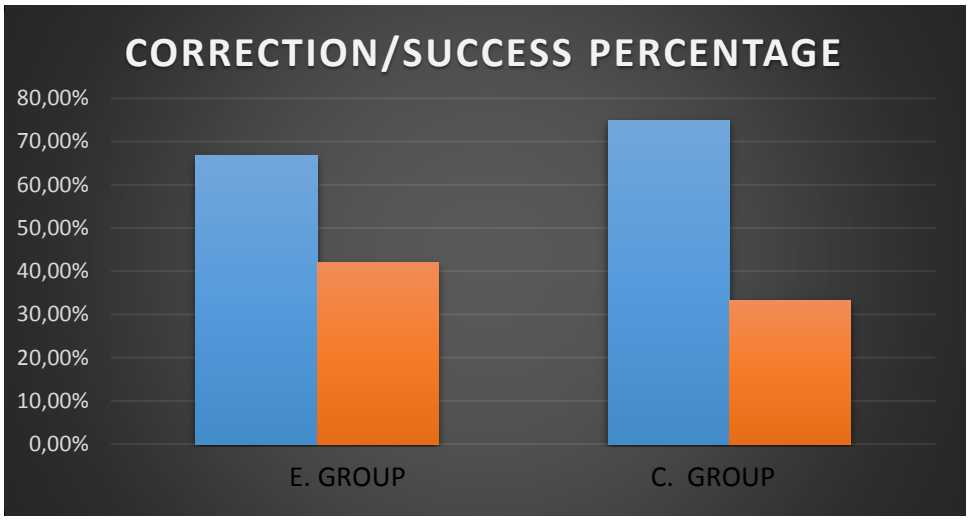

Figure 6. Correction/ Success percentage

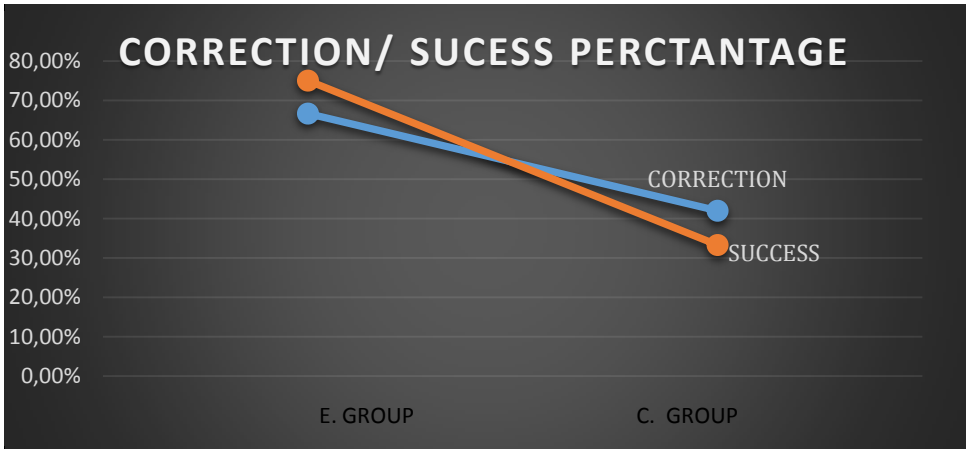

Figure 7. Correction/ Success percentage

4. Discussion

The goal of this study was to focus on Iranian infants' vocabulary learning in their first language (Farsi) acquisition and how the process might be facilitated by the aid of rhymed story books as a source of input, taking into account the assumption that such a procedure is to enhance their prosodic skills; what is consequently to bring about the formation of a broader knowledge of vocabulary in them. Analyzing the collected data could then provide a reliable basis in order to answer the research questions of the present study. Definitely, 'Data Analysis' revealed the followlling outcomes :

- The total percentage of the correct answers provided by the children in the two groups for the two Tests – as represented in Figure 1 – indicates that rhymed vocabulary inputs can enhance the vocabulary learning process since a 16.7% decrease was probed. Another way, Infants in the Exprimental Group were more sucessful than those in the Comparison Group in answering correctly.

- Children in the Exprimental Group had less hesitations and pauses than the Comparison Group in answering as the average pause time for the children in the Exprimental Group was 21 seconds while it was 26.3 seconds for the comparison group (Figure 4). Additionally, putting into analysis the data in case of the pauses, it can be found that more children in the Comparison Group needed longer period of pauses or hesitations than the children in the Exprimental Group. This is much significant and sheds light on the fact that children in the Comparison Group had much more difficulty or problem in dealing with the vocbulary items in the provided tests. Besides, the category of 'partial answers' (indicated by Figure 2 and Figure 3), must also be taken as important here despite the fact that the data revealed no difference between the two groups in this case. In fact, such an equality can be claimed to be accidental as it has not been affecting the category of ' pause' or 'hesitation'. In other words, if it was an effective item, the way it could alter, modify or condition other categories like ' pause' or 'hesitation' had to be testable.

- Children in the Exprimental Group needed less feedback or reassurance from their parents than the children in the Comparison Group so as to answer the tests. As indicated by Figure 4, for the Exprimental Group the total percentage of 'feedback' is 41.6% while it is 75% for the Comparison Group. This can be a good confirmation to the fact that rhymed vocabulary input is to have positive effects on the process of acquisition since it can be inferred that children, in the experimental group, can recall the vocabulary items faster; that is why not only they have less pauses in their process of coming up with the answers to the provided vocabulary tests, but also need less assurance, repetition, feedback or confirmation from their parents to help them conquer their doubts or undecidedness.

- According to Figure 6, the avarege percentage of attempts done in the way of self- correction by the children in the Exprimental Group is 66.7%, while it is 75% for the other group.It is not hard to guess that it is their success in providing more correct answers with less pauses and need for less feedbacks in sum, that leads to such a result. However, it is important to note that the higher percertange of attempts done so as to correct themselves has another implication besides representing the comparison group children's less effective vocabulary acqusition procedure. Factually, as Figure 7 depicts, the lower percentage of their success in self- correction, 33.3%, in comparison to the due percentage for the exprimental group, which is 41.6, is another proof that sheds light on the effectivness of rhymed vocabulary input and how it can facilitate the formation of a broader knowledge of vocabulary in children.

5. Conclusion

This study was an attempt to bridge some of the existing research gaps regarding the issue of 'rhymed vocabulary input in first language acquisition and infants'. To this aim, and bearing in mind the relativity of the matter

and how the linguistic, and contextual variables as well as individual learner's characteristics and learning potentials may affect the results, the present study focused on Iranian infants' vocabulary learning in the process of developing their Farsi learning competence and the way rhymed story as a source of input can facilitate the formation of a broader knowledge of vocabulary in them. The analysis of the data gathered from the experiment indicated that there is significant relation between the level of vocabulary acquisition in children and how they were exposed to vocabulary items. Precisely, it was revealed that children who were provided with new vocabulary items through rhymed story books – narrations done by songs, poetry or via a language with foregrounded prosodic features – were much more successful in acquiring the new vocabulary items than those other exposed to the same vocabulary materials by the aid of stories told in the ordinary or everyday language. The findings also showed that not only the children who had been exposed to the vocabulary materials through rhymed story had acquired much vocabulary materials than the other children in the experiment, but also they showed greater confidence and assurance in tests conducted based on the new vocabulary materials they had absorbed as more speed in answering, much ability in self-correction and less need for feedback from their parents were what their monitoring revealed in comparison with the children in the other group.

Accordingly, at the end, it can be asserted that what was noticed earlier in the research questions of this study has been examined to a great extent in the process of the experiment done. In fact, it can now be claimed that rhyme and prosody (prosodic competence) act as key important factors in the process of first language acquisition of Iranian children and can play a great role in the process of the development of these children's vocabulary knowledge.

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Appendix I

Sample Farsi Song Used in the Study as Input for the Exprimental Group:

موزکه پخته، شیرینه

باغبون اونومی چینه

ازدرخت پرازبرگ

برگ های سبز و خوش رنگ

موزپخته که زرده

داروی هرچی درده

Appendix II

Sample Farsi Story Used in the Study as Input for the Comparison Group:

موز یه میوه است که روی یه درخت با برگ های بزرگ سبز میشه. عزیزم میدونی موز اول رنگش سبزه و وقتی پخت و کامل رسید رنگش زرد میشه. وقتی مریض میشی موز مثل داروست و خیلی برات خوبه.

Appendix III

Sample Farsi Questions Asked after Each Story:

A . موز روی ------- درمیاد.

B . موز وقتی رسیده است رنگش --------؟

Appendix IV

Sample Farsi Song Used in Interview:

یه موز پخته چیدم

از -------- من اونو چیدم

یهو -------- شیطونه دم دراز

قاپید اون موزی که چیدم