LEXICAL FAST MAPPING ABILITIES IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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CERTIFICATE

This is to certify that the dissertation entitled ***Lexical fast mapping abilities in children with autism spectrum disorder*** is the bonafide work submitted in part fulfillment for the degree of Master of Science (Speech-Language Pathology) of the student (Registration No. 15SLP009). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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This is to certify that the dissertation entitled ***Lexical fast mapping abilities in children with autism spectrum disorder*** has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any Diploma or Degree.

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DECLARATION

This is to certify that this dissertation entitled ***Lexical fast mapping abilities in children with autism spectrum disorder*** is the result of my own study under the guidance of Dr. Shyamala K C, Department of Speech language pathology, All India Institute of Speech and Hearing, Mysore, and has not submitted earlier in any other University for the award of any Diploma or Degree.

Mysore **Register No: 15SLP009**

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Dedicated to My Parents &

My dear sister

for their endless love, support and encouragement

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CHAPTER 1

INTRODUCTION

Learning the conventional meanings of object labels requires that children make an arbitrary link between labels that are aurally perceived and object referents that are seen in the environment. The rapid, associative process by which label and object are paired to establish the earliest entry of a word in a child's lexicon was termed 'Fast mapping' (Carey & Bartlett, 1978). According to Carey and Bartlett (1978), there are two stages in word learning process. Fast mapping is thought to be the primary stage, where in child forms an association between a novel word and its meaning which the child not exposed before. Second stage is the "Extended mapping", in this stage child refines some of the information about that specific novel word which already the child has experienced.

There is a wealth of literature focusing the efficacy of fast mapping in word learning. Literature suggests that typically developing children as young as 13 months of age do acquire new words through fast mapping (Woodward, Markman & Fitzsimmons,1994 ; Schafer & Plunkett, 1998; Kay-Raining Bird & Chapman, 1998). Similar study done by Bion, Borovsky and Fernald (2013) revealed that novel words were fast mapped and retained by typically developing children in the age group of 18-30 months. Children were able to fast map words which were more concrete particularly nouns or descriptors, including colour and shape with significant amount of practice (Heibeck & Markman, 1985). Word learning process involves acquisition process and repeated practice fine tunes the information about the particular novel word which the child was exposed (Rumelhart & Norman, 1978). Practice effects are very

important in learning new word (Newell & Rosenbloom, 1981). Most of the reported studies were concentrated on visual stimuli along with auditory stimuli, visual and auditory stimuli were paired to provide a concrete learning experience. Fast mapping was even more successful when the stimuli were real objects and pictures.

Fast mapping has been explored in children with language impairments as well. A study done by Dollaghan (1987) proposed that children with and without language impairment were equally skilful in several aspects of the fast mapping process. The language impaired children were able to make appropriate inferences by linking a new word with a new referent.

Children with Autism Spectrum Disorders (ASD) often have delay or deviancy in the language acquisition (Charman, Drew, Baird & Baird, 2003; Matson, Mahan, Kozlowski, & Shoemaker, 2010), and they may exhibit difficulties in linking novel labels with the referents during word learning process. These difficulties are mainly due to their poor joint attention and poor eye gaze to a particular referent (Baron-Cohen, Campbell, Karmiloff-Smith, Grant & Walker, 1995; Mundy, Sigman, & Kasari, 1990, 1994). As a result of this, children with ASD tend to make inaccurate word/object pairings and pairing words to inappropriate referents which might lead to slow vocabulary growth.

To study the process of word learning in children with ASD, researchers have used fast mapping paradigms. McDuffie,Yoder and Stone (2006) studied fast mapping abilities in children with ASD in the age range of 24 to 46 months. They found out a significant concurrent association between fast mapping and the receptive and expressive language abilities. Priessler and Carey (2005) suggested that school going

children with ASD were successful in word learning tasks through fast mapping and were able to make link between label and object.

Some studies have addressed the question whether children with ASD are able to learn words under highly scaffold conditions in which one label is presented in the presence of only one object, which is accompanied by attention directing cues (Luyster & Lord 2009, McDuffie et al. 2006, 2013). Luyster and Lord (2009) studied the performance of children with ASD (age range 17–61 months) and without ASD (age range 14–24 months) on label-object pairing tasks and they found that both the groups had performed equally well on the given task. Barcus (2011) examined the vocabulary acquisition through fast mapping in four children with ASD. Results of this study indicated that all the participants with ASD could fast map novel words and also were able to retain the vocabulary acquired through fast mapping.

Need for the study

Building vocabulary provides a foundation for language growth. One of the primary processes by which young children acquire their vast vocabularies is fast mapping. It also gives an opportunity for vocabulary expansion in children with ASD. Fast mapping abilities in typically developing children have been extensively studied (Woodward et al., 1994; Schafer & Plunkett, 1998; Bion et al., 2013, Deepak, 2016). Few researchers were also interested on studying the novel word acquisition through fast mapping in children with various language disorders such as Specific Language Impairment (Alt, Plante & Creusere, 2004; Gray, 2005), Hearing Impairment (Gilbertson and Kamhi ,1995), Cognitive Impairment (Wilkinson & Green,1998;

Wilkinson, 2007), Down Syndrome (Bird, Chapman& Schwartz , 2004), Autism (McDuffie et al , 2006 ; Heibeck and Markman ,1985) etc . Majority of the studies on fast mapping in different clinical populations have been carried out in western context and studies addressing the fast mapping abilities in Autism spectrum disorders are scarce in Indian context.

India being a multilingual country, it would be interesting to know the novel word acquisition by children in their native language. In a cognitive linguistic perspective, learning can be influenced by the native language. To explore the learning mechanisms in children with ASD, it is important to study the acquisition of novel words in the same population using fast mapping paradigms. Hence the present study is planned at aiming to extend research in this area by evaluating the fast mapping abilities in Malayalam speaking children with and without Autism Spectrum Disorder.

Aim of the study

The aim of the present study is to investigate the fast mapping abilities in Malayalam speaking children with Autism Spectrum Disorder (ASD).

Objectives of the study

1. To compare the novel word learning in recognition and production task in children with ASD and typically developing children
2. To study the practice effect in novel word learning in children with ASD and typically developing children

3. To study and compare immediate and delayed recall abilities of novel word in children with ASD and typically developing children

Hypotheses

1. There is no significant difference in recognition and production scores in children with ASD and typically developing children
2. There is no significant practice effect in novel word learning in children with ASD and typically developing children
3. There is no significant difference in immediate and delayed recall of the novel words through fast mapping in children with ASD and typically developing children

CHAPTER 2

REVIEW OF LITERATURE

2.1 Vocabulary development

Vocabulary development is a process by which children acquire words. There is a considerable variation in the vocabulary acquisition in typically developing children. Most toddlers acquire 10-15 words at around 1 ½ years of age (Nelson, 1973). By the age of 2 years, their vocabularies extend to around 200-300 words; and by the age of three years, they will be having vocabulary of 900-1000 words. They enter kindergarten with the capacity to comprehend or potentially utilize more than 2,000 words. (McLaughlin, 1998).It is studied that more than 60,000 words' comprehension will be accomplished by the time of graduation.

The skill in learning novel words is especially exponential and is one of the essential angles in speech and language development. Children in the age range of 2-3 years of age are estimated to learn around 2 new words for every day; on opposite 8-12 year old children learn upwards of 12 words for each day (Bloom, 2000).As indicated by Bloom (2000) to gain this vocabulary size a child must be included in learning of new words on regular premise all through his/her adolescence. Learning novel words in children varies across age wherein younger children learn these words by focusing the particular stimulus that is in and around their environment. Gradually these styles of learning will be supplanted with more developed form of learning novel word where children begin linking to the previous episodes of events and try to link with lexical – semantic map.

A few studies have detailed that children between age of 2.5 - 4 years select unfamiliar object as a novel word referent and with repeated exposure they map that word. Couple of speculations explains that novel word learning is happening by linguistic experience in the developmental period. The strategy of learning word through novel mapping is one such illustration (Lederberg & Prezbindowski, 2000). Measuring the child's vocabulary learning is significant in the time of language advancement to both clinician as well as researchers. Learning language is one of the crucial components of cognition. Hence several researchers who studied language acquisition have emphasized on cognition, working memory and IQ since it's altogether interrelated to each other (Marchman & Fernald, 2008).

Word learning links the connection between conceptual and linguistic organization in infants (Bloom, 2000). In conceptual domain the linkage between objects and events will be taking place and in linguistic domain phrases and words are learned through melody of human language. A few researchers have demonstrated that amid infant's stage, word learning happens through a strong linkage of conceptual and linguistic domain. To become a successful word learner, infants must distinguish significant relevant linguistic units, conceptual units and make a strong mapping between linguistic and conceptual units. And each of these domains require certain amount of abstraction for example a given word or utterances must be related to abstract phonological representation and should have abstract concept related to it. And vocabulary development is measured through a skill called fast mapping.

2.2 Fast mapping

Fast mapping is defined as the phenomenon which forms lexical representation for the newly learned word. This came into field of child language acquisition around 3 decades ago (Carey & Bartlett, 1978). As indicated by Carey and Bartlett (1978), there are two phases in word learning process. Quick mapping is thought to be the primary stage, where in child forms a relationship between a novel word and its meaning which the child not exposed before. Second stage is the "Extended mapping", in this stage child refines some of the information about that specific novel word which already the child has experienced. The word fast mapping is believed to be critical in the first stage of learning new words or novel words, which requires intact phonological and semantic processing skills (Ellis Weismer & Evans, 2002; Gray, 2003).

Few researchers investigated novel word learning and opined that with single exposure to a new phonological form and semantic value of the word, children create a 'map' (Form meaning), which is pre requisite or initial stage to the learning of novel word. During this stage there is phonological, syntactic or semantic information represented. In typically developing child novel word learning creates particular lexical semantic map and this is refined through various experiences across communicative contexts. (Dollaghan, 1987; Ellis Weismer & Hesketh, 1996 ; Ellis Weismer & Evans, 2002; Gray, 2003; Alt, Plante, & Creusere, 2004; Hwa-Froelich & Matsuo, 2005;Capone & Mcgregor, 2006).

In ideal situations, fast mapping tasks includes two phases, exposure phase and probe phase. In exposure phase child listens to a novel word and looks into the corresponding referent which would be in the form of pictures or real objects. In probe

phase child has to name a particular picture which he has learned in the exposure phase. Further probe phases are evaluated with two tasks namely, recognition and expression probes (Ellis Weismer & Evans, 2002). Ideally fast mapping task is carried out without specific feedback or teaching over very short duration. In the present study above mentioned phases have been evaluated.

Studies on monolingual preschool children found that receptive probe is better than expression probe. Gray (2003) exclaimed that children' fast mapping receptive scores might be a strong predictor of child's capability to express the learnt novel word. Hence, reception becomes eternal part for expressing the word.

2.3 Factors affecting fast mapping

Several studies have found that there are various and potentially influencing aspects of learning skills in typically developing young children. First, age becomes the primary contributing factor in the process of novel word learning. Fast mapping and age have direct one to one relationship, with evidence of older children outperforming better than young children (Alt et al., 2004; Gray, 2003). Second influencing factor in the process of fast mapping is cohesion of child's underlying language system. Children diagnosed with specific language impairment perform poorer than their peers with intact language skills in fast mapping task (Dollaghan, 1987; Ellis Weismer &Hesketh, 1996; Ellis Weismer & Evans, 2002; Alt et al., 2004; Alt &Plante, 2004). The third important learning factor influencing the child's learning skills is their persistent language knowledge (Gray, 2003).

Fourth important novel word learning factor is phonotactic probability. It refers to frequency of occurrence of individual sounds and sounds combination it is believed that behavioral effects of phonotactic probability provides insight about the role of phonological representation in language processing (Vitevitch & Luce, 1999). Children learn words which have high phonotactic probability easily than low phonotactic probability words (Storkel & Rogers, 2000; Storkel, 2001).

2.4 Retention of Fast-Mapped Words

The word learning process occurs step by step over time. After initial exposure to a word, Children probably store some trace of the word-meaning mapping they have deduced and expand on it with every exposure. Carey (1978) termed this generally long and slow process of refining the depiction of a word and its meaning is alluded to as slow mapping. Keeping in mind the end goal to see early word learning, it is important to see how the procedure of slow mapping unfolds. Children's retention of words they have effectively fast mapped after some time is one of the important steps in the slow mapping process. Most of the studies in fast mapping addressed retention abilities of fast map words in young children (Dollaghan, 1985; Golinkoff, Hirsh-Pasek, Bailey, & Wenger, 1992; Wilkinson and Mazzitelli, 2003; Wilkinson, Ross, & Diamond, 2003; Spiegel & Halberda, 2011; Bion et al., 2013; Zosh, Brinster, & Halberda, 2013).

Few reviews have evaluated the retention of recently mapped words after more significant delay. These reviews have demonstrated that 1 and 2 year old children able to remember referents of novel words they have been taught through ostensive naming for no less than 24 hours (Tomasello, Mannle, & Werdenschlag, 1988; Waxman &

Senghas, 1992; Woodward, Markman, & Fitzsimmons, 1994). Evidences have also shown that young children hold referents of words they have incidentally learned (Carey & Bartlett, 1978; Markson & Bloom, 1997). A study done by Horst and Samuelson (2008) found there is no maintenance of fast mapped words at age 24 months not withstanding for 5 minutes unless those words were taught extensively.

Deepthi, Trupthi, Shwetha, Nikhil and Deepa (2009) investigated fast mapping skills in Kannada speaking children in the age range of 2.5-4.5years on a naming task. In this study accuracy of naming was assessed, where initially the names were trained and the subjects were asked to remember the names after 10 minutes and after one week. They found that older children in the group performed better when compared to younger children and performance of naming was reduced after one week when compared to efficiency of naming tested after 10 minutes.

Zosh, Brinster, and Halberda (2013) compared 3-year-old children's word learning via inference and direct teaching and found that the children were more likely to retain a word's meaning when the meaning had been inferred than when it had been specifically instructed with no distracter. However, taken together these reviews suggested that young children are able to retain the newly learnt words for a considerable length of time, hours, and even weeks.

2.5 Fast Mapping in Different Populations

2.5.1 Typical development

Several studies have addressed fast mapping across different populations. Carey and Bartlett (1978) studied fast mapping abilities in typical population. They obliged children to retrieve an object from a field of two, one recognizable and one new object. They found that through brief presentation and contrast with a familiar object, children fast mapped new words. Children were evaluated one week later in an alternate setting and they were able to demonstrate learning of the fast mapped words. Results of other studies support Carey and Bartlett's findings (Gershkoff-Stowe & Hahn, 2007; Heibeck & Markman, 1985).

Heibeck and Markman (1985) completed a similar study in which three lexical domains were assessed: color, shape, and texture. Children were assessed for retention of unfamiliar words in the same session in which they were originally presented. To assess comprehension, children were instructed to identify the target item when paired with three familiar and three unfamiliar items. These researchers found that in typically developing children ages 3:0 to 4:8, fast mapping was successful. The participants comprehended more colour and shape words than texture words. Fast mapping had a greater impact when children knew some words in the same category as the unfamiliar word. Research suggests that fast mapping is successful in typically developing children, as well (Carey & Bartlett, 1978; Heibeck & Markman, 1985). New vocabulary is fast mapped and retained by typically developing children. Fast

mapping seems to be more successful with more concrete vocabulary, such as nouns or descriptors, including colour and shape (Heibeck & Markman, 1985). Deepthi et al.(2009) investigated fast mapping skills in Kannada speaking children in the age range of 2.5-4.5years on a naming task. They found that older children in the group performed better when compared to younger children.

According to Sushma, Amulya, Ranjini and Swapna (2010) studied fast mapping abilities in typically developing toddlers whose age range was in between 16-20 months. These children were taught with names of 24 unfamiliar objects over a period of 12 training sessions that lasted for about 24 days. Children were divided into two groups, where the experimental group underwent both training phase and evaluations in all the sessions. But for control group, training and testing was done only in first and last session. Results revealed significant difference between experimental and control group. Scores were better for experimental group than control. Thus this study concluded that fast mapping occurs in toddlers and significant amount of practice is necessary for mapping the word.

More recent study done by Deepak (2016) explored the fast mapping abilities in novel word learning in bilingual children using naming and recognition task. Children were able to learn new words in a single new exposure by fast mapping the new word and results revealed that recognition was especially easier for the children compared to naming task.

2.5.2 Cognitive impairment

Fast mapping in children with cognitive impairment was examined through successive and concurrent introduction of items (Wilkinson & Green, 1998). A computer-based approach was used rather than physical objects. Participants included individuals aged 5 to 22 years who had been diagnosed with moderate to severe cognitive impairment. In the concurrent introduction condition, two new words were introduced in each of the first and second sessions, and were then tested for acquisition in the last session. Subjects were provided twelve exposures for each word. In the successive exposure condition, one word was presented for fast mapping during the first session, and two words (the word from the first session and a new word) were presented for sessions two and three. Learning was tested three days later. The first word was presented 18 times and the second word six times in a modified fast mapping trial. Successive introduction proved to be equal or more successful than concurrent introduction. Eight out of ten individuals successfully fast mapped two unfamiliar words when successive introduction was used. Individuals with little expressive language were able to benefit from fast mapping via this approach (Wilkinson & Green, 1998).

In a follow-up study by Wilkinson et al. (2003), learning was significantly better following the successive introduction procedure for the typically developing control group; however, for individuals with cognitive impairment, there was no statistical difference between the concurrent and successive introduction conditions. Receptive vocabulary acquisition is challenging for children with significant cognitive impairment. Some

participants with receptive age estimates below 60 months did not demonstrate learning under either condition. Results also suggested that children in the autism spectrum may learn better through concurrent presentation. This research indicated that children with cognitive impairment were successful at fast mapping, but that this was not necessarily leading to learning new vocabulary. This implication was supported in later research by Wilkinson (2007) who found that initial fast mapping was successful, but that retention was poor in children with cognitive impairment.

2.5.3 Hearing Impairment

Lederberg et al. (2000) studied two aspects of language acquisition in hearing impaired, namely; rapid word learning and novel mapping who were 3-6 year old and found that performance was better in rapid word learning than the novel mapping. And also they found that there was a significant correlation between receptive vocabulary and performance. Hansson, Forsberg, Löfqvist, Mäki-Torkko and Sahlén (2004) compared children with mild-to-moderate bilateral sensorineural hearing impairment, and specific language impairment between 9–12 years to check the role of working memory in learning new words for primary school age children. Children with hearing impairment performed significantly better than children with the specific language impairment on tasks assessing novel word learning, They found that the best predictor of novel word learning in children with hearing impairment and specific language impairment is the complex working memory. Stelmachowicz , Pittman, Hoover, Lewis and

Moeller (2004) studied rapid word learning in children with hearing impaired (Moderate hearing loss) in the age range of 6-10 years old and typical individuals. It was found that hearing impaired performed poorer even with adequate training and exposure given.

2.5.4 Specific language impairment

Another population in which fast mapping has been evaluated is in individuals with specific language impairment (SLI). Alt, Plante, and Creusere (2004) studied the fast mapping abilities in children with SLI. Participants in this study included children ages 4:0 to 6:5. One group was composed of children with SLI, while the other group included children with typical language development. Objects were introduced and knowledge was assessed through a computer program. Objects were presented by a creature figure; the children clicked a smiling creature or a crying creature to answer if the response was correct or incorrect. In the fast-mapping context, fewer features were recognized by the SLI group than children with typical language development for both objects and verbs. Gray (2005) provided additional support for the finding that children with SLI have difficulty with words learning during fast mapping tasks. Results from that study indicated that children with SLI had difficulty forming phonological representations and phonological-semantic links for word learning. Alt and Plante (2006) emphasized that children with SLI performed poorly when mapping lexical labels and nonverbal semantic features during a fast mapping task.

2.5.5 Down syndrome

Fast mapping studies have also been done in children with Down syndrome. Chapman, Kay-Raining Bird and Schwartz (1990) compared the performance of adolescents with Down syndrome and children with typical language development on a fast mapping task. Individuals with Down syndrome were ages 5:6 to 20:6, while the typically developing children were 2:0 to 6:0 years of age. The two groups were matched for nonverbal mental age. Participants were exposed to target words through a hiding activity. For comprehension, older children (16-20 years) with Down syndrome performed significantly better than the 12 - 16 year old group. Sixty-two percent of the younger group passed the comprehension task, while 100% of the older group passed. An expressive measure was also obtained by having the experimenter hold up the objects and asks the child to name them. Research indicates that fast mapping is successful in children as well as adolescents with Down syndrome; it appears that more success is achieved with older adolescents.

2.6 Fast Mapping in Children with Autism

Few studies have addressed fast mapping in children with autism. Research by Heibeck and Markman (1985) indicated that fast mapping had a greater impact when children knew some words in the same category as the unfamiliar word. Baron-Cohen, Baldwin, and Crowson (1997) investigated the influence of the speaker's direction of gaze in word learning for children with autism who had documented impairment in joint-attention. The subject was given an object and the experimenter kept an object. As

the child looked at his/her object, the experimenter looked at the object held in the experimenter's hand and said the name of the novel object. In this condition for introduction of the novel item, the experimenter's direction of gaze was used. The two objects were then put in a bag with two unused novel objects, and the child was asked to find the previously named object. The researchers found that only 29.4% of children with autism with documented deficits in joint-attention correctly mapped a novel word to a novel object using the experimenter's direction of gaze. Children with autism mapped the object that they were looking at rather than referring to the object the experimenter was looking at.

McDuffie, Yoder, and Stone (2006) examined whether fast-mapping mediates the relationship between attention and vocabulary size in a group of 29 children diagnosed with autism spectrum disorders. The children were ages 24 to 46 months of age. Eight objects representing brightly colored wooden shapes were presented. Fast mapping trials and attention trials were conducted. During attention trials, the object was labeled. For the fast mapping trials, previously labeled objects were presented with novel objects. Using repeated attention-following cues in combination with fast mapping allowed for successful acquisition of nouns in children with autism.

A study done by Luyster and Lord (2009) addressed fast mapping to determine if children with autism spectrum disorder (ASD) were able to use social information to guide their word-object mapping when matched with typically developing children with similar expressive vocabularies. The mean chronological age for children with autism was 30.86 months and the mean age for typically developing children was 20.62 months. The study began with familiar object training in which children were asked to choose the familiar object requested by the investigator when placed next to two

distracters. This task was used to determine if children were able to complete a basic task of fast mapping by associating a word with an object from a group of three. Children who passed this task were administered word learning tasks. Words for each fast mapping task were randomly chosen from twenty simple nonsense words. During the training phase, the investigator moved an object in front of the child and said, another non labelled object was also presented. The testing phase required the child to choose the named object from a group containing the non labelled object and the distracter. Results indicated that children with autism did not differ in their ability to learn the name of a novel object when the examiner followed the focus of the child's own attention or when the examiner's focus of attention was different from the child's. This suggested that, compared to typically developing children with the same expressive vocabulary, children with ASD also used social information to guide word object mapping.

Research focused on fast mapping skills in children with autism suggests that fast mapping of labels is successful when attention cues are given. It also indicates that children with autism who have impairment in joint attention fast map using their own direction of gaze rather than the examiner's direction of gaze.

More recent fast mapping studies of children with autism focused on their use of attention, gaze, and social information, rather than their capacity to learn and retain vocabulary (Brock, Norbury, Einav , Nation ,2008; Luyster & Lord ,2009). Objects to be fast mapped in these studies were presented individually rather than in a contrasting pair (one familiar and one unfamiliar item). The examiners presented an item and then labeled that individual item.

Norbury, Griffiths and Nation (2010) had investigated novel word learning in typically developing children and children with autism, participants were asked to define and name novel objects (testing semantic and phonological knowledge, respectively), quickly subsequent to learning and after four weeks . For verbal participants with ASD, recall of phonological information was noteworthy at both time focuses. In fact, they beat typically developing controls at mapping phonological forms to novel referents immediately after learning.

Another study done by Barcus (2011) investigated whether fast mapping a valid technique for vocabulary acquisition in school-age children with autism and whether children with autism able to retain novel words acquired through fast mapping. Participants included four children ages six to eight years who were diagnosed with autism. Participants 1 and 3 were nonverbal. Participant 3 had little meaningful expressive language. Participant 2 was verbal and had the largest vocabulary of all participants. While the language and cognitive levels of participants were diverse, all participants in the study benefited from fast mapping. Results indicated that fast mapping was successful in children with a range of expressive language levels. Even with such diverse language abilities, fast mapping was successful for all subjects, indicating its effectiveness among children with autism across different levels of cognitive and linguistic ability. To conclude, the above studies cited provide few interesting findings that pertain to fast mapping in Autism spectrum disorder population.

CHAPTER 3

METHOD

Aim

The present study aimed to investigate to the fast mapping abilities in Malayalam speaking children with Autism Spectrum Disorder in the age range of 4- 7 years.

Objectives of the study

The main objective of the present study was to investigate fast mapping abilities in children with Autism Spectrum Disorders.

Further, study also examined,

1. Comparison of novel word learning in children with ASD and typically developing children across recognition and naming tasks.
2. Comparison of practice effect (5 vs.10 repetitions) in children with ASD and typically developing children in novel word learning.
3. Comparison of immediate and delayed recall abilities of novel word learning in children with ASD and typically developing children

3.1 Participants

Two groups of subjects were considered for the present study, clinical group and the control group.

3.1.1 Clinical group

The clinical group consisted of a total of 10 children with ASD in the age range of 4-7 years.

3.1.1.2 Inclusion criteria:

While selecting these participants it was made sure that the participants were:

- ✓ Preschool or school going verbal children with native language as Malayalam
- ✓ Diagnosed as Autism spectrum disorder (ASD) by qualified speech language pathologists / psychologist / using Modified Checklist for Autism in Toddlers (MCHAT) (Robins, 1999) and Differential diagnosis checklist-Autism Spectrum Disorders (DDC-ASD) (Shyamala, Vijayashree, Sujatha & Rajkumar, 2008)
- ✓ Children who fall into the category of Mild Autism on Childhood Autism Rating Scale (Schopler, Reichler & Renner,1986)
- ✓ The participants with mild (MR), borderline or average intelligence as diagnosed by a psychologist
- ✓ No issues of hearing loss, visual impairment, and medical complications

Table 1
Details of the participants considered in clinical group

Sl No	Age/ Gender	Education
1	4 y/ M	Play school
2	4.4 y/M	Play school
3	5 y/ F	LKG
4	5.3 y /M	Play school
5	5.5 y/ M	Play school
6	6 y/ M	LKG
7	6.8 y/M	LKG
8	6.10 y /M	UKG
9	7 y/ M	1st Grade
10	7 Y/M	UKG

3.1.2 Control group

The control group consisted of a total of 10 age matched typically developing children. The language skills of the participants in control group were screened before the task. All children were screened and ruled out for sensory motor impairment using A TEN – question disability screening test (Appendix I) (Singhi, Kumar,Malhi & Kumar ,2007). The participant characteristics are shown in Table 2.

Table 2

Details of the participants considered in control group

Sl No	Age/ Gender	Education
1	4.3 y /F	LKG
2	4.6 y/ F	LKG
3	5 y/ M	LKG
4	5.5 y/ M	LKG
5	5.7 y/ M	UKG
6	6 y/ M	UKG
7	6.5 y/ F	UKG
8	6.7 y/M	1st Grade
9	6.9 y/M	1st Grade
10	7 y/ F	2nd Grade

3.1.3 Study design

Standard Group Comparison design

3.1.4 Operational definition of Novel word

Novel word is any word which is new and not present in the vocabulary of a group of 4 to 7 year old typically developing children.

3.1.5 Selection of novel words:

1. A set of 30 picturable words in Malayalam were randomly selected from the Malayalam text books of grade III to grade V. Those objects which are

commonly named in their second language were excluded to minimize the inaccurate responses.

2. To check the novelty, these words were given to 10 children within the age range of 4-7 yrs and were asked whether it is familiar or not. Twenty words which were selected as unfamiliar were considered for further procedures.
3. These twenty novel words were given to two speech language pathologists and two teachers to rate the stimuli using a two point rating scale (0-not appropriate and 1- appropriate)
4. 10 words rated as '1- appropriate' by at least one speech language pathologist and one teacher were selected for the current study.

From the finally selected ten novel words, two separate sets (S1 and S2) with five in each were made to give the two different practice trials(5 repetitions and 10 repetitions). The design of novel words selection is depicted in Figure 1.

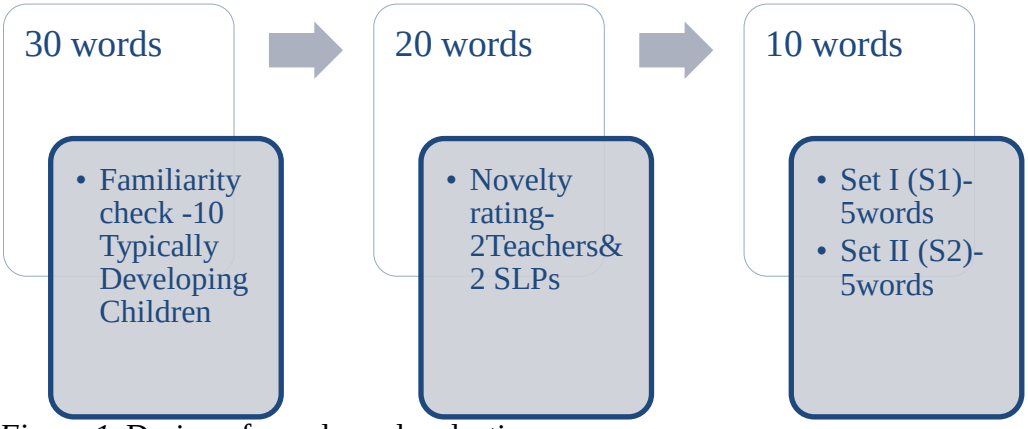


Figure 1 Design of novel words selection

After selection of these 10 novel words, the respective bmp picture and audio file were saved. Six sets of power point presentation files were prepared. The first and second sets of files were used in the training phase as practice trials

with 5 and 10 repetitions respectively (APPENDIX II). Third and fourth were prepared for the recognition and production tasks for S1 and fifth and sixth for S2 respectively. Slide show option was used to present the stimulus only in training phase.

3.2 Procedure

3.2.1 Training Phases

In the present study testing was done in distraction free and quiet environment. Study was carried out in 2 phases.

3.2.1.1 Phase I

In this phase each novel word was introduced in visual and auditory mode simultaneously in laptop using Microsoft PowerPoint software (Microsoft office 2013). For each novel word the visual stimuli was presented for a duration of 7,000ms and simultaneously, the corresponding audio file was repeated for 5 times. Inter stimulus interval was set to 6,000ms.

During the training period for typically developing children, no prompts or visual cues were given. The participants were instructed to carefully listen, watch, and remember the novel word. Similar training procedure was followed for children with ASD but during the initial training phase, prompts and visual cues were given to ensure that they sustain their attention on the screen.

3.2.1.2 Phase II

Same procedure was used for the second phase. Here next 5 new set of novel words were presented for 10 times.

3.2.2 Response Phase

After both the training phases, immediate and delayed recalls were checked. Delayed recall was checked after two days. The responses were evaluated for both immediate and delayed recall through

1. Recognition task
2. Production Task

3.2.2.1 Recognition task

In recognition task, children were given 3 pictures consisting two non trained words and one trained novel word. Participants were asked to identify trained target novel word. Participants were instructed to point to the trained novel word when named by the examiner. These trained novel pictures were presented via laptop (Dell Inspiron15 inches with Windows 7 operating system) along with pictures of word which was given as choice. Child scored '1' for every correct response.

3.2.2.2 Production/ Naming task

In production task, child was presented with each novel word picture through laptop and name it and score '1' was given for correct name. To rule out the familiarity of the responses due to recognition and production task, counter balancing of the task was done. Here 5 children

in both the groups performed recognition task first followed by production task. And next 5 children in both the groups performed production task first followed by recognition task.

3.3 Scoring and Analysis

Scores of each participant were noted for recognition and production tasks across

1. 5 repetitions and 10 repetitions
2. Immediate and delayed recall

Data of all the twenty participants in both the groups were entered into SPSS (Version 21) software and subjected to further statistical analysis.

CHAPTER 4

RESULTS AND DISCUSSION

The present study aimed to explore the fast mapping abilities in novel word learning in children with autism spectrum disorder using recognition and production tasks. Statistical analysis was done to measure recognition and production responses in both control and clinical group participants in the following conditions.

1. Fast mapping abilities in children with autism spectrum disorder and typically developing children across recognition and production tasks
2. Effect of number of training; 5 (S1) vs. 10 (S2) repetitions in training phase in children with Autism spectrum disorder and typically developing children on fast mapping
3. Immediate (I) vs. Delayed recall (D) abilities of novel word learning in children with Autism spectrum disorder and typically developing children

Following statistical measures were applied to the data collected for recognition and production scores obtained by 10 children with ASD and 10 typically developing children.

a) Descriptive statistical analysis was done for recognition and production scores across the above mentioned three conditions.

b) Non parametric Mann Whitney -U test was carried out on the data to examine pair wise difference between children with Autism spectrum disorder and typically developing children.

c) Non parametric Wilcoxon Signed rank test was applied on the data to examine pair wise difference between the conditions for two sets such as (S1) and (S2).

d) Similarly for the immediate recall (I) and delayed recall (D) the pair wise difference between the conditions were examined using Wilcoxon Signed rank test.

There were eight variables studied.

Table 3

Expansion of variables measured in the study

Conditions	Expansion
NIS1	Normal Subtest one Immediate recall
NIS2	Normal Subtest two Immediate recall
NDS1	Normal Subtest one Immediate recall
NDS2	Normal Subtest two Delayed recall
AIS1	ASD Subtest one Immediate recall
AIS2	ASD Subtest two Immediate recall
ADS1	ASD Subtest one Delayed recall
ADS2	ASD Subtest two Delayed recall

Note: I: Immediate Recall and D: Delayed Recall, S1: Subtest 1, Novel words presented to children with 5 repetitions and S2: Subtest 2. Novel words presented to children with 10 repetitions ,N: Typically developing children A: Children with ASD

The results of the study are discussed in specific to following objectives.

4.1 Objective 1: Fast mapping abilities in typically developing children and in children with ASD: Recognition & production

The mean, median and standard deviation measures were compiled for NIS1, ADS1, NIS2, ADS2, NDS1, ADS1, NDS2 and ADS2 for both recognition and production tasks which are depicted in Table 4.

Table 4
Mean, Median and standard deviation measures of typically developing children and children with ASD in recognition and production tasks

Variables	Recognition			Production		
	Mean	Median	S. D	Mean	Median	S. D
NIS1	4.70	5.00	0.483	2.90	3.00	0.876
AIS1	3.70	4.00	1.160	1.80	2.00	0.789
NIS2	4.90	5.00	0.316	3.50	3.00	0.972
AIS2	4.00	4.50	1.333	2.10	2.00	0.738
NDS1	4.80	5.00	0.422	3.10	3.00	0.994
ADS1	3.80	4.00	1.317	1.30	1.00	0.823
NDS2	4.90	5.00	0.316	3.10	3.00	0.994
ADS2	4.00	4.00	1.054	1.90	2.00	0.876

The figure 2 represents the median values of recognition and production of ASD and typically developing children across 4-7 years.

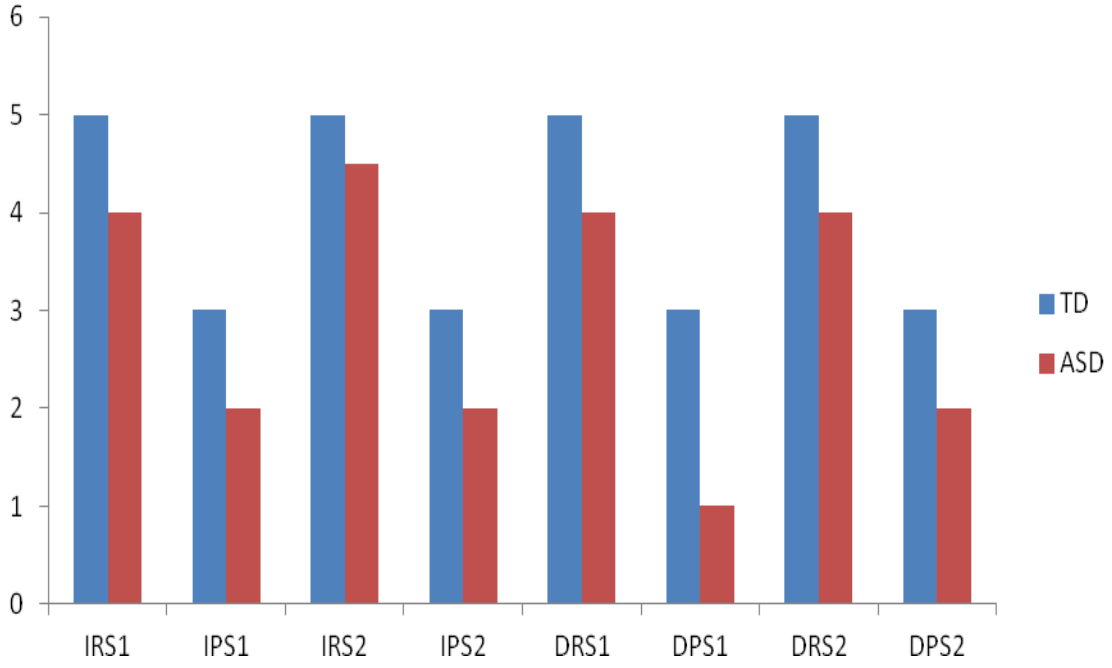


Figure 2 : Median values for recognition and production in ASD and typically developing children

The median scores for immediate recognition of S1 in typically developing children and ASD were 5 and 4 respectively whereas for immediate production the scores were 3 and 2 respectively. For the S2, median scores for immediate recognition in typically developing children and ASD were 5 and 4.5 and corresponding median scores of immediate production were 3 and 2. For the delayed recognition of S1, median scores for typically developing children (5) were higher than children with ASD (4) and for delayed production the scores were 3 and 1 respectively. Median scores for delayed recognition and production of S2 in typically developing children were greater than children with ASD.

So from Table 4 and figure 2, it was found that there was a difference between children with ASD and typically developing children across recognition and production

of S1 and S2 tasks. The median scores for both groups in production task were lesser compared to recognition scores.

Further, Mann Whitney U test was applied on the data to examine the statistical significance between children with ASD and typically developing children for both recognition and production task which is tabulated in Table 5.

Table 5

Comparison of performance in recognition and production task for typically developing children and children with ASD

Pairs	Recognition		Production	
	Z	p Value	z	p Value
AIS1-NIS1	-2.134	0.033	-2.568	0.010
AIS2-NIS2	-2.009	0.044	-2.935	0.003
ADS1-NDS1	-1.780	0.075	-3.270	0.001
ADS2-NDS2	-2.364	0.018	-2.494	0.013

*p<0.05-significant difference

From Table 5, test results revealed that in recognition task there was a significant difference found in children with ASD and typically developing children for the immediate recognition of S1 (AIS1-NIS1 |Z|=2.134, p=0.033), immediate recognition of S2 (AIS2-NIS2 |Z|=2.009, p=0.044) and for the delayed recognition of S2 (ADS2-NDS2 |Z|=2.364, p=0.018) but no statistically significant difference found for delayed recognition of S1. Whereas for production task, there was significant difference across all the pairs i.e. for the immediate production of S1 (AIS1-NIS1 |Z|=2.568, p=0.010), immediate production of S2 (AIS2-NIS2 |Z|=2.935, p=0.003), delayed production of S1 (ADS1-NDS1 (|Z|=3.270, p=0.001) and delayed production of S2 (ADS2-NDS2 |Z|=2.494, p=0.013), the differences were statistically significant.

From median scores and Mann Whitney-U test it is evident that scores obtained for typically developing children was better than children ASD.

While comparing recognition and production skills across children with ASD and typically developing children, both groups succeeded at correctly fast-mapping novel words in the recognition task than production task. However as expected, typically developing children had better fast mapping skills in both recognition and production than children with ASD. This result can be explained in the following two possible ways.

1) Role of attention in word learning

Majority of the literature highlights that both visual and auditory attention are equally important in early word learning(Mundy & Neal, 2001; Sigman, Dijamco, Gratier, & Rozga, 2004).The child's visual and auditory attention to spoken language , the ability to direct and engage attention, making use of the relevant contextual and social cues, influence early vocabulary learning in typically developing children. The studies have shown that children with ASD might show difficulties with different aspects of attention such as; attention shifting, reflexive gaze following, joint as well as shared attention, attention to child directed speech , atypical attention allocation etc. when compared to typical population (Charman et al., 2003; Landry & Loveland, 1988; Leekam, Lopez, & Moore, 2000).

A study done by Priessler and Carey (2005), indicated that children with ASD show joint attention difficulties and in learning new words and fast mapping of those novel words. Walton and Ingersoll (2013) studied how the typically developing children (mean age was 23.53 months) and children with ASD(aged 38-97 months)

fast map novel words, they found that young typically developing children follow where another person is looking and fast map object names. However, in their study, the children with ASD demonstrated wrong mapping of newly learnt words.

A review of referential gaze and word mapping in ASD by Akechi and Kobayashi (2014) suggests that some individuals with ASD have difficulty mapping novel words to novel objects using eye gaze cues because they attend less to the speaker's face and some have difficulty because although they can follow the speaker's gaze, they do not appear to consider it an important referent. From the literature it can be concluded that the ability to learn novel words is facilitated by the ability to focus attention on relevant aspect of objects. Hence in the current study, the difference between children with ASD and typically developing children on fast mapping skills may be attributed to attention deficits.

2) Lexical semantic networks

Secondly, healthier the exposure, richer is the semantic network. Children with ASD frequently reveal lesser comprehension of how words relate each another and experience difficulties incorporating new lexical-semantic information with previously learned one, which additionally substantiates diminished semantic networks in ASD population (McClelland, 2000; Tachibana et al., 2013; Henderson, Powell, Gareth Gaskell, & Norbury, 2014), they also suggest that the lexical-semantic deficits in children with ASD may indicate their weaknesses in declarative memory. According to Boucher, Mayes and Bigham (2008) children with ASD often experience deficits in declarative memory, which restrain or inhibit episodic learning and word learning

(Boucher, Mayes, & Bigham, 2008; Boucher & Mayes, 2012). Other views propose that individuals with ASD may have relative strengths in explicit or declarative learning, but atypical consolidation processes may prevent the consolidation of explicit memory and integration of lexical-semantic information (Henderson et al., 2014). In fact, Boucher and Mayes (2012) have suggested that atypical connectivity in the posterior parietal cortex or the prefrontal cortex may underlie semantic deficits in individuals with ASD. The poor fast mapping abilities in children with ASD in the current study could have been due to their impaired declarative memory leading to lexical semantic deficits and thereby hindering novel word learning in children with ASD.

From the results it was also observed that both groups had reduced scores on production task compared to recognition task. The asymmetry in recognition and production may be attributed to difference in demands imposed by the tasks. The two tasks place different demands on retrieval process that is, the retrieval of a word for production may require activation strengths that are greater than those needed to access a word in comprehension (Capone & McGregor, 2005). The finding that an expressive mapping task is more troublesome for typically developing children than a receptive mapping task is in consonance with the studies of early language development, which specify that children frequently comprehend words that they are not yet able to say (Fenson et al., 1994). The findings of the study done by Walton and Ingersoll (2013) suggest that, in the language age range examined (15–30 months), receptive mapping is well-solidified, but expressive mapping is not yet solidified. Interestingly, children with typical development were most likely to make correct mappings during follow-in trials,

and were less likely to form correct mappings during orienting or redirecting trials, which were not significantly different from chance.

In the current study typically developing children performed better than children with ASD in production task. Probably the poor performance in children with ASD on production task can be due to their poor phonological and semantic lexical processes affecting one another in word learning (Henderson et al., 2014). The other factor which influencing the performance of task is the nature of modality. Since production involves active retrieval, there is necessity for numerous exposures to the novel words in order to fast map these in the memory lexicon.

Objective 2: Effect of Training phase - S1 (5 Repetition) vs. S2 (10 Repetition): Recognition & Production in ASD and typically developing children on fast mapping.

The mean, median and standard deviation measures were compiled for NIS1, NIS2, NDS1, NDS2, AIS1, AIS2, and ADS1and ADS2 to compare the effect of practice trials which is depicted in Table 6.

Table 6
Mean, Median and standard deviation measures of typically developing children and children with ASD in recognition and production tasks

	Recognition			Production		
Variables	Mean	Median	SD	Mean	Median	SD
NIS1	4.70	5.00	0.483	2.90	3.00	0.876
NIS2	4.90	5.00	0.316	3.50	3.00	0.972
NDS1	4.80	5.00	0.422	3.10	3.00	0.994
NDS2	4.90	5.00	0.316	3.10	3.00	0.994

AIS1	3.70	4.00	1.160	1.80	2.00	0.789
AIS2	4.00	4.50	1.333	2.10	2.00	0.738
ADS1	3.80	4.00	1.317	1.30	1.00	0.823
ADS2	4.00	4.00	1.054	1.90	2.00	0.876

The figure 3 represents the median values of recognition and production of S1 and S2 in ASD and typically developing children across 4-7 years.

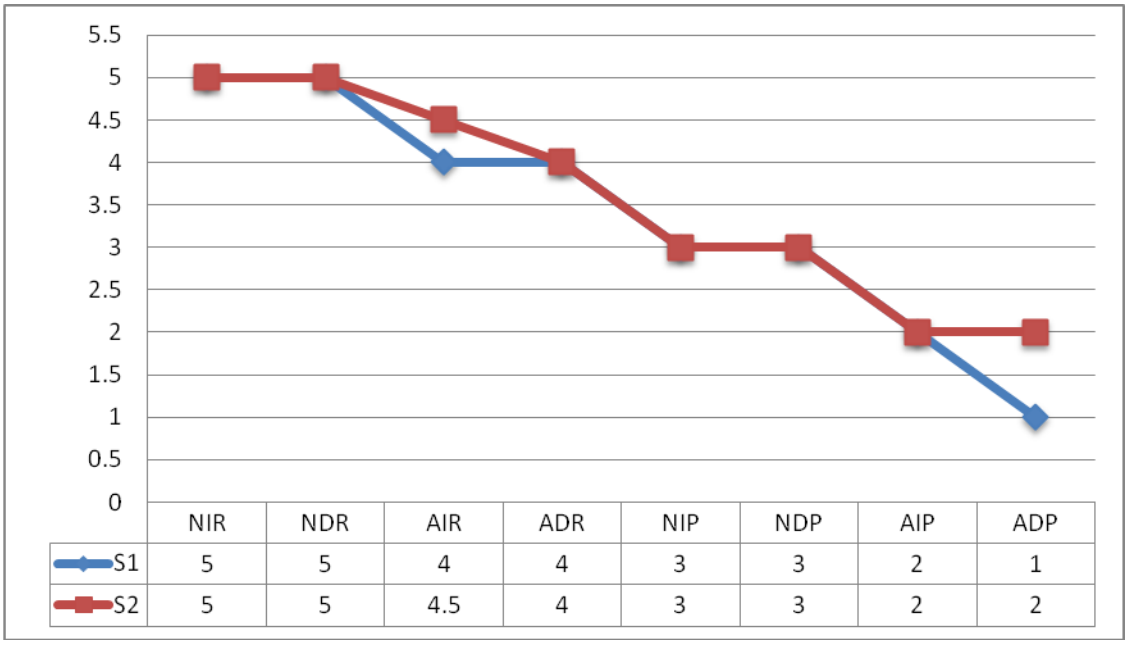


Figure 3: Median values for recognition & production of S1 vs. S2 (5 vs. 10 repetitions) in typically developing children and children with ASD

Note: NIR- Normal Immediate Recognition, NDR- Normal Delayed Recognition, AIR- ASD Immediate Recognition, ADR- ASD Delayed Recognition, NIP- Normal Immediate Production, NDP- Normal Delayed Production, AIP-ASD Immediate production, ADP-ASD Delayed Production

In typically developing children median scores for immediate as well as delayed recognition and production were same for S1 and S2. Similarly in children with ASD, no difference was observed for delayed recognition and immediate production of S1

and S2. Whereas median scores for immediate recognition and delayed production of S1 and S2 were 4, 4.5, 1 and 2 respectively.

Further, explicitly to compare effect of S1 vs. S2 (5 vs. 10 repetitions), Wilcoxon Signed rank test was applied on the data to examine the statistical significance on S1 vs. S2 for both recognition and production task in children with ASD and typically developing children, the scores are tabulated in Table 7.

Table 7

Comparison of S1 and S2 performance for recognition and production tasks in typically developing children and children with ASD.

Pairs	Recognition		Production	
	Z	p value	Z	p value
NIS2-NIS1	-1.414	0.157	-2.121	0.034
NDS2-NDS1	-0.577	0.564	-0.000	1.000
AIS2-AIS1	-1.000	0.317	-1.342	0.180
ADS2-ADS1	-0.707	0.480	-2.121	0.034

From Table 6, on analyzing practice effect of S1 and S2 for recognition task , no statistically significant differences were found for immediate and delayed recognition in both typically developing children and in children with ASD (NIS2-NIS1 $|Z|=1.414, p=0.157$; NDS2-NDS1 $|Z|=0.577, p=0.564$); AIS2-AIS1 $|Z|=1.000, p=0.317$ & ADS2-ADS1 $|Z|=0.707, p=0.480$). This suggests that just the repetition of novel words for five times was sufficient enough to recognize the novel words in both typically developing children and in children with ASD.

Houston-Price et al. (2007) found that typically developing young children were able to fast map new words to object images after just three image-label repetitions when highly salient visual and auditory stimuli were used in their sample of sixty four children aged 18 months. On opposing to this finding study done by Deepak (2016), young children in the age range of 5- 8 years performed better when the novel words presented for 10 times than 5 times across both naming and recognition tasks.

On analyzing the results of production task, the results revealed that there was significant difference in the immediate production of S2 and S1 in typically developing children (NIS2-NIS1 (|Z|=2.121, p=0.034)), whereas there was no difference found in the scores for delayed production of S2 Vs S1 in typically developing children. In children with ASD, statistically significant difference was found in the delayed production of S2 (ADS2-ADS1|Z|=2.121,p=0.034). This suggests that the participants were able to produce more words in subset 2 (S2) which were presented for ten times than in subset 1 (S1) which were presented for only five times. This finding supports Gershkoff- Stowe & Hahn (2007), where in the authors have found that learning of novel words in younger children progressed as the training trails increased. MacDonald and Christiansen (2002) concluded that number of input frequencies directly strengthens the knowledge representation of the language. In Luyster's (2007) novel word-learning study, children with ASD heard the novel word nine times as opposed to three times and author found that children showed improved performance for the words which are heard for nine times. This can be assumed to be due in increase in strengthening of lexical activation with repeated trials.

Secondly it can be due to stages involved in fast mapping phase, wherein in the initial stage child has only partial knowledge of the meaning of the word, whereas in the second phase of acquisition, this information will be gradually expanded and modified as additional experiences with that word clarifies its full meaning, eventually coming to resemble adult meaning. Perhaps second stage requires more exposure and if the child has achieved the second stage of mapping then the learned word will be easier to retrieve. This might be one of the reasons, to say that with increase in number of repetitions recognition and naming of word is easier (Carey, 1978). In the same vein, findings of the current study reveal that practice effect was observed for the fast mapping skills of children with ASD which is reflected as the better scores in S2 delayed production. This indicates that even in fast mapping as the practice trials increases the child is better able to store it into the long term memory and retrieve it.

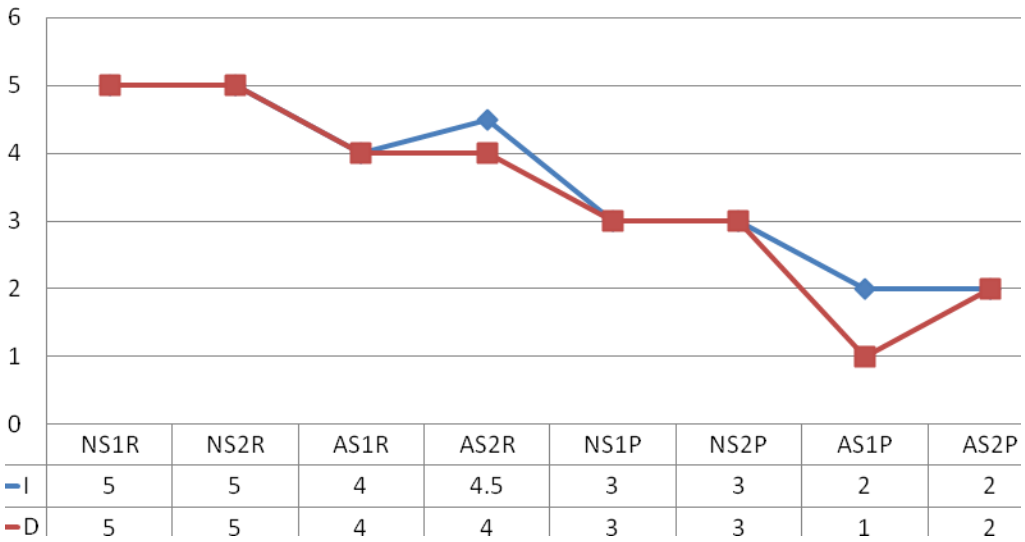
Objective 3: Immediate Recall vs. Delayed Recall: Naming & Recognition

The median and standard deviation measures were compiled for NIS1, NDS1, NIS2, NDS2, AIS1, ADS1, AIS2 and ADS2 to compare the performance of children with ASD and normal children in immediate and delayed recall tasks are tabulated in Table 8.

Table 8
Mean, Median and standard deviation measures of typically developing children and children with ASD for recognition and production tasks

Variables	Recognition			Production		
	Mean	Median	S. D	Mean	Median	S. D
NIS1	4.70	5.00	0.483	2.90	3.00	0.876
NDS1	4.80	5.00	0.422	3.10	3.00	0.994
NIS2	4.90	5.00	0.316	3.50	3.00	0.972
NDS2	4.90	5.00	0.316	3.10	3.00	0.994
AIS1	3.70	4.00	1.160	1.80	2.00	0.789
ADS1	3.80	4.00	1.317	1.30	1.00	0.823
AIS2	4.00	4.50	1.333	2.10	2.00	0.738
ADS2	4.00	4.00	1.054	1.90	2.00	0.876

The median values for immediate and delayed recall recognition and production of S1 & S2 are depicted in figure 4.



	NS1R	NS2R	AS1R	AS2R	NS1P	NS2P	AS1P	AS2P
I	5	5	4	4.5	3	3	2	2
D	5	5	4	4	3	3	1	2

Figure 4: Median values for immediate and delayed recognition and production across typically developing and children with ASD

Note: NS1R- Normal Subset1 Recognition, NS2R- Normal Subset2 Recognition, AIR- ASD Immediate Recognition, ADR- ASD Delayed Recognition, NIP- Normal Immediate Production, NDP- Normal Delayed Production, AIP-ASD Immediate production, ADP-ASD Delayed Production.

From Table 8 and Figure 4, it can be inferred that there was no difference in median values of recognition and production between immediate vs. delayed recall task in typically developing children. Overall, recognition scores were superior to production scores for both immediate and delayed recall tasks. From the median scores, it was observed that children with ASD scored high on immediate recognition of S2 compared to delayed recognition of S2. Similarly these children performed better on immediate production of S1 compared to delayed production of S1.

Further, explicitly to compare effect of immediate recall vs. delayed recall, Wilcoxon Signed rank test was applied on the data to examine the statistical significance between immediate and delayed recall for both recognition and production

task in children with ASD and typically developing children, Results of pair wise comparison are tabulated in Table 9 .

Table 9
Comparison of performance in immediate recall vs. delayed recognition and production of novel words across typically developing children and children with ASD

Pairs	Recognition		Production	
	Z	p value	Z	p value
NDS1-NIS1	-0.816	0.414	-1.134	0.257
NDS2-NIS2	0.000	1.000	-1.897	0.058
ADS1-AIS1	-0.577	0.564	-2.236	0.025
ADS2-AIS2	0.000	1.000	-1.000	0.317

From Table 9, results revealed there was a significant difference found in children with ASD on the immediate and delayed production of S1 (ADS1-AIS1 $|Z|= 2.236$, $p=0.025$); that is immediate production of set one (S1) word list was better when compared to delayed recall of set one (S1) word list. The findings of this study support the study done by Deepak (2016), wherein the author had found that recognition and naming of novel words in bilingual children within 5 to 8 years was better in immediate recall on comparison with delayed recall. The old memories are stronger while newer memories are more prone to disruptions or they may interfere with old memory. In order to make newer memory stronger, it requires sufficient amount of exposure as well as number of rehearsals (Suzuki et al., 2004). Hence increased exposures to new words result in better memory retention over the older learned words. Immediate recall of newly learned words are triggered by short term memory which is independent of any rehearsals, while delayed recall is by long term memory which is directly dependant on

frequent rehearsals. Hence this explained why immediate recall is superior to delayed recall.

The children may not retain all the words learned from the fast mapping process as fast mapping may not be sufficient for improving lexicon as well as for the retention of newly learned words. Therefore, a subsequent extended slow mapping would also be necessary for word learning. Hence it could be inferred that development of lexicon is a process and fast mapping just triggers the process and need not be the complete word learning process (Deepthi et al., 2009). So after stage of fast mapping there should be a stage of slow mapping to make delayed recall abilities stronger, this in turn requires sufficient amount of exposures and rehearsals. This could be another probable reason why immediate recall was better than delayed recall.

From overall statistical analysis of the study, following results were revealed

1. There was significant difference across naming and recognition in all the conditions. Control group and clinical group participants outperformed in recognition task compared to production in all the conditions.
2. Children with ASD performed better in 10 repetition training phase compared to 5 repetition phase in production task, where as in recognition task tasks practice effects were not seen.
3. Children with ASD performed better on immediate recall compared to delayed recall in production task, No effect of immediate and delayed recall in recognition tasks..

CHAPTER 5

SUMMARY AND CONCLUSION

The present study aimed to explore the fast mapping abilities in novel word learning in children with ASD using recognition and production task. In this study two groups were considered, control and clinical group. Control group consisted of 10 typically developing children aged from 4-7 years and clinical group consisted of 10 children with ASD. Children were trained for a set of 10 novel words in Malayalam. Out of ten words, five words were trained for 5 repetitions and another five words were trained for 10 repetitions. These words were trained with aid of pictures and audio recordings. After the training phase, children were tested for recognition and production task in terms of immediate and delayed recall task. Hence results were unfolded and studied across three conditions; i) comparison between fast mapping abilities of typically developing children and children with ASD ii) Effect of training phase (5 vs. 10 repetitions) and iii) Immediate vs. delayed recall abilities in fast mapping iv)Effect of task)Recognition Vs Production). Each condition scores were separately calculated for each participant and overall data was statistically analyzed using SPSS software version IBM 21. The data was subjected to descriptive statistics and based on the normality criteria, non-parametric tests were employed.

When comparing fast mapping abilities in children with ASD and typically developing children on recognition and production skills, both group succeeded at correctly fast-mapping novel words in the recognition task. However as expected, typically developing children had better fast mapping skills in both recognition and production than children with ASD.

On examining effect of (5 vs. 10) repetitions, results revealed that in children with ASD novel words when trained for about 10 times had superior scores compared to 5 repetitions and this was attributed to strengthening of lexical activation & lexical semantic connections. Further, when these links experienced more and more activation, retrieval of newly learnt words becomes easier and efficient. Thus, it can be said that network successively readjusts the connection weights and results in representing information.

Results for comparing immediate recall condition vs. delayed recall revealed better performance in immediate recall than delayed recall. Increased exposures to new words result in better memory retention over the older learned words. Immediate recall triggered by short term memory involves fleeting representation of novel lexical knowledge which is independent of any rehearsals, whereas in delayed recall that is actively functional by long term memory is directly dependant on frequent rehearsal. Hence this explained why immediate recall is superior to delayed recall.

From the present study, it can be concluded that Fast mapping is a valid technique for stimulating vocabulary acquisition in children with autism. The factors that play crucial role in the process of fast mapping any language are extended exposures and longer retention skills. Recognition is especially easier for any children compared to production, since the nature of demands imposed by the former is least. Although, children learn new words in a single new exposure by fast mapping the new word, it may not be sufficient for the development of lexicon. Hence, the children may not retain all the words learned from the process of fast mapping, a subsequent extended slow mapping would also be necessary for word learning. Fast mapping can

be applied across settings and situations to introduce new vocabulary. Children with autism responded well to the fast mapping strategies of novel word learning.

Implications of the study

- The process of fast mapping can be employed in order to further enhance the vocabulary of children with ASD.
- This study is insightful to understand the relationship between mode of stimulation and response elicitation in novel word learning for both typically developing children and children with Autism spectrum disorder.
- This study implies that fast mapping strategies might be included in the intervention procedures for language disordered population, especially in children with autism.

Limitations of the study

- The present study included a small sample size of ten subjects in both groups of typically developing children and children with ASD; hence generalization of these findings to wider population may be restricted..
- Number of repetition rates could have been varied to see wider variations in recognition and production tasks.
- Word length would have an influence on novel word learning; in the current study this variable was not controlled. Influence of word length on fast mapping skills may be studied independently.
- Only children with mild autism were studied.

- Gender comparison was not done as there was only one female child in the control group.

Future directions

- Fast mapping abilities can be studied across different age groups in children with ASD to check for how these words are acquired by children in each age group.
- Fast mapping abilities in children with different severities of autism can be studied.
- The variables such as age and gender could be considered for comparison in future studies..
- Fast mapping abilities can be studied across different lexical categories like noun vs. verbs.
- Reaction time / response time taken for learning can be incorporated in future studies.
- Long term retention of fast mapped novel words can be studied.

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Appendix I

CHECKLIST 1

A TEN – QUESTION DISABILITY SCREENING TEST

These questions can be used in a house-to-house survey to identify children who could benefit from extra stimulation or special care. This could also be used in child centers and schools where teachers might be able to provide direct assistance or refer children with particular needs to special health or educational facilities.

1. Compared with other children, did the child have any serious delay in sitting, standing or walking?
2. Does the child speak at all?
3. Can the child make himself understood in words; can he say recognizable words?
4. Does the child having difficulty seeing?
5. Does the child have any difficulty hearing?
6. When you ask the child to do something does he seem to understand what you are asking?
7. Does the child have any weakness and/or stiffness in the limbs and/or difficulty in walking or moving his arms?
8. Has the child had often fits, become rigid or lost consciousness in the last six months?
9. Has the child had any other serious accidents or illness?
10. Compared with other children his age, does the child appear in any way backward, slow or dull?

Appendix II

Sl No.	S1 (5 repetitions)			
	CB 1	CB 1	CB 2	CB 2
1	കലപ്പ	/kalappa/	ചിരവ	/tʃirava/
2	നെറ്റിപ്പട്ടം	/nettippattam/	ഗദ	/gada/
3	തെറ്റാലി	/t̪etta:li/	പല്ലക്ക്	/pallakk/
4	പീരങ്കി	/pi:rangi/	തബല	/t̪abala/
5	ചങ്ങാടം	/tʃaŋa:dam/	പീരങ്കി	/pi:rangi/

Sl No.	S12 (10 repetitions)			
	CB 1	CB 1	CB 2	CB 2
1	കാറ്റാടി	/ka:tta:di/	പടക്കം	/padakkam/
2	ഭരണി	/bʰaraṇi/	പരിച	/paritʃa/
3	ചർക്ക	/tʃaRka/	കമുക്	/kamuk/
4	പങ്കായം	/panka:jam/	പമ്പരം	/pambaram/
5	ആട്ടുകല്ല്	/a:ttukall/	തോരണം	/t̪o:ranam/

Note:

CB1: Counterbalance 1
CB2: Counterbalance 2
S1: Subtest 1 (5 repetitions)
S2: Subtest 2 (10 repetitions)

Pictures used to teach novel words

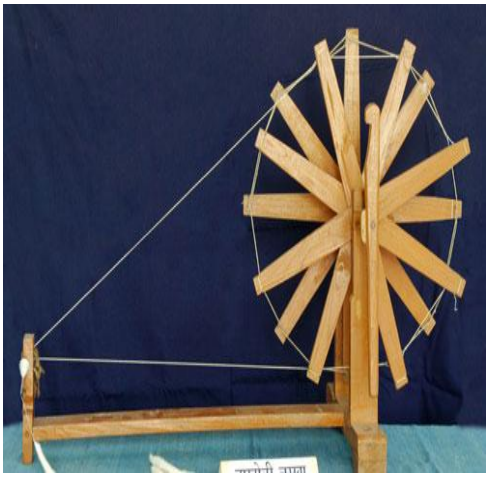
S1 (5 repetitions)

CB 1

CB2: S1 repetition related pictures

S2 (10 Repetitions)

CB 1



CB 2: S2 repetition related pictures