EÖTVÖS LORÁND UNIVERSITY
FACULTY OF EDUCATION AND PSYCHOLOGY
PH.D SCHOOL OF EDUCATION

Rapid Naming Ability of Children on the Autistic Spectrum

Submitted By Ronit Welgreen

Advisor: Prof. Mária Gósy

April 2008

ABSTRACT

Rapid Naming Ability of Children on the Autistic Spectrum

By

RONIT WELGREEN

Advisor: Professor Mária Gósy

This research deals with rapid naming ability of children on the Autism Spectrum. The objective of this study was to investigate word retrieval ability of autistic children and to research the impact of therapy intervention on retrieval production.

The research population consists of twenty children with typical development of communication, language and speech and forty children diagnosed on the Autistic Spectrum (twenty children diagnosed as Asperger Syndrome and twenty children diagnosed as PDD NOS).

All the children were integrated in regular elementary schools, and had reading skills enabling them to cope with written letters and numerals. All the children come from a similar social and economic background and their mother tongue is Hebrew. The autistic children had language skills enabling language and oral communication interaction.

The subjects of the study were presented with three word retrieval tests:

1. Rapid Automatized Naming Test (including the rapid automatized naming of common objects, colors, numbers and letters).

2. Verbal Fluency Test (including semantic and phonological naming tasks).
3. Word Finding Test-2 (including picture naming of nouns and verbs, as well as sentence completion).

An intervention plan was structured and administered by the researcher in order to study the effectiveness on retrieval production. Ten low grade children (five from the Asperger group and five from the PDD group) were engaged in therapy intervention, focused on enhancing word retrieval and rapid naming abilities for four months.

Twenty low grade children on the autistic spectrum were tested again, four month after the first test session.

The findings suggest that children on the autistic spectrum have word retrieval difficulties. These difficulties decreased with age in the Asperger group.

Most of the children who were engaged in the therapy intervention managed to improve their retrieval abilities after treatment.

The findings further indicate that professional therapy dealing with word retrieval ability can improve word retrieval and rapid naming among children on the Autism Spectrum.

ACKNOWLEDGMENTS

I would like to thank all the caring people who helped me in conducting this study.

First and foremost I would like to extend my most sincere thanks to my advisor, Professor Mária Gósy, for being so professional and kind in her remarks. I greatly appreciate her interest in the study, her accessibility, her guidance and her continual support and encouragement.

Thanks to Dr. Yehuda Schwartz for his optimism, efficiency and his assistance in the organization work

Thanks to Miri Peer who translated the research study so professionally with sincere motivation to understand every professional word and idea.

I am most grateful to the children and their parents who took part in the studies, for their assistance, cooperation and participation as subjects for my research. Without you, this thesis would not have been possible. I love you all.

Finally I want to express my love and deep gratitude to my mother, my husband Zvika and my three children Eran, Oded and Michal. Thank you so much for believing in me and supporting me in difficult hours.

I want to express special gratitude to you, Zvika, for your never-ending love, for being so encouraging and patient with the long hours I spent over this research. You are my love and my best friend ever.

I dedicate this work to all of you - my beloved family. Thanks to you, nothing seems impossible.

Ronit Welgreen

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: LIITERATURE REVIEW

A. Communication, language and speech

Both speech and language are parts of the larger process of communication. Communication is the primary function of language. (Muma, 1978 in Owens, 1992). It is the process participants use to exchange information, ideas, needs and desires, an active process that involves encoding, transmitting and decoding of a message (Owens, 1992). The degree to which the speaker is successful in communicating is called communication competence. (Dore, 1986 in Owens, 1992).

Language is a code shared by human society, representing ideas through the use of a rule-governed system made up of arbitrary symbols. It enables people to convey and receive ideas and messages and function effectively in society. (Bemstein & Tiegerman, 1993 in Plaut, 1994).

Language is a complex system which can be divided into three components – form, semantics and pragmatics (Bloom & Lahey, 1978).

The form component comprises the phonological system - the sound system we use in language; the morphological system - the rules of joining sounds in order to produce words or to change the meaning of words; the syntax system – how words are organized in sentences and syntactical phrases.

The semantic component includes the rules governing the meaning or content of words and phrases. Semantics deals with the relation between the form component of language and our perception of our surroundings, objects and events, cognition and thought (Bowerman, 1976 in Owens, 1992).

The pragmatic component includes the rules governing conversation and social use of language. Pragmatics is the linguistic functioning in changing social situations (Owens, 1992) .

When we use language in order to influence another person or convey information, we employ pragmatics, which is the manner in which we use the form and content component for social communication purposes.

Pragmatics involves three aspects of language use: conversational skills, adaptation of the use of language to a situation (location, conversation topic, and partners) and the ability to step into the shoes of one's conversation partner (Neville, 1990).

In normal pragmatic functioning, the speaker should be able to change the utterance when s/he feels that the message has not been adequately understood, to adapt the use of language to different groups of listeners, to be familiar with and employ the correct conversation rules, to react to language interaction in a relevant manner, to initiate relevant interaction with conversational partners and to use non-verbal clues of language in a relevant manner.

When we demonstrate normal pragmatic language ability, we can create language interaction in a specific context, dedicated to a specific purpose (Heward & Orlansky, 1992).

People with an impairment related to the form component of language may demonstrate pronunciation errors or difficulties, a limited vocabulary, a lack of grammatical skills (e.g. verb declensions according to person and time – single/plural, masculine/feminine, etc.) and difficulty in joining words into sentences according to the accepted syntax rules.

Difficulties or a disability in the semantic field are related to meaning. People with a semantic impairment may present problems in word retrieval, production and comprehension of abstract concepts and word categorization, as well as difficulties in production and comprehension of words with a double meaning, word combinations, comprehension and production of slang, idioms and imagery, focusing on the subject of a

sentence or an idiom, difficulty in organizing a coherent and focused verbal message, etc.

A pragmatic disability may also take the form of non-correlated use of language. While a person with this problem may have a normal morphological system, adequate speech comprehension and good syntax skills, he or she may demonstrate difficulties in understanding verbal interactions and participation in verbal communications.

Children with pragmatic disorders may learn the language code but have difficulties communicating by means of language (Lahey, 1988).

A problem with the pragmatic component causes difficulties with corresponding conversational rules (speaking in turn, making eye contact, focusing on the subject of the conversation), theory of mind and obsessive and inflexible discussion of a specific subject, lacking social consideration.

Verbal message can be conveyed by means of the voice channel, written language or sign language. Speech is the oral channel of language.

Speaking is one of man's complex skills. It is a skill which is unique to our species. Every typically developing child acquires speaking skills at an early age. The ability to acquire language is clearly driven by a genetically given propensity for language. Speech develops throughout the years of childhood and necessitates interaction between the child and his or her language environment.

The mature language user also keeps expanding his lexicon as new words are needed or arise in the language. (Levelt, 1989).

Numerous research projects attempted to explain the process wherein the speaker can transform intentions, thoughts and feelings into fluently articulated speech. Words serve to invoke concepts. They do this by using largely arbitrary phonological emblems. To bridge the divide between meaning and sound in production, many theories postulate that

there is an intermediate retrieval step in the transition from a concept to the sound form that conventionally conveys the relevant meaning. Because messages are not represented linguistically, appropriate words must be located within or retrieved from the vast mental dictionary in a speaker's memory. (Bock, Konopka & Middleton, 2006).

In order to produce effective oral verbal interaction (speech for communication purposes), one requires word retrieval – the ability to find the requested word as rapidly as possible, in order to convey the desired message in the most precise and intelligible manner.

B. The Mental Lexicon and Word Retrieval.

Our mind has a concept for every existing object in the form of a mental image, as well as a lexical entry, which is the actual word (form or meaning), stored in the mental lexicon. This lexicon is the long-range memory reservoir where words are stored throughout life. It includes semantic information about the meaning of the word, syntactical information related to the manner in which the word is incorporated in a sentence and information pertaining to form –spelling and the manner in which it is spoken. When a word is retrieved from the mental lexicon, it is accompanied by its syntactical, morphological and phonological attributes. From this word reserve, we create phrases and sentences (Jackendoff, 2002 in Elman, 2004).

While the mental lexicon resembles a dictionary in that it contains information about words and other language components, it differs by the manner in which words are organized. In an ordinary dictionary, the words are arranged in alphabetical order and when the spelling of a word is known, it is easy to find. In the mental lexicon, the words are not accessed by their spelling, but rather by their meaning, form and relation to other words. Also, there is a certain amount of word substitution in the

lexicon, when throughout the years, certain words are forgotten and new ones are added.

When discussing the order and organization of the mental lexicon, the main theory claims that it consists of a collection of connected networks where words with a similar meaning are grouped together. Hence, if the words in the lexicon are connected semantically, then words which are related to each other, such as “chair”, “sit”, “table” will be located close together, while words which have nothing in common, such as “chair”, “dinosaur” and “broccoli”, will be far apart.

People know and use thousands of words most of which are accessed in the space of microseconds for the purpose of speech. This indicates that, the mental lexicon is meticulously organized. It is important to keep in mind that efficient organization enables both -quick retrieval and storage of a maximum number of concepts. The conclusion is that the mental lexicon is both extensive and highly complex (Aitchison, 2002).

According to Aitchison (2002) the mental lexicon – a metaphor – is concerned with links, not locations, with cores – not peripheries and with frameworks – not fixed details.

The ordinary speed of speech production is about 15 sounds or several words per second. The average adult may know more than 75,000 words in his mother tongue (Matlin, 1998 in Schwartz, 2002)

A person writing or speaking has to find words in order to express thoughts; however, knowing the word and its inclusion in the lexicon are not enough. We have all experienced the situation where we are searching for a familiar word but cannot access it when we need it. Usually, people can provide partial information about the requested word; if the speaker provides a wrong word, it usually shares certain features with the target word, such as similar semantic character, a similar role in the sentence, identical end phoneme or prefix, etc.

Even if the speaker has a very extensive mental lexicon, slow word retrieval creates a problem with the regular flow of speech.

Naming speed has been conceptualized as ‘a complex ensemble of attentional, perceptual, conceptual, memory, phonological, semantic and motoric’ sub-processes that place heavy emphasis on precise timing requirements within each component and across all components.

(Wolf et al., 2000).

How does the speaker retrieve the correct word from among thousands of others? The lexical retrieval process has to be capable of choosing the right word, as well as the correct transformation of the word. As a result, the retrieval model has to take into account how syntax changes the retrieved words (Pinker, 1999 in Schwartz, 2002).

In normal speech process, mistaken retrievals occur at an average of only once per thousand words. Namely, we are capable of retrieving two to three words per second from a lexicon containing tens of thousands of items, almost without erring (Butterworth, 1989 Levelt et al, 1991 in Biran & Friedmann, 2006; Levelt, Roelofs & Meyer, 1999)

The lexical processes consist of a lexical production. In lexical comprehension, the individual accesses and retrieves the words from the mental lexicon, joins them together and tries to interpret and comprehend the sentence as a whole. This lexical process consists of the following:

1. Recognition of the words – either auditory or visual
2. Lexical access – the point where all the information about the word becomes accessible
3. Speech comprehension– understanding the semantic representation.

Lexical production means the conveyance of a verbally communicated message. This process consists of the following:

1. The formulation of the communicated message.
2. Lexical access – the point where all the information about the word becomes accessible.
3. Speech production–production of the relevant semantic representation.

Research has found that accessibility of the required word crucially depends on the manner in which the information is stored and organized in the mental lexicon (Baddeley, 1982).

Morton (1969) and Brown & McNeill (1966 in Biran & Friedmann, 2002) assumed that lexical access consists of a single stage, based on a certain criterion which determines the retrieving process from a single word list. A different and widely accepted view maintains that speech planning progresses via conceptualization and formulation, followed by articulation (Levelt, 1989).

Research findings of speech errors, "tip of the tongue" situations and word retrieval pathologies led to the development of different models which suggested a double-stage approach (Dell, 1986; Levelt, 1989; 1992; Garrett, 1992; Butterworth, 1989 Patterson & Shewell, 1987 in Biran & Friedmann, 2002; Harley & Bown, 1998 Martin, Dell, Saffran, & Schwartz, 1994 in Schwartz, 2002).

According to these models, lexical access consists of two separate stages – the semantic and the phonological. Some of the models claim that the semantic stage precedes the phonological, with very little overlapping between them and that the semantic and phonological information about a word are stored separately. Despite the fact that the models differ in some details, the basic model advocating that semantic retrieval comes

first, followed by phonological retrieval, is generally accepted (Caramazza & Miozzo, 1997).

According to the model described by Ellis & Young (1988 in Biran & Friedmann, 2002) naming an object requires that it be recognized (visual identification). The identification is not yet represented by a word, since it is only a conceptual representation. It is language which enables the translation of concept into words. If we wish to participate in verbal interaction, we must first formulate the communication we wish to convey (verbal conceptualization). Identification of an object leads to activation of the information we have about its significance.

If so, the first stage in accessing a word is the process of semantic retrieval, in which the speaker activates the correct and relevant semantic information for the purpose of the desired speech activity. The semantic concept of the object is represented by a word in the lexicon. The speaker addresses a lexical concept, in accordance with the relevant context and purpose (Levelt, 1989; 1992). Conveying the verbal message requires that the words representing the concept be retrieved from the lexicon. The representations of the words are stored in the semantic system, which contains the meaning of the words in the lexicon. The semantic lexicon contains the semantic characteristics of the word, such as category, function, size, color, form, noun, etc.

In certain models, the semantic stage is divided into the conceptual non-verbal stage and the semantic lexical stage. These models suggest that the semantic lexicon contains an abstract representation of the words, known as lemma (Levelt 1989; Kempen & Hhijbers, 1983 in Biran & Friedmann, 2002).

The lemma contains semantic and syntactic information about the word which to be retrieved, with no phonological details. The syntactical characteristics of word class labels, sub categorization features for verbs

and grammatical gender for nouns - when connected to the abstract meaning of the word - produce the lemma.

This initial stage consists of the semantic representation of the word, its meaning, without any information about sound. The chosen concept activates the syntactical and semantic components system which represents it and this activation spreads in the semantic network to all the concepts related to the target word, which in turn activate their lemmas.

The chance for selecting the target lemma from the mental lexicon is the ratio between the activation level of this lemma and the general activation of all the lemmas. This ratio is known as “Luce”.

When the target word is accompanied by a deflecting word, the latter leads to a contest between the related semantic lemmas, and is slowing down the selection process. This phenomenon is known as the semantic delay effect. The activation spreads along the semantic network and is the explanation for semantic mistakes, which constitute about two thirds of picture naming errors (Biran & Friedmann, 2002; Levelt, 1999).

The second stage of the retrieval process is the phonological retrieval stage, in which the specific phonological form of the word in question is accessed; successful phonological access enables word production. The morphological, phonological and prosodic features of the word, known as lexeme, are the sound representation of the word.

In the phonological output lexicon there is access to the word’s spoken form and that is where we retrieve the structure of the word as a sound sequence. The assumption is that the connections between the lemma and the lexeme are arbitrary in principle and the semantic and phonological information about the word are stored separately (Bock & Levelt, 1994; Dell, 1986; Fromkin, 1971; James & Burke, 2000; Garrett, 1975; Levelt, 1992; 1989; 1999).

The phonological output lexicon transfers activation from the semantic system to the phoneme level stored in the phonological buffer, where the speech sounds are represented as separate units. At this stage, activation of the required phoneme sequence takes place. The distinction between the morphological and syntactic levels was first suggested by Garrett (1975). Garrett claimed that there are two types of errors:

1. Errors of substitution, involving words from the same grammatical class but different phonology (e.g. replacing “pillow” by “blanket”); namely – the mistaken word fits the required lemma. (Tweney et al, 1975).
2. Substituting words with a similar phonological structure, but with different meanings, namely lexeme matched (e.g. replacing “mittens” with “muffins”) (Tweney et al., 1975).

Garrett (1975) did not refer to the clear distinction between lemma and lexeme, presented by Kempen and colleagues (Kempen and Huijbers, 1983 in Roelofs, Meyer & Levelt, 1998; Kempen and Hoenkamp, 1987), whose theory states that the lexical representation of lemma indicates the semantic/syntactic properties and that lexeme indicates the morphological properties.

For example, the lemma of the word “blackboard” specifies that the word is a noun. A noun lemma can be specified for the abstract morph syntactic parameter of number. A verb lemma specifies, in addition to the word class, which types of arguments (e.g. a direct and an indirect object) the verb takes. It contains free parameters for the specification of tense (e.g. present or past), aspect (imperfective or perfective), number (singular or plural), and person (first, second, or third person). During the subsequent process of word-form encoding, the lemma and the abstract morph syntactic specification are used to recover the appropriate morphemes and segments (together making up the lexeme) from the

mental lexicon. For example, for the lemma of “blackboard” plus the parameter singular, the morphemes black and board and their segments are recovered. (Roelofs, Meyer & Levelt, 1998).

Caramazza and Miozzo (Caramazza, 1997; Caramazza & Miozzo, 1997; Miozzo and Caramazza, 1997) opposed the lemma/lexeme distinction proposed by Roelofs, Meyer & Levelt, (1998), claiming that there is only one lexical stage between the meaning and the segments of a word, instead of two – lexeme and lemma. Their theory proposes a single junction connecting meaning and syntax with the phonology of the word. The customary debate in research is whether words are represented as syntactic and semantic elements, distinctive from the form representation. According to the model of Butterworth (1989 in Biran & Friedmann, 2002) the first stage consists of access to the semantic lexicon which receives a semantic code as input and produces a phonological code as output. In the second stage, the phonological lexicon receives a phonological address as input and produces a phonological word form as output. In this model, the semantic lexicon is based on pairs of feature sets connecting a set of semantic characteristics with a set of phonological characteristics. The semantic features lead to a search based on the semantic criterion of the word in the lexicon. The set of phonological features (e.g. the number of syllables, accent, prefix, end phoneme) represents an address for the word in the phonological lexicon. Addresses based on phonological properties may represent several words (Nickles, 1997 in Biran & Friedmann, 2002).

An important element in Levelt’s model, as well as in the models proposed by Butterworth (1992 in Biran & Friedmann, 2002) and others, is that the phonological form of the word does not appear as a whole word and is not retrieved as such; rather, it is structured from the word mold – the metric information which includes information about the

number of syllables and the location of the accent (Levelt 1989; 1992), as well as from the segments which compose it. The segmental information includes details about the consonants and vowels, and according to Levelt & Wheeldon (1994 in Biran & Friedmann, 2002) – about clusters of consonants, as well. Some researchers claim that the metric and segmental information are organized in parallel form (Butterworth, 1992, Levelt et al, 1999).

According to Levelt (1992) the metric information is retrieved before the segmental information, and that is why examinees in 'tip of the tongue' situations can provide information about the number of syllables in the non-retrieved word, but not segmental information.

According to Levelt's model, the phonological stage consists of four parts:

1. The metric information is retrieved from the phonological representation, making the word mold accessible.
2. The segmental structure of the lexical item is retrieved and provides a sequence of phonemes.
3. The segments are introduced into the syllable mold.
4. The syllable molds serve for retrieving syllable plans stored for articulation purposes.

At this stage, the speaker has a word with the appropriate meaning and phonological structure, and must make the necessary motor plans for oral production of the word.

The research conducted by Biran and Friedmann (2006), examined how the phonological information is represented and retrieved and how the metric and segmental information are organized by analyzing naming mistakes made by people with anomia (naming disorders) caused by brain damage. Twenty-four anomic examinees with different naming

disorders were asked to name 200 pictures of objects. A detailed analysis of the types of paraphasia (naming mistakes) was made. The model for phonological information retrieval emerging from this research shows that the metric and segmental representations are separate and apparently organized in a parallel order. After retrieving the metric and segmental representation, the segments are embedded in the sound envelope of the word during phonemic placing stage, creating the whole word.

According to Aitchison (2002), when attempting to formulate a model of a word selection process, the following important factors must be taken into account:

- While the lemmas (meaning and word class) may be separate from the word form, this separation is not absolute. Some word retrieval mistakes involve mistakes of meaning as well as mistakes of form.
- The general framework of the retrieved target word may be correct, while the details are erroneous.
- Words similar in meaning and form properties may compete with the target words. People activate many more words than are necessary for speech, and these sometimes jump into the utterance unnecessarily.

Although most researchers have adopted this two-tiered approach, the relationship between the two levels of encoding remains controversial. Are the two stages independent and discrete, in that no information is transmitted until a single lemma has been selected, or does information pass to the next level as lemmas get activated (i.e. a cascaded system)?

If the latter is correct, are there phonological influences on lemma selection via feedback from the phonological to the lemma level?

These questions engage the best researchers in the field, and there is as yet no clear-cut theory regarding retrieval processes from the mental lexicon.

The findings from research studies with adults have led to three models of the process. Aitchison (2002) mentions three word retrieval models:

1. Stepping stone model

This model portrays the speaker as crossing a stream, stepping from stone to stone and pausing on each stone. Each step is completed before the next one is attempted, and there is no interaction between the steps. According to this model, a person selects a lemma (meaning and word class) when stepping on the first stone. When moving to the second stone, the speaker grasps the form of the word. These two stages are serial, indicating that the lemma must be retrieved first, followed by the phonological retrieval.

(Butterworth, 1992; Miozzo & Caramazza, 1997).

In the modular view (Levelt et al., 1999), naming is seen as a serial process, moving from the lemma to the lexeme. Phonological encoding is assumed to start only after the target lemma is selected and to constitute the phonological encoding of the target lexeme alone. This model does not explain why there may be mistakes in both meaning and form if there is absolutely no connection between one stage and the next.

2. Waterfall or cascade model

In this model, the information about the meaning still exists when the sounds are selected. The activation of the word remains accessible while the speaker is busy with the sounds, indicating that the person turns to sounds before the final selection of the meaning has been made.

Cascade models suggest that activation spreads from lemmas to the phonological level and that activation of the target lemma occurs as well as partial activation of alternative forms (Blanken, Dittman & Wallesch, 2002 in Messer & Dockrell, 2006).

This model does not address the fact that meaning and sound are mutually influential (like a waterfall which flows in one direction only).

3. Interactive activation model**:**

In interactive models with a changing flow direction, the movement is to and fro and activation moves forward and backward between the lemma and lexeme levels, activating several foci.

Interactive processing models (Dell, Burger, & Svec, 2002 in Messer & Dockrell, 2006) allow for a bidirectional spread involving positive feedback from lexeme to lemma. According to Burke et al. (1991), in the interactive models the search for the lexeme depends partly on success in the lemma stage. Therefore, in both the serial and the interactive models, the lemma represents an important initial stage in accessing word forms (Miozzo & Caramazza, 1997; Harley & Bown, 1998 in Roelofs, Meyer and Levelt, 1998)

Each model points to the importance of both the lemma and lexeme levels in fast and accurate lexical selection. In addition, the role of competitive items in influencing error patterns has been noted at both the lemma (Blanken et al., 2002 in Messer & Dockrell, 2006) and the lexeme levels (Gaskell & Dumay, 2003).

One form of evidence often cited in support of interaction is the occurrence of “mixed” errors (semantic errors that bear a phonological relationship to the target), which occur in both natural and experimental corpora at rates greater than chance.

Those who do not accept the frequency of mixed errors as support for the interactive view suggest that the errors may be artifacts of one kind or another (a point to be addressed further later), and also that these are among the errors most likely to be missed by a speech editing mechanism charged with finding discrepancies between the target word and the item that has been programmed for output (e.g. Levelt et al., 1999).

In models of language production of adults, accessing a word in the lexicon involves activation and competitiveness between numerous candidates. The stronger the activation of the word, the better the chance that the word will be selected as a candidate for retrieval (Dell, 1990 Marslen-Wilson, 1990 Stemberger, 1989 in Gershkoff-Stowe 2002). Word naming is influenced by a range of factors such as word frequency, age of acquisition, and lexical neighborhood (Newman & German, 2002)

Frequency of the word in the language:

The frequency of the word in the language is known to affect the different stages in the lexical processes. In the course of speech perception, words used more frequently tend to be identified faster (Luce & Pisomi 1998) and more precisely in both noisy and quiet conditions (Dirks, Takayanagi, Moshfegh, Noffsinger & Fausti, 2001). In speech production assignments, frequently used words are pronounced faster (Jescheniak & Levelt, 1994; Lachman, Shaffer, & Hennrikus, 1974), are less prone to errors (Dell, 1988; Vitevitch, 1997, 2002) and are less involved in tip of the tongue situations in both young and adult speakers (Vitevitch & Sommers, 1999).

Less commonly used words are more exposed to error than words which are used frequently (Dell, 1990 Stemberger & MacWhinney, 1985 in Gershkoff-Stowe, 2002). Children with word retrieval difficulties presented more naming errors with seldom-used words (German, 1979, 1984).

In the early stages of speech development, when children begin to name objects, all words are of low frequency use, because of the short time span. Hence, children's first words are fragile and highly vulnerable to the effect of interference. This assumption explains word retrieval difficulties of the child learning new words (Gershkoff-Stowe, 2002).

During the language acquisition period, when the child encounters numerous occasions in which s/he hears and uses the word, the relative frequency of the word use is on the rise. (Schwartz & Terrell, 1983 in Gershkoff-Stowe 2002). This indicates that the age of the word acquisition is of significance, as well. Some words are learned earlier in life than others. Such words are applied more frequently and retrieved more easily on the basis of partial clues of sound or syllable than others, which are acquired later on in life (Gilhooly & Gilhooly, 1979; Lachman, Shaffer, & Hennrikus, 1974)

Age of acquisition also affects word reading speeds (Barry et al., 2001) and as a result, words learned recently are less accessible (Newman & German, 2002). The effect of age decreases with time; the difference in accessibility of a word learned at the age of five in comparison with a word acquired at the age of six wanes within a span of a few years. Therefore, the acquisition age factor is more significant among younger children than among older ones. Nevertheless, research shows that acquisition age continues to be relevant among adults, as well (Gilhooly & Gilhooly, 1979).

The research of Milianti & Cullinan, (I974 in Leonard et al 1983) and Rudel, Denckla, Bro-man, & Hirsch, (1980) who examined word retrieval ability among children, and that of Oldfield & Wingfield, (1965 in Leonard et al, 1983) – who researched the word retrieval ability of adults, showed that the retrieval process was faster when the target words were more frequently used in the language.

Lexical neighbourhood:

According to the neighbourhood activation model, a potential source of lexical accessibility difference is the similarity of certain words to others in the mental lexicon (Luce & Pisoni, 1998). This model is supported by semantic priming tests. In this process, the word retrieval assignment is

preceded by the presentation of a word tasked with activating or delaying the retrieval of the target word. The findings show that the examinees make a faster and more correct decision when the priming word is semantically related to the target word.

Meyer and Schvaneveldt (1971) tested these theories in relation to the lexical decision assignment. In their research, they presented words with meaning and pseudo-words and the examinees had to decide as fast as possible whether the presented word was familiar. This decision involves searching the lexicon for the target word; the time required for reaction equaled the time required for the search. The researchers assumed that this interval would be shorter if the previous search was held in the neighborhood of the search for the current target word, and longer if two consecutive words were in very different locations in the lexicon. In order to test this assumption, they presented consecutive pairs of items and asked the examinees whether each item in a pair is a standard word. The researchers correctly assumed that the reaction time for the second item would be shorter if it is a familiar word and if the first item in the pair is a word which is semantically related to the second. This process can be likened to a dictionary search for a word which begins with the same letter as the previous word.

This research result strengthened the theories based on spreading activation, which assumed that to identify or think of a word involved activation of a node that codes the word. The activation spreads to neighboring nodes which are semantically related; therefore, priming those nodes provides for a shorter reaction time and a more efficient functioning in the word retrieval assignment. By performing assignments of this type, involving words with different meanings, it is possible – in theory – to create a map of the semantic organization of the lexicon.

In the phonological lexicon, words are also organized according to their phonological resemblance to other words. For example, the word “cat” is located in a dense surrounding, because there are many similar words in English. Neighboring words compete with each other during word recognition and word retrieval because, as mentioned before, it is more difficult to focus, identify and retrieve words in a dense neighborhood.

According to Aitchinson (2002), the words stored in the mental lexicon are complete, but there is also storage of word prefixes and suffixes, so the speaker can change the words at will.

Thus - for adults, at least, there is a consensus among researchers that an initial semantic specification of the word at the lemma level occurs early in processing and that later there is more activation of phonological information at the lexeme level (Levelt, Roelofs, & Meyer, 1999).

The semantic level involves activation of a set of lexical candidates or lemmas and the selection of the target lemma, as well as relationships between words (Clark, 2002; Dockrell & Campbell, 1986 in Messer & Dockrell, 2006), although no single set of semantic relations or organizational structure is adequate for the entire lexicon (Miller & Fellbaum, 1991 in Messer & Dockrell, 2006).

The phonological processing stage includes the activation and the selection of phonological forms – lexemes (Fromkin, 1988 Garrett, 1988 in Messer & Dockrell, 2006; Levelt, 1989).

If we take into account that the naming process comprises object identification, then the naming process includes three stages: object identification, name activation, and response generation (Johnson, Paivio, & Clark, 1996 in Messer & Dockrell, 2006).

The developmental process of word acquisition indicates that the child’s acquisition of a word stock in as regards perception and comprehension precedes word production ability. The research conducted by Benedict

(1979 in Gósy & Kovács, 2002) reported the case of a 13 months' old child who could comprehend about 50 words, while the ability to produce 50 different words was acquired only at the age of 19 months. Despite these differences in comprehension vis-à-vis articulation development, there is no evidence of the existence of two mental lexicons – one for articulation and one for perception. Neurological explanations and research findings indicate that there is only one mental lexicon (Coleman 1998 in Gósy & Kovács 2002).

The size of the word store is not necessarily in linear correlation with the child's chronological age, and there are major differences from child to child. On the other hand, the development of comprehension and production of a single concept is much more uniform and regular. The accepted assumption is that comprehension of a concept is acquired first, while recognition and use of semantic relationships is secondary (McNeill 1970 in Gósy & Kovács 2002). Indeed, semantic fields are developed quite late in language acquisition.

Research findings confirmed that lexical details are organized in networks; a semantic store of words organized in a spider net-like manner exists at a relatively early age (Aitchison, 2002).

Children are capable of integrating recently acquired lexical items within the semantic network in the mental lexicon, but the new words are interconnected and linked to older words in the lexicon in a much looser manner than words acquiered earlier. The assumption is that a child's vocabulary continues to develop not only in terms of pronunciation and acoustics, but also by means of phonological mapping (Ingram 2001 in Gósy & Kovács 2002).

As for language development, word comprehension requires recognition of the word sounds and the ability to connect the word to the object it

symbolizes (such as an object, action, relation, etc.) (Huttenlocher, 1974 in Dapretto & bjork, 2000).

Language production requires the retrieval of a sound mold in association with meaning. In order to comprehend or produce a name which signifies an object, the child has to store in the mind non-verbal information about the type of object – shape, color, function – as well as a phonological representation of the sound mold which makes up its label. The discrepancy between comprehension and production of this object label must rely on the process of retrieving both types of information. In the language comprehension process, the child must retrieve the mental representation of the object when s/he hears its name and in the production process, the child must retrieve the phonological representation together with the name, whether the object is located right in front of it or in its mind.

The retrieval of a word meaning is usually easier than retrieval of word sounds, due to the following reasons:

1. Young children can mentally represent the images of people and objects long before expressive language appears (Mandler, 1988 in Dapretto & Bjork, 2000).
2. Words assume significance only if they are mapped for non-linguistic information. In order to comprehend a word, it is necessary to retrieve the phonological information which will link what we hear with what is stored in our memory. However, when we initiate production of a word, the process involves access to the phonological representation of the word without external clues, as well as maintaining this representation as active while motor planning and execution take place. (Dapretto & Bjork, 2000)

When referring to the language production model proposed by Levelt (1989) we may state that in lexical representations, the levels of lemma and lexeme exist in their entirety at a young age and the distinction between them becomes clearer as the child increases his or her word reservoir. Therefore, children's lexical access during language production is characterized by strategies resembling that of the adult person. However, there is a developmental difference between children and adults in word accessibility.

The research of Gathercole–Baddeley (1993 in Gósy & Kovács, 2002) observed that among English-speaking five-year olds, the length of the words and their phonemic similarity did not affect the vocabulary accessibility process, while in the case of 7-year olds, these two factors played a significant role. The semantic associations of the five-year olds still included concepts which did not fit the category in question, as opposed to the seven-year old children.

The activation of a word based on a prefix sound was hardly possible among four-year old examinees, while children aged seven and above could access several words matching the prefix sound they were supplied.

The research held by Dapretto & bjork (2000) examined word retrieval development at the end of the second year, together with progress in word production abilities.

Huttenlocher (74 in Dapretto and bjork, 2000) claimed that word retrieval difficulties at the beginning of the lexical stage stemmed from the gap between comprehension and utterance abilities. Certain researchers also add word overextension (in the production, not the comprehension process) to the retrieval problems. (Naigles & Gelman, 95 Fremgen & Fay, 1980 in Dapretto & Bjork, 2000).

According to Jarovinszkij (1995 in Gósy & Kovács, 2002) there is a significant similarity in the initial word store of children and the mental lexicon differences between one child and another are more quantitative than qualitative (Bakonyi, 1918 in Gósy & Kovács, 2002).

Certain research data suggest that word acquisition is relatively slow until the age of one and a half years, when significant word acquisition takes place. According to Gosy (1984), a test group numbering 30 children aged 3.0-3.3 in Hungary, demonstrated an average vocabulary of 1256 words.

According to Aitchison, (2002) the language acquisition process involves three stages: labeling, packaging and network building.

Labeling is not an automatic process. The ability to symbolize and understand that every object has a name develops slowly, beginning at the age of 1-2 years.

Packaging is the classification of several objects under a single label, or in other words – the ability to categorize. This process is characterized by two frequent mistakes – under extension and over extension – and takes place at the age of two to five.

Network building is a process which takes place by stages and can continue throughout life. Words are applied in a limited context only when first acquired. Slowly, the words are integrated in the network and a link is created, both due to syntax acquisition and also in order to enable fast word search when the vocabulary grows.

c. Word Finding Difficulties:

Object naming is a process we learn to perform during the early stages of language development. It is a process which takes place throughout life, rapidly and without conscious attention, except for those times when we "cannot think" of the required word (Lahey & Edwards, 1996).

Naming difficulties can greatly affect the production of larger language units (sentences, phrases, conversation). The naming of portrayed objects involves both lexical processes, such as retrieval of semantic information and phonological representation of the object's name and non-lexical processes, such as recognition and encoding of the visual stimulus (Lahey & Edwards, 1996).

Children with naming difficulties are children for whom lexical retrieval problems impede the normal pattern of language development and use. These problems include inaccurately producing the correct word even when the word's meaning is understood.

The terms word retrieval problem or word finding difficulty describe a situation in which an individual who knows and understands words and had used them effectively in the past, sometimes finds it difficult to come up with the appropriate word as rapidly as desired. The problem is defined as difficulty in retrieving a specific word in a given situation (Leonard, 1999).

The term word finding refers to the mental activity of selection or retrieval from the word lexicon, in order to express oneself verbally or in writing. A problem with word retrieval is an impairment of this mental activity (German, 2001).

Higbee (1993 in German, 2001) discerns between accessible and available information stored in memory. Available information is information one knows, stored in the memory, while accessible information can be either remembered or retrieved. According to Higbee, if there are word retrieval problems, the available information may not be accessible. While the speaker knows the word - it exists in his or her memory and is available – s/he cannot retrieve it and it is not available for use.

A word finding impairment is typically defined as a reduced ability to recall and/or produce a specific word in response to a stimulus or situation. (Faust, Dimitrovsky & Davidi, 1997).

Word finding problems may be evident in the production of a single word, connected discourse, or both. (German 1992 in Tingley et al, 2003). People who find it difficult to retrieve words or produce a specific word are capable of identifying and choosing this correct word when presented with a choice of possible words, but may be unable to produce it spontaneously and rapidly (Rubin & Liberman, 1983 in Dockrell et al, 1998).

People with a word retrieval problem may seem to be unable to answer questions, while in fact they know the answers and are prevented from expressing themselves clearly.

A difficulty or inability to produce the appropriate word in a given language activity may take one of several forms: a complete failure to produce the word, a pause – or delay tactic granting the speaker more time to come up with the right word, production of substitute words which do not fit the context, frequent use of unspecific "filler" words such as "this" or "thing", used to substitute the specific word (as in "the thing which opens doors"), or a meta-linguistic comment about the personal ability to produce functional language ("I can't recall the word"). In a context of spontaneous conversation or narrative discourse, the problem may take the form of hesitation, interrupted speech fluency or a re-phrasing of the entire text (Faust et al, 1997).

Byers et al (1989 in Dockrell et al, 1998) stated that children with word retrieval problems are perceived by their conversation partners in two different ways: either as quiet and non-communicative, due to the scarcity of spoken language, or as talkative - due to the extensive use of a

variety of substitute words and a verbal organization consisting of a lengthy description instead of a single focused word.

Children with word retrieval difficulties may also have a problem with the simple task of naming common nouns in a picture; they have been observed to be slower and less precise in their naming than their peers (Dockrell et al 1998, Constable et al, 1997).

This profile could occur in children who have typical levels of comprehension but whose difficulties with production are worse than average or children who have language disabilities but their ability to produce words is further below what would be expected on the basis of their comprehension. (Messer & Dockrell, 2006).

German (German, 1987; German & Simon, 1991) reported that in a story-telling paradigm, children with word finding difficulties, compared with chronological-age matched children, produced significantly fewer word tokens and had significantly more difficulties with lexical access (e.g., reformulations; unnecessary repetitions; fillers such as ah, er, or uhm; empty words such as thing or stuff; long pauses; and target word substitutions). Thus, the clinical pattern involved both an inability to find the appropriate word and the use of alternative behaviors to compensate for the word-retrieval difficulty.

Despite the fact that no specific cause for word finding difficulties among children has been defined, research indicates that both storing and retrieval processes are the source of these difficulties.

Nippold (92 in German, 2002) researched the basis for word finding problems and claimed that the causes are efficient storage and access difficulties of the phonological representation of the target words. (Faust et al 1997; Wing, 1990)

Research of retrieval errors indicates that easy access to words is not based solely on the meaning of the word or the structure of the lexicon,

but also on its phonological features (Fromkin, 73). As mentioned, the words are stored according to their meaning and form, and usually it is the form which delays access. Findings from these research projects led researchers to believe that word finding difficulties can gain from the use of phonological pointers in retrieval assignments (Faust et al, 1997).

There are three types of word finding difficulties:

- **Slip of the tongue-** use of a wrong word
- **Twist of the tongue-** wrong articulation of the word
- **On the tip of the tongue-** the speaker knows the word but cannot retrieve it.

Word finding difficulties may involve all three types – both simultaneously or singly (German, 2001).

Slip of the tongue – substitution of the target word by another word, usually related to it in meaning or sound. A specific word may be substituted by others from the same semantic field (e.g. the name of another animal, instead of the specific animal) or by words which are phonologically similar - words which sound similar (Snyder & Godley, 1992 in Tingley et al 2003; Fromkin, 1973).

Substitution on the basis of meaning takes place when one word is substituted by another because they are both uttered often in conjunction with other words in a sentence, or when two names are similarly linked to the speaker or to each other (e.g. substitution of children's names) (Roelofs, 1993 in German, 2001).

Substitution on the basis of sound occurs when the substitute word contains similar sounds to the target word (Fay, 1977 in German, 2001).

Twist of the tongue – involves omitting or substituting syllables in a word which was previously used correctly (German, 2001). This happens with words whose pronunciation is very familiar to the speaker and which were correctly pronounced in the past (Fromkin, 1973). Some of these retrieval errors are known as spoonerism. Despite the fact that the target word is known, there is a problem with retrieving all its sounds or the sound sequence. Sounds are either added (e.g. preliminary instead of primary), dropped (ambilent instead of ambivalent), substituted (asortize instead of amortize) or jumbled (irasel instead of Israel) (German, 2001).

On the tip of the tongue (TOT) is a situation in which the word retrieval is temporarily impossible and later is resolved. Most speakers can retrieve the target word when they are supplied with pointers such as the first sound or syllable. (Nicholas, 1977 in German, 2001). In natural settings TOTs are estimated to occur only about once a week (Reason and Lucas, 1983 in Gollan, 2001).

TOT situations have been observed in children as young as two years old (Elbers, 1985 in Gershkoff-Stowe, 2002). Schwartz (1999) reported that there is a term describing the phenomenon in all languages and in 45 of the 51 languages checked, the term included the word “tongue”, which relates to our feeling when we cannot retrieve a required word.

When there is a problem in rapid naming, the person feels like the word is on the tip of the tongue (TOT). This condition signifies a temporary lack of access, accompanied by a sense of being close to the specific word (“I know what I want to say”). This is a selective difficulty also experienced naturally by normal speakers, when seeking a certain item in their inner word lexicon; the speaker may report familiarity with the significance of the word, while simultaneously finding it difficult to retrieve it (James & Bruke, 2000; Rastle & Bruke, 1996)

This feeling of knowing the target word In a TOT situation, regardless of a person inability to retrieve it, is known as the “feeling of knowing”. (Koriat, 2000).

This feeling is described by James (1890 in Vigliocco, 2002) who said that we have a feeling of being close to the word, but are unable to produce it. Inaccessibility and imminence are two key features of an operational definition of TOT (Brown, 1991).

Frequent word retrieval problems significantly impair people’s oral language production for communications purposes. The solution of the TOT condition is spontaneous when the target word is retrieved after the speaker abandons the retrieval attempts (James and Burke, 2000). Retrieval is not an all or nothing situation. In a TOT situation, it is possible to access partial information about the target word, despite the retrieval failure. (Brown & McNeill’s, 1966 in Koriat et al., 2003)

In the research conducted by Koriat et al (2003), the examinees who failed to retrieve the word after being provided with its definition were capable of guessing its structure properties. In this case the pointers were semantic and the examinees managed to obtain partial information about the phonological structure of the target word. In other cases, where the pointers were different, the examinees could also access semantic and associative aspects of the target word (Lovelace, 1987 Yarmey, 1973 in Koriat et al., 2003). Since the normal lexical retrieval process is rapid, it is difficult to dismantle it experimentally into components; therefore, the TOT phenomenon is important to lexical retrieval theories. TOT is defined as a temporary breakdown in lexical retrieval and as such can provide some insight into the retrieval process, when it is delayed or halted (Kohn et al, 1987 in Schwartz & Frazier, 2005; Brown, 1991). This slowed-down retrieval process enables the researchers to examine its progression (Roelofs, Meyer & Levelt, 1998).

In the case of word finding models supporting two stages in word accessibility, there are two levels which have the potential to cause mistaken word retrieval – the lemma level, which represents the meaning and syntax of a specific lexical item, and the lexeme level, which describes the phonological and morphological form of the item. The assumption is that the errors reflect the point of failure.

Words are represented in our memory as a network of semantic associations. The more complex, strong and varied the network, the better and faster the word retrieval. A sparse network requires increased precision and therefore more time for word retrieval. Mixed errors – semantic and phonological – are attributed to retrieval stages corresponding to lemma and lexeme (Lahey & Edwards, 1999; McGregor, 1997).

Constable et al (1997) propose that word finding difficulties may stem from faulty phonological processing and not necessarily from the semantic system. Learning a new word involves phonological processing which includes auditory discrimination, segmentation ability and recollection of the word's sound mold. Their research found that word retrieval difficulties were caused by deficiencies in two phonological components of the lexical representation – phonological representations and motor planning. Problems with the phonological processing on the input and output levels lead to imprecise phonological representations. As a result, the connections between the semantic representation and the motor planning are faulty, impairing access to motor planning via the semantic representations and causing word retrieval problems.

James & Burke (2000) claimed that the structure of the phonological system which consists of junctions connected by a single node, and not numerous nodes – as in the semantic system – makes it more vulnerable.

According to McGregor (1997) semantic errors can also stem from a breakdown on the lexeme level; this is what happens when a child is incapable of finding the phonological structure of the target word and retrieves a similar semantic structure whose lexeme is retrievable.

Additional proof of the claim that deficient phonological processing causes word retrieval difficulty and that TOT reaction comes from blocked access to phonological information is the decrease of TOT phenomena following phonological treatment (McGregor, 1994).

Three psycholinguistic models of the TOT phenomenon have dominated research on the topic.

1. **Blocking hypothesis** (Jones, 1989). This is a theory relating to a situation wherein a competing lexical item blocks the retrieval of a target word (Woodworth, 1940, Reason and Lucas, 1983 in Gollan, 2001; Jones and Langford, 1987; Jones, 1989). In this type of theory, called the blocking model, the process of accessing the target word has been altered by the presence of an interfering and more active lexical representation. In more recent terminology, blocking could be implemented either with or without positing direct competition (e.g., Rumelhart and Zipser, 1986 in Gollan, 2001) between lexical representations. Direct competition is not necessary if there is a limited amount of activation that can be distributed among possible lexical candidates, but (at least in this instance) the outcome of direct and indirect competition is the same.

2. **Partial or incomplete activation hypothesis.** The hypothesis proposes that the target word is in a state of incomplete activation (Burke et al., 1991; Yaniv & Meyer, 1987 in Gollan, 2001) or that the representation is degraded (Brown & McNeill, 1966 in Gollan, 2001). In this type of account it is assumed that the order of events in lexical access is the same as it is in on-line language production but that it has been slowed drastically (Brown, 1991).

This conjecture states that a TOT situation occurs when the target word cannot be recalled but one feels that it exists. TOT is caused by sensing the existence of an un-requested target in memory, accompanied by a failure to bring it up to cognitive level.

3. **Transmission deficit model** which was developed by Burke et al. (Burke et al., 1991; James & Burke, 2000; Rastle & Burke, 1996; Askari, 1999 in Schwartz 2002). This model states that TOT occurs when the semantic representation of the word is activated but activation of the entire phonological representation fails; that the weak connection between the phonological representations leads to TOT, which in turn is strengthened by the production of phonologically-related words. For example, if one hears the definition, "a device for protection from the rain or sun" a semantic and perhaps a visual representation of the object may be retrieved, but the definition does not activate the phonological representation (e.g., the word "umbrella") (Schwartz, 2002). Like Burke, Caramazza & Miozzo, (1997; Miozzo & Caramazza, 1997) also stated that TOT situations occur when the phonological information does not follow the semantic information; they, however, disagreed about the number of stages in the process.

One way to study the storage system is through analysis of error types. Word-finding errors indirectly reveal the type of information stored and linked in the lexicon. Relations between errors and targets are predictable given current models of lexical access.

A simplified model of the process shows that the naming process includes the following:

a. A pre-word retrieval stage during which the picture to be named is processed visually.

b. Word retrieval proper, during which the lexical entry in the long-term store is accessed.

c. A post-retrieval stage wherein articulatory planning and production of the name are carried out. (McGregor, 1997)

This process comprises several points at which breakdowns may occur. Errors in visual perception may cause word substitution; these are not considered retrieval errors because they take place prior to the word finding process (German, 1989 in McGregor, 1997). True word-finding errors happen because of breakdowns in the stage of lexical entry. Under the assumption that errors are a direct reflection of point of breakdown (e.g., Butterworth, 1989 in McGregor, 1997), we can expect semantic errors because of breakdown at the lemma (e.g., horse for camel), phonological errors because of breakdown at the lexeme (e.g., honkey for donkey), and because of potential overlap in lemma and lexeme retrieval stages mixed semantic + phonological errors (e.g., cat for rat). (McGregor, 1997)

Additional naming errors may result because of breakdown following the retrieval process during the phonological planning and lower-level processes of articulation. Again, these mistakes are not considered to be word-finding errors. These errors are most easily distinguished from lexeme-based errors by their systematic nature. Often children's phonological and articulatory errors manifest a pattern (e.g., backing of alveolar stops in 80% of initial contexts). On the other hand, errors that result from poor storage and/or access to a lexeme are word-specific. (McGregor, 1997)

Tager-Flusberg (1986 in McGregor, 1997) examined object naming errors in a test group of 42 children of school age, consisting of 14 autistic cases, 14 mentally retarded children and 14 normally developed subjects. In each group, the most common mistakes were semantic

substitutions. McGregor, (1997) tested 12 kindergarten pupils with word finding difficulties vis-à-vis 12 normally developed children in word retrieval assignments (object naming, verb naming, story-telling) and also found that semantic errors were more common than any other phonological errors. McGregor explained the findings as supporting "In lemma and lexeme distinctions as proposed in adult-based models of lexical storage. Furthermore, the predominance of errors that bore semantic relations to their targets produced by both normal development and word finding groups suggests an early and robust organization of lexical storage into a network of related information.

Despite the similarity between the two, the children's group with naming problems demonstrated more word finding difficulties in all three research assignments.

The phenomenon of increasing TOT situations in older people has been widely researched, resulting in two main theories:

1. **Decrement theory** (Burke et al., 1991)

According to this theory, the increased frequency of TOT situations among older people is explained in deteriorating lexical network terms. The older we become, the weaker the connection between the semantic representations (lemmas) and the lexical representations (lexemes). This deterioration may render the retrieval process more difficult to perform, or cause it to be blocked by stronger connections. These failures in the retrieval process are experienced as TOT situations.

2. **Incremental knowledge theory** (Dahlgren, 1998 in Schwartz & Frazier, 2005)

This theory assumes that in general, older people have a larger vocabulary than younger people and more words can become temporarily inaccessible. While the retrieval process may be normal, the larger

number of retrieval options generates more errors and TOT situations are more frequent.

Word retrieval difficulties have been observed among diverse populations, including children who are not making good progress at school, children with dyslexia and children with language difficulties (Dockrell et al, 1998, Lahey and Edwards, 1999).

Accuracy and/or speed of production are typically measured, with slow, inaccurate performances thought to indicate word finding difficulties. (Tingley et al, 2003)

It has been found that word finding difficulties delay and lower the quality of oral communication, also hampering the acquisition of reading skills. Both oral communication interaction and reading are processes which require efficient word retrieval from the mental lexicon (Snyder & Godley, 1992 in Tingley et al, 2003).

Different research projects showed that the majority of children with reading difficulties in all languages and all ages had problems with naming speed. (Bowers & Wolf, 1993; Catts, 1996 ; Siegel & Ryan, 1988 ; Kamhi & Catts, 1989 Wagner, Torgesen, & Rashotte, 1994 Blachman, 1997 In Wolf et al, 2000).

While Torgesen et al (1997) regarded rapid naming ability as an indication of general phonological capability; Wolf et al (Wolf et al., 2002 In Rispens, 2004; Wolf & Bowers, 1999) claimed that rapid naming difficulties are the basis for reading skill acquisition problems, regardless of phonological deficiencies. The double deficit hypothesis assumes that children with reading problems may suffer from a phonological deficit or naming deficiency, or both together.

Empiric findings provided by Wolf et al (2002) show that 60% of a sample group of children with reading problems also experienced

difficulty with phonological awareness and rapid naming; 15% had problems with rapid naming and 19% had problems with phonological awareness only.

Automatic retrieval ability and not recognition or knowledge of the names themselves, foresee reading ability (Meyer et al., 1998), which is a marker for lexical encoding processes (Ellis & Miles, 1981 in Rice & Brooks, 2004). Denckla (1972 in Davis et al, 2001) provided some of the earliest evidence for a correlation between reading difficulties and repetitive naming of colors in severely dyslexic kindergarten-aged boys. Because children learn colors very early in life, often before they learn to read (Denckla and Cutting, 1999 in Davis et al, 2001), this initial study used color-naming as a predictor of later reading skill. Subsequently, Spring and Capps (1974 in Davis et al, 2001) examined two groups of boys (poor-readers and normal-readers), ages 8 to 13 years, who were presented with an expanded set of visual stimuli, including randomly sequenced digits, color patches, and common objects. The investigators concluded that boys from the poor-reader group performed this naming task more slowly than boys from the normal reader group, and that this difference was larger for digits than for colors and objects.

Wolf et al, (2000b) found that there is a direct connection between good word retrieval ability and effective reading skill acquisition.

Some researchers (de Jong & Vrielink, 2004; Wolf et al., 2002 in Rispens, 2004) found that slow naming speed of colors and letters, as well as difficulties in phonological awareness were precursors of reading difficulties. Menyuk et al (1991) and Wolf, (1984) (in Lahey & Edwards, 1996) also found that a slow reaction time in naming assignments is an early sign of reading skill acquisition problems.

Catts et al (1999 in Catts et al, 2001) indicated that rapid automatic naming ability stands in direct relation to reading acquisition

achievements. They observed that second grade children with poor reading skills were four to five times more likely to have problems in rapid automatized naming as kindergartners than were second graders who were good readers.

Denckla et al researched naming problems among children with reading impairments. They regarded naming difficulties as a deficiency in the linguistic base of the reading problem.

(Denckla & Rudel, 1976; Rudel, Denckla, Broman, & Hirsch, 1980; Denckla, Rudel, & Broman, 1981 Rudel, Denckla, & Broman, 1978 in Casby**,** 1992) reported that children with reading impairments demonstrated lower naming speed and made more naming errors than children with normal reading skills.

In confrontation naming tasks, reading-disordered children often perform poorly, demonstrating frequent substitutions and circumlocutions (German, 1982). In tasks involving the rapid "automatized" naming of letters, digits, colors, or common objects, poor readers perform slower than good readers (Denckla & Rudel 1976; Wolf, 1982; Blachman, 1984b Spring & Capps, 1974 in Catts & Kamhi, 1986)

These naming deficits may arise from difficulties reading-disordered children have in retrieving phonological codes from long-term memory (Ellis, 1981 in Catts & Kamhi 1986).

In other words, reading-disordered children may have subtle problems in accessing the phonological representations of words from their lexicon.

Blachman (1984b in Catts & Kamhi, 1986) has also reported that rapid automatized naming of letters and colors may be an effective predictor of reading achievement.

Wiig et al. (1982) reported that children with language learning deficiencies required longer naming time than children with normal academic achievements. Their findings indicated that these children had a

mean naming time of 1.54 sec/item, while the average time of children with normal academic achievements was 1.00 sec/item.

Catts**,** (1993) tested a group of children with a specific language impairment identified at kindergarten age; they were examined by a series of language and speech tests and measurements of phonological awareness and rapid automatic naming. Subjects were followed in first and second grades and administered tests of written word recognition and reading comprehension. In this research, the measurements of phonological awareness and rapid automatic naming were found to predict written word recognition ability.

Denckla & Rudel (1976) tested 128 children with learning disabilities and 120 normal-range children, ages 7 to 13 years, on rapid naming of numbers, colors, objects and letters. Results revealed a significant relationship between reading deficits and the speed of verbal responses to visual stimuli.

More recently, a number of studies have confirmed that children with reading disability often experience difficulties when attempting to name a series of items rapidly (e.g., Badian, 1993 ; Korhonen, 1995; Meyer et al., 1998; Scarborough, 1998; Wolf et al., 2000; Compton, 2000 Cornwall, 1992 Snyder and Downey, 1995 Zeffiro and Eden, 2000 in Davis et al 2001).

Researchers and therapists are increasingly interested in understanding the causes of word retrieval problems. Researchers claim that these difficulties are related to lexical production and to the language processing procedure which involves storage and retrieval of verbal items from the lexicon (Dockrell et al, 1998, Lahey and Edwards, 1999).

Word finding difficulties are considered one of the features of developmental language disorders (Lahey & Edwards 1996; Kaill &

Leonard 1986) and acquired language disorders (Goodglass et al, 1998 in Tingley et al, 2003).

Researchers who examined children diagnosed with SLI (specific language impairment) claimed that they had few and weak associations in their semantic memory and that the representation of their lexical values is sparse and poorly organized; as a result, they make more semantic errors during word retrieval. The researchers claimed that the lexicon of children with SLI differed from that of normal children in three parameters:

1. They had fewer lexical values
2. They had a faulty semantic representation and due to limited lemma storage, the semantic network is sparse, impairing the retrieval process.
3. Their semantic information was poor, preventing them from discerning between the target word and its semantic neighbours.

These differences caused children with SLI to be slower and less accurate in word retrieval, in comparison with their peers. (McGregor, 1997; McGregor & Windsor, 1996; Lahey & Edwards, 1999; Leonard 1999).

(Dockrell et al, 1998; Constable et al, 1997) also showed that children and adults with oral and written language impairments often functioned slowly and inaccurately in object naming assignments.

Kail, Leonard, and colleagues, who researched naming problems of SLI children (Leonard, Nippold, Kail, & Hale, 1983) found more encoding and storage problems among examinees with language deficiencies.

The research of Leonard et al (1983) examined a group of language-disordered children vis-à-vis a group of children without language problems, of identical age, in the field of naming assignments. The differences between the groups supported the clinical impression that the language-disordered children did not demonstrate retrieval skills pertinent to their age; they functioned at a lower speed than the children

with no language impairments. They noted a certain similarity between the functioning of the normal group and that of the language impaired group when the target words were infrequently used words. Both groups functioned relatively more slowly, as compared to the retrieval of frequently used words. Hence, the frequency of use was found to be significant in word retrieval time.

Wiig and Semel (1984 in German, 1987) reported that in the Detroit Test of Learning Aptitude, Free Association subtest, the examinees with language deficiencies were at a loss for words very quickly in the free associations test.

Some researchers suggested that slow functioning in retrieval assignments among children with language problems was related to less developed semantic elaboration (Kail & Leonard, 1986; Leonard et al, 1983). They proposed that children with language impairments learned words at a later stage and slower than their peers. The result of this late development is that the word acquisition process is less elaborate and the processing, planning and semantic storing is less complex. They found that these children had more problems with word storage than with word retrieval. Kail (Kail & Leonard, 1986) claimed that the problem with the naming skill was an indication of poorly developed semantic values.

It is very important to understand the basis for retrieval difficulties when wanting to make intervention plans. If the problem is due to a limited word store, the therapists must employ strategies to help the patients expand their semantic entries and networks. On the other hand, if the problem is, first and foremost, one of processing inefficiency, it is necessary to develop word retrieval strategies.

A model of the semantic memory relevant to vocabulary extension, required in the case of children with naming problems, is the levels-of-processing framework (Craik & Lockhart, 1972). This framework

suggests that the word storage capability is affected by the depth of the word procession. These researchers believe that the priming word can be processed on three levels:

a. The shallowest level, originating in auditory/acoustic assignments, wherein the examinee is asked to produce a word rhyming with a priming word or to judge whether the given word rhymes with the priming word.

b. A less shallow level stemming from categorical assignments wherein the examinee is asked for a general name to a verbal stimulus (e.g. is this an animal?).

c. The deepest level of semantic/syntactic assignments, where the examinee is asked to produce a sentence using the priming word, or to decide whether it is possible to fill a blank in a given sentence with the word.

Research conducted among children and adults showed that recall and recognition are better when the verbal stimulus is processed at the deepest level (Craik & Tulving, 1975 ; Lockhart & Craik, 1990 Ghatala, 1984 Jacoby & Craik, 1979 Cermak & Craik,1979 in Casby, 1992)

Craik & Lockhart, (1972) claimed that exercising assignments at the deep processing level results in more elaborate, longer lasting, and stronger traces. A similar explanation is given by therapeutic intervention plans for word finding, focusing on enhancing semantic structure (e.g., Wiig & Semel, 1980 in Lahey & Edwards, 1996).

On the other hand, different researchers claim that semantic elaboration is not the main factor responsible for the slower naming pace of language-disordered children. Therapeutic intervention which focuses on imagery and phonemic analysis, has been found to be more effective in improving picture naming skills of language-disordered children, rather than intervention focused on semantic organization (Wing, 1990).

The lexical processes involve phonological and semantic processes.

Slower picture naming among language-disordered children could be related to the retrieval ability of phonological representation or to a reaction of lexical response processing, for example phonetic encoding of the accessed lexical item, as well as problems with the production of phonetic representations related to word retrieval problems. Furthermore, both slower naming pace and problems with the phonetic representations production were found to be linked to language learning disabilities (e.g., Catts, 1989; Kamhi, Catts, Mauer, Apel, & Gentry, 1989; Wiig et al., 1982).

Johnson and Myklebust (1967 in German, 1982) reported that children with word-finding problems may often define the target word, give its function, or substitute a word with similar meaning or from the same semantic category. In addition, they stated that younger children may use noises that represent the target word whereas others may use gestures or pantomime to communicate their messages. Johnson and Mykelbust (1967 in German, 1982) also identified these responses in learning-disabled children who were having difficulty retrieving words.

Word retrieval plays a central role in language processing and cognitive development. A population survey of children with language impairment revealed that 25% of the children had difficulties with word finding (Dockrell, Messer, George, & Wilson, 1998) whereas the figure is estimated to be approximately 50% for students who are learning disabled (German, 1998 in Messer & Dockrell 2006).

D. Autism Spectrum Disorders

In the Diagnostical Statistical Manual of Mental Disorders -DSM IV, of the American Psychiatric Organization, (fourth edition), a group of five extensive developmental deficiencies with common characteristics were grouped together under the classification ‘PDD’ – Pervasive

Developmental Disorder. All of them are neurological and usually appear until the age of three, affecting overall life development.

This diagnostic category is known as **continuum or spectrum of autistic disorders** (Sverd, Dubey, Schweitzer & Ninan, 2003). Children with these deficiencies have problems with communication, playing with other children and general attitude towards other people, including their family (Kasher & Meilijson, 2003).

According to the definition set in the DSM-IV, (Diagnostic and Statistical Manual of Mental Disorders, 2000) and recent research in autism, Pervasive Developmental Disorders are characterized by severe and pervasive impairment in three areas of development. These features have been shown to be relatively independent of intellectual abilities and acquired skills (Wing & Gould 1979).

1. Impairment in socialization

This is a specific impairment in the quality of reciprocal interactions. Wing & Gould (1979) tried to characterize the social impairment observed in young autistic children. They found that the lower the IQ, the higher the proportion of children affected by social impairment. They attempted to classify the social impairment and described three types of children: the aloof, the passive and the odd. The distribution of these three types of social impairment among children before age seven was such that about half were aloof and the other half was evenly distributed between passive and odd. In a follow-up study many children had changed the quality of their social impairment and many had lost their aloofness.

There is marked impairment in the use of multiple nonverbal behaviors, failure to develop peer relationships appropriate to developmental level

a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people.

2. Impairment in communication and language

This impairment ranges from failure to develop any language (mute) to the use of language with impairment at different levels. There are Qualitative impairments in communication. For example, as manifested by at least one of the following: delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime), stereotyped and repetitive use of language or idiosyncratic language.

While it is now widely accepted that pragmatics is the most disturbed in Autism, it is still prevalent in the literature to describe it as communication impairment (Fay & Schuler, 1980; Rapin, 1991).

3. Impairment in imagination and special patterns of behavior

Lack of varied, spontaneous make-believe play or social imitative play which is appropriate to developmental level (Wing & Gould, 1979).

There are restricted, repetitive, and stereotyped patterns of behavior, interests, and activities. For example, encompassing preoccupation with one or more stereotyped and restricted patterns of interest, that is abnormal, either in intensity or focus. Apparently inflexible adherence to specific, nonfunctional routines or rituals, stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting or complex whole-body movements), persistent preoccupation with parts of objects.

The Five Types of PDD according to DSM IV

Autistic Disorder: Autistic Disorder, sometimes referred to as early infantile autism or childhood autism, is four times more common in boys than in girls. Children with Autistic Disorder have a moderate to severe range of communication, socialization, and behavior problems. Many children with autism also have mental retardation.

Rett's Disorder: Rett's Disorder, also known as Rett Syndrome, is diagnosed primarily in females. In children with Rett's Disorder, development proceeds in an apparently normal fashion over the first 6 to 18 months at which point parents notice a change in their child's behavior and some regression or loss of abilities, especially in gross motor skills such as walking and moving. This is followed by an obvious loss in abilities such as speech, reasoning, and hand use. The repetition of certain meaningless gestures or movements is an important clue to diagnosing Rett's Disorder; these gestures typically consist of constant hand-wringing or hand-washing.

Childhood Disintegrative Disorder: Childhood Disintegrative Disorder, an extremely rare disorder, is a clearly apparent regression in multiple areas of functioning (such as the ability to move, bladder and bowel control and social and language skills) following a period of at least 2 years of apparently normal development. By definition, Childhood Disintegrative Disorder can only be diagnosed if the symptoms are preceded by at least 2 years of normal development and the onset of decline is prior to age 10.

Asperger's Disorder: Asperger's Disorder, also referred to as Asperger's or Asperger's Syndrome, is a developmental disorder characterized by a

lack of social skills; difficulty with social relationships; poor coordination and poor concentration; and a restricted range of interests, but normal intelligence. The major difference from Autism is the greater preservation of language skills in the areas of vocabulary and grammar, with abnormalities in the area of pragmatics.

Since abnormalities are mild enough to be disregarded in childhood, the diagnosis is often sought for the first time during adolescence. Asperger's first description of the syndrome stressed social abnormalities as opposed to speech abnormalities. An individual with Asperger's Disorder does not possess a significant delay in language development; however, he or she may have difficulty understanding the subtleties used in conversation, such as irony and humor. (Newsom, Dawson & Everard, 1983 Tantam, 1991 in Kasher & Meilijson, 2003) showed that what Asperger observed as social abnormalities are actually pragmatic ones. Tantam (1988) found in her study that 67% of the subjects affected by Asperger syndrome showed pragmatic abnormalities.

Asperger have lack of nonverbal expressiveness, impression of clumsiness and unusual “special” interests which are narrow and private (Tantam, 1988)

Also, while many individuals with autism have mental retardation, a person with Asperger's possesses an average to above average intelligence (Autism Society of America, 1995). Asperger's is sometimes incorrectly referred to as "high-functioning autism”

Pervasive Developmental Disorder Not Otherwise Specified: Children with PDD NOS either do not fully meet the criteria of symptoms clinicians use to diagnose any of the four specific types of PDD above (Harris and Glasberg, 1966) and/or do not have the degree of impairment described in any of the above four PDD specific types.

According to the DSM-IV, this category should be used "when there is a severe and pervasive impairment in the development of social interaction or verbal and nonverbal communication skills, or when stereotyped behavior, interests, and activities are present, but the criteria are not met for a specific Pervasive Developmental Disorder, Schizophrenia, Schizotypal Personality Disorder, or Avoidant Personality Disorder".
In general, the accepted view is that 20% of children on the autism spectrum are high functioning (Bryson, 1997 Gillberg et al., 1991 in Sverd et al., 2003)

E. Autism, Language and Word Finding Ability

Parents of children with autism most often report that the first sign of a problem with their child is either the absence of language or the loss of language that had begun to develop in the second year of life (Kurita, 1985 in Tager-Flusberg, 2000a; Lord & Paul, 1997)
A delay or absence in language development and a lack of communications skills are characteristics of the autism spectrum, varying from child to child. According to the definition of ICD-10, World Health Organization, (1993); and DSM-IV, (Diagnostic and Statistical Manual of Mental Disorders, 2000) language in autism is usually damaged or absent, often accompanied by mental retardation. Additional damage may affect the sensorial, perceptional and motor functions (Boucher, 2003).
Language deficiencies may include a delay in expressive and receptive language development, partial or total lack of expressive and receptive language, problems with initiating or participating in conversation and stereotyped, repetitive and idiosyncratic language.
Kanner (1946 in Tager-Flusberg, 2000a) noted the autistic child's tendency to use words with special or unique meanings not shared by others. The use of idiosyncratic lexical terms, or neologisms, has been

found even in higher functioning children and adults with autism (Volden & Lord, 1991 in Tager-Flusberg, 2000a), suggesting that it does not mark a developmental stage in acquisition.

Kanner, (1943 1946 in Tager-Flusberg, 2000a) was the first to note that children with autism often simply echo the words, phrases, or sentences spoken by others. Echolalia is a classical feature of autistic language. It is most typical of children who have very little productive language (McEvoy, Loveland & Landry, 1988 in Tager-Flusberg, 2000a).

Echolalia is a parrot-like repetition of words the child has just heard spoken – ("Say hello Bob" – "Say hello Bob"), or delayed echolalia, repetition of words or phrases heard in the past (often in the accent of the original speaker). It is now viewed as having some functional value for children. Echolalia may help children with autism to maintain some role in the ongoing discourse even when they either do not understand or have not yet acquired the pragmatic or linguistic skills needed to respond more appropriately. (Prizant & Duchan, 1981 Tager-Flusberg & Calkins, 1990 in Tager-Flusberg 2000a).

Sometimes there are unsuitable syntactic structures of spontaneous speech, problems with sequence and comprehension, confused word order, confusion between words with similar sounds or meaning. There is a reversal of pronouns—referring to oneself as "you" and to the conversational partner as "I." Although reversing personal pronouns is not unique to autism, it does occur more frequently in this group than in any other population (Lee, Hobson, & Chiat, 1994 in Tager-Flusberg 2000a). Pronoun reversals are viewed as important in the diagnosis of this disorder (American Psychiatric Association, 2000; Le Couteur et al. 1989 in Tager-Flusberg 2000a). The reversals reflect difficulties in conceptualizing the notion of self and other as it is embedded in shifting discourse roles between speaker and listener (Lee et al., 1994

Tager-Flusberg, 1993 1994 in Tager-Flusberg 2000b). The intonation is monotonous and flat; sentences are repetitive and non-creative. There may be a communications model based on ritual questions and insistence on repetitive answers. Sometimes, even if language does develop, it is very concrete and literal, lacking comprehension of metaphors and imagery. For example: "It is raining cats and dogs" resulted in sitting by the window all day screaming "Where's the cats, where's the dogs? It's raining water". (Howlin and Rutter, 1987 in Allott 2001)

The language damage is not limited to problems with spoken language acquisition; usually, the ability to acquire symbolized language is equally impaired, as are comprehension and use of non-verbal communication signals, regardless of whether language exists. Comprehension and use of facial expressions, gestures and vocal prosody are always abnormal, even among Asperger's Syndrome cases (Boucher, 2003).

At times, learning sign language is an option in the autism spectrum, when the subject has additional problems, such as a hearing impairment and oral dysphasia. Sometimes, when autism is accompanied by mental retardation, it is easier to learn a limited number of signs than to learn speech.

If manual and oral dyspraxia exist, or in case of severe mental retardation, it is sometimes easier to use pictures than signs in order to convey basic necessities (Seal, &. Bonvillian, 1997; Rapin, 1996)

It is interesting to note that at the opposite end of the spectrum, among high functioning autism and Asperger's subjects, written language is easier to learn than the spoken language (Jolliffe et al., 1992).

In her article, discussing the distribution of linguistic impairments across individuals within the autistic spectrum who have at least some language, Boucher (2003) noted that among Asperger's syndrome cases, there is pragmatic language damage without phonological or syntactical

deficiency. She also stated that among those diagnosed with HFA (high functioning autism), comprehension is lower than expressive ability, semantic deficiency is moderate and there is syntactical deficiency but no phonological deficiency. Among those diagnosed with LFA (low functioning autism), comprehension is on a lower level than expressive ability, the pragmatic damage is severe to profound, semantic and syntactical deficiencies are severe and phonological deficiency is mild to moderate. The fact that often, comprehension is more damaged than expression seems logically impossible. When the issue is creative language ability, language comprehension is nearly always on a higher level than language expression. This anomaly is a result of the fact that a considerable part of the expressive language in the autism spectrum is formulaic, enabling formulaic learning of well constructed phrases and their use in a non-fragmented form. This is the case in a situation of delayed echolalia (Loveland et al., 1997). Repetitive use of certain syntactical frameworks may occur (Dobbinson, Perkins & Boucher, 1998).

Muller et al (1998) also found better expressive than receptive language among the examinees (high functioning autistic men).

The form component:

The syntactic disorder of high and low functioning autism spectrum cases who acquired certain language ability has not been sufficiently researched. Past theories stated that syntactical ability among HFA and Asperger's Syndrome subjects is relatively normal. Newer research showed that this is definitely not so and syntactical errors and abnormalities are common (Kjelgaard & Tager-Flusberg, 2001), especially in spontaneous language. Among LFA subjects, syntactical ability is poor and communication takes place with the aid of single

words or memorized signs and phrases (Dobbinson, 2000 in Boucher, 2003)

Phonology is less damaged in the autism spectrum. If we examine the echolalia we will usually find that the phonology of spoken language is precise (Lord & Paul 1997). Research showed that verbal children diagnosed on the autism spectrum were never described as having a phonological disorder (Allen, 1989; Rapin, 1996). As for autism cases who have not acquired language skills and do no imitate language or produce echolalic phrases, phonology – like syntactical and semantic aspects of language – has probably not been acquired (Boucher, 2003).

The semantic component:

Semantic deficiency in language ability among Asperger's Syndrome cases refers to problems with comprehension, the use of metaphors or implied language, irony and jokes involving puns; this, despite their normal vocabulary and grammar (Happe´, 1994)

Both HFA and LFA have much clearer difficulties with the semantic component of language. They tend to use words or phrases in a narrow and formational manner and have special problems with abstract terms (Eskes et al., 1990) and even more so – with meaning-dependent terms (terms which change their meaning according to time, place or speaker, e.g. the word "now" – which is time-dependent, or the word "there", which is place-dependent) (Lord & Paul, 1997).

A specific deficiency in acquiring terms relating to state of mind or emotions has also been observed (Tager-Flusberg & Sullivan, 1995)

The pragmatic component:

Pragmatics as a language component has been defined as the regulations and conventions which control language for communication purposes; these rules and conventions involve social information (e.g. how to

address friends in the presence of other people in a position of authority) or socio-cognitive understanding (e.g. to take into account the other person's knowledge and his or her intentions). Incorrect use of rules and conventions constitutes an important element in the definition of communications deficiency.

Pragmatics also involves the knowledge and use of the linguistic tool in order to produce coherent talk or narrative or to clarify something which has not been understood.

Autism has been identified as a language disorder that, at its core, involves pragmatic impairments - the ability to use language effectively in social contexts. (Baltaxe, 1977 Tager-Flusberg 1981 in Tager-Flusberg 2000b; Lord & Paul, 1997).

The linguistic and non-linguistic pragmatic deficiencies can easily be discerned in disorders of the autism spectrum, including the higher functioning cases (Landa, 2000). Children with autism are often unresponsive to the conversational initiations of others. Even when autistic children do engage and respond to others, they may offer little to the ongoing discourse; have difficulty sustaining the conversational topic, or offer irrelevant comments (Tager-Flusberg & Anderson, 1991 in Tager-Flusberg 2000b; Fine et al, 1994). When language is acquired in autism, verbal communication continues to be primarily limited to the expression of instrumental functions, or simple labeling (Tager-Flusberg, 1996; Wilkinson, 1998)

People on the autism spectrum find it difficult to take into account the listener's perspective (theory of mind) and this affects their ability to take part in a conversation in a meaningful and acceptable manner. They tend to lecture about what interests them without paying attention to or including their conversational partner/s (Tager-Flusberg, 1996). There is a problem with realization of the fact that language is a tool for

interaction and sharing thoughts and feelings with other people (Tager-Flusberg, 1992 1993 in Tager-Flusberg, 1999)

These discourse deficits are seen as central to the defining characteristics of autism (Tager-Flusberg, 1996) they parallel and are closely linked to the social and communicative impairments discussed earlier.

As mentioned, despite the fact that the deficits in communication and language are part of the diagnostic criterion for autism, children with autism have very differing communication skills. Some are non-verbal, while others have sufficient skills to participate in a conversation (Rice, Warren & Betz, 2005).

Lord & Rutter (1994 in Rice, Warren & Betz, 2005) found that 50% of children on the autism spectrum are non-verbal. On the other hand, Lord, Risi, and Pickles (2004 in Rice, Warren & Betz, 2005) noted that when they used the Ados and Adi-R diagnostic tool for gauging communication skills, they found that only 14-20% of autistic children aged 9 were non-verbal (non-verbal defined as using five or less words in daily use).

A significant part of autistic children also have additional language-related disorders, including lexical-semantic and syntactic development deficiencies (Kjelgaard & Tager-Flusberg, 2001).

According to Williams et al (2006) children with autism do not use the required organizational strategies for supporting memory. For example, they may remember words in a certain order, without support of semantic or syntactic organization (Frith, 1970a 1970b Fyffe & Prior, 1978 In Williams et al, 2006).

Other research projects showed that autistic children encoded the meaning of words and could gain from clues they were given; however, they did not spontaneously use the effective semantic, syntactic or

temporal sequences which could facilitate the retrieval of information (Tager-Flusberg, 1991 in Williams et al, 2006).

In her article on the neurological basis of autism, Rapin (2000) listed the language difficulties of children on the autism spectrum, claiming that some of them had a mixed receptive and expressive deficit which impaired phonologic decoding and stopped or impaired all subsequent language activities, to the extent that some children could not speak or understood very little or not at all. She found that some may have language processing deficits that result in an atypically organized lexicon and word retrieval difficulties, insufficient comprehension of open and closed questions and conversational difficulties. Echolalia and the use of memorized formulae were a compensational mechanism of children who relied on an excellent verbal memory, circumventing word retrieval difficulties, reaction to questions and a coherent discourse organization.

Broderick and Kasa-Hendrickson (2001), in their article which deals with a case study of a boy on the autistic spectrum, indicates among the language problems, a situation of word retrieval difficulties. Williams (1995) also noted in her article “In the Real World”, on dominant difficulties with word retrieval, among people on the autistic spectrum.

Biklen and others (1993a, 1993b) in their criticism on the research dealing with facilitated communication of autistic subjects, claimed that in experimental studies, the researchers didn’t take into consideration the fact that the subjects might have word finding difficulties, and, therefore, naming pictures or activities is not a valid way to evaluate facilitated communication.

When ASD (Autism Syndrome Disorder) subjects are asked to name pictures as rapidly as possible (so-called "'rapid automatic naming") a mixed profile can be seen, with some subjects showing normal performance, whereas others are impaired. (Muller et al, 1999 in

Walenski, 2006) Similarly performance on verbal fluency tasks in which subjects are asked to name as many words as possible in a given period of time seems to be generally, but not always, spared. Norma1 performance has been found in both letter fluency (e.g.. "Name as many words as you can that begin with the letter F") and category fluency (e.g.. "Name as many animals as you can,") (Minshew 1995; Boucher, 1988; Muller et al, 1999 in Walenski, 2006) other studies, in contrast have reported deficits in both types of verbal fluency tasks. (Rumsey, et al, 1990 in Walenski, 2006) as well as in unconstrained ("("miscellaneous") verbal fluency (e-g., "Say as many words as you can think of, any words at all") (Boucher, 1988).

Jacobson et al (1995) mentioned in their article that people on the autistic spectrum might have word retrieval difficulties.

Children diagnosed as being on the autistic spectrum have a limited mental lexicon (Wilkinson, 1998). They could also differ from their peers in the semantic organization of their mental lexicon (Minshew et al, 1995).

According to Tager-Flusberg (1985), these children have a lexical representation limited to prototypical referents of specific words.

In the autistic population, the majority of associations for verbal representations in the mental lexicon are related to primary learning situations of the representation in question, leading to inflexibility and narrow semantic links of the verbal representations. For example, if the first time an autistic child sees a chair, it is a pink object with four legs, this representation will be retained, and not the real characteristics of a chair (a piece of furniture used for sitting) (Fay & Schuler, 1980).

In her research, Tager-Flusberg (2000a), analyzed spontaneous phrases collected from autistic children, children with Down syndrome and normally developed children. She found that the underlying mechanisms

for acquiring language were the same in children with autism, children with Down syndrome, and normally developing children. Despite the obvious surface and pragmatic differences in their speech, children with autism who do acquire language appear to depend on the same mechanisms and processes for developing language as do other children.

F. Intervention therapy

A better understanding of the component processes of word retrieval in children will assist practitioners by allowing a more precise localization of the cognitive processes that cause the difficulty and will address the question of whether word-finding difficulties can be viewed as an isolated difficulty or a by-product of other language disabilities. (Messer & Dockrell, 2006)

Precise identification of word retrieval difficulties is an integral part of the language skill diagnosis conducted by the speech and language pathologist. Various word retrieval assignments are given in the course of the diagnosis with the purpose of detecting word-finding difficulties (Snyder & Godley, 1992 in Tingley et al, 2003). These assignments usually involve naming in reaction to a visual or auditory stimulus given to the examinee. The stimulus could be pictures, letters, definitions, rhymes or a request to retrieve information from the semantic lexicon, such as names of animals or words beginning with a certain sound. The common denominator of the various assignments is the required rapid production of a specific word or series of words. Precision and/or the speed of production are measured. Slow or inaccurate retrieval is considered a word-finding difficulty (Tingley et al, 2003). In spite of the fact that the research literature often describes naming difficulties among children with language and learning impairments, there is little evidence

of rapid naming problems among children on the autism spectrum with language ability.

The research dealing with therapeutic intervention is divided regarding the source of naming difficulties.

According to McGregor, (1997) Successful word finding depends on both an intact long-term lexical store and retrieval processes that operate successfully in real time. Deficiencies in either could underlie word-finding problems.

Research shows that sometimes intact retrieval processes (Kail & Leonard, 1986) and the ability to retrieval use cues (McGregor & Windsor, 1996) have prompted storage accounts of developmental word-finding problems. (McGregor, 1997).

The best evidence supporting this supposition is provided by the research wherein therapeutic intervention based on encoding and storage was found to be more effective than word retrieval exercises. (McGregor & Leonard, 1989; Wright, 1993 in McGregor, 1997).

There is little research evidence about intervention programs. According to German, (1979, 1984) and Wiig & Semel, (1980 in Casby, 1992) therapeutic intervention aimed at improving children's word retrieval skills should include planned activities involving the use of various cues and organization techniques (based on semantic categories, perception, phonemic features and syntactic features.

Assuming that a limited word storage is the basis of naming difficulties, Kail and Leonard (1986) and Kail (1989 in Casby, 1992) proposed that therapeutic intervention in word retrieval difficulties should be also aimed at strengthening and extending word representation in the mental lexicon (in contrast to interventional activity based solely on retrieval cues).

McGregor and Leonard (1989) reported on the results of an approach designed to improve word-finding skills by expanding the vocabulary and exercising word retrieval.

They defined “word-finding” as the act of producing or trying to produce a word and “word retrieval” for the strategies or processes used to access the target in storage. Their subjects were 4 language-impaired children ranging in age from 9; 1 to 10; 5. Two of these children served as controls.

They used a different set of words for each of four treatments:

(a) An elaboration treatment based on providing new information designed to enable children to elaborate semantic and phonological representations of words in storage

(b) A retrieval treatment focusing on helping them learn to use already known semantic and phonological information as the basis of more efficient retrieval cues

(c) A combination of treatments (a) and (b)

(d) No treatment

The dependent variables were picture naming and repeated free recall tasks using the words used in training.

The authors concluded that the treatment combining elaboration and retrieval training (c) was most effective. These results must be interpreted with caution because of the small number of subjects.

The results are, however, consistent with the findings of Kail and Leonard (1986). They showed that children with word-finding deficits had less extensive lexical knowledge than normal children.

Wing (1990) reported about an experiment with two groups of six-year old language-impaired children contrasted the effects of two treatment programs on generalization to untrained words in a picture naming task.

Wing planned two kinds of interventions: The first was a combined phonological and imagery-based retrieval intervention which focused on phonological and perceptual components of the retrieval process and involved exercises in word segmentation and manipulation of word segments (e.g. counting the number of syllables or phonemes in the cue word and words rhyming with the cue word). And exercises in forming and holding visual and auditory images, in which the child was asked to create a stronger image of the word by trying to visualize it in his mind. They were asked to "see the picture in your mind" and "hear voice saying the name of it in their mind.

More traditional therapy focused on semantic associations and organization of the semantic store. The children grouped pictures in categories, provided as many lexical details as possible for a given category and mentioned various features describing animals and objects. The subjects of the phonological and perceptual therapy improved significantly in naming untrained pictures, while the group which received the semantic therapy showed no significant improvement.

Despite the fact that the research conducted by McGregor and Leonard (1989) and Wing (1990) suggested an interesting approach, the findings were not decisive.

When relating to speech and language difficulties in population on the autistic spectrum, most of the research focuses on the different language components, such as a poor vocabulary, grammatical skill and faulty syntactical, semantic and pragmatic system, which prevent normal verbal interaction and communication. Identification of word retrieval problems and subsequent therapy designed to impart suitable retrieval strategies among children on the autistic spectrum may develop better oral language skills.

CHAPTER 2: RESEARCH OUTLINE AND HYPOTHESES

The following study consists of two parts. In the first part, twenty children with typical development of communication, language and speech and forty children diagnosed on the Autistic Spectrum (twenty children diagnosed as Asperger Syndrome and twenty children diagnosed as PDD NOS) were presented with the following three word retrieval tests:

1. Rapid Automatized Naming (RAN) - including the rapid automatized naming of common objects, colors, numbers and letters.
2. Verbal fluency – including semantic and phonological naming tasks.
3. Word finding (TWF-2) – including picture naming of nouns and verbs, as well as sentence completion.

Data were collected from the tests.

In the second part of the study, an intervention plan was structured and administered by the researcher in order to study the effectiveness on retrieval production. Ten low graders children, (five from the Asperger group and five from the PDD group) were given forty minutes' therapy sessions once a week over a period of four months (15 sessions) and then - at the end of the intervention period - were submitted again to the tests. In addition, the other ten low graders children (Five from the Asperger group and five from the PDD group) were tested again without any intervention therapy.

The following were the specific hypotheses of the research:

1. The children on the Autistic spectrum will demonstrate more problems with word retrieval than the typically developing children.

2. The PDD NOS children will demonstrate more problems with word retrieval than the Asperger children.

3. The children who participate in the intervention therapy will improve their retrieval skills following the intervention plan.

4. The children who were tested again without an intervention plan will have similar score as their primary results.

CHAPTER 3: RESEARCH METHOD

A. Research Subjects

A total of sixty children served as subjects for this study. They were divided into three groups:

- Twenty children with typical development of communication, language and speech abilities.
- Twenty children diagnosed as PDD NOS.
- Twenty children diagnosed as Asperger Syndrome.

The children with typical development of communication, language and speech served as a control group.

All the children were of elementary school age, ranging from six years and three months old, to twelve years and nine months old. The average age was 9.28 (S.D. 1.89).

The test group numbered forty children. The children were divided to thirty one boys and nine girls.

The test group members were selected according to the following criteria:

1. All the children had been diagnosed on the Autistic Spectrum. (Diagnosed as PDD or Asperger).
2. All the children were integrated in regular elementary schools. The children on the Autistic Spectrum studied in autistic classes in regular schools, or were individually integrated in regular classes.
3. All the children had language skills enabling language and oral communication interaction.
4. All the children had been given communications therapy by a speech-language pathologist from an early age.
5. All the children had reading skills enabling them to cope with written letters and numerals.
6. All the children's mother tongue was Hebrew.

7. All the children had a similar social and economic background.
8. None of the children had undergone any past diagnosis and/or focused therapy related to word retrieval deficiency.

Twenty children with typical development of communication, language and speech (TDCLS) served as a control group, twelve boys and eight girls.

The children for the control group were selected according to the following criteria:

1. All The children in the test and control groups were matched in grade.
2. All the children are enrolled in public schools and all of them belong to their age-appropriate grades.
3. All the children have no apparent physical or psychological anomaly which might have interfere with the typical development of speech and language.
4. All children have normal reading and learning abilities, befitting their age and grade. (According to their teachers).
5. All the children's mother tongue is Hebrew.
6. All the children have a similar social and economic background.
7. None of the children had undergone any past diagnosis and/or focused therapy related to word retrieval deficiency.

Table 1: Characteristics of the Study Groups

	PDD Group N=20		**Asperger Group N=20**		**TDCLS Group N=20**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Gender						
Male	18	90.0	12	60.0	12	60.0
Female	2	10.0	8	40.0	8	40.0
Grade						
First	4	20.0	4	20.0	4	20.0
Second	3	15.0	3	15.0	3	15.0
Third	3	15.0	3	15.0	3	15.0
Forth	4	20.0	4	20.0	4	20.0
Fifth	3	15.0	3	15.0	3	15.0
Sixth	3	15.0	3	15.0	3	15.0
Place of Education						
Regular Class	12	60.0	20	100.0	20	100.0
Special Class	8	40.0	0	0.0	0	0.0
	Mean (Std. Dev.)		**Mean (Std. Dev.)**		**Mean (Std. Dev.)**	
Age	9.28 (1.89)		9.38 (1.82)		9.16 (1.86)	

40 % of the PDD group children are in special classes in comparison to 0% in the other groups

The three groups were similar on the variables age and grade.

B: Stimulus materials

1. RAN (Rapid Automatized Naming) Tests

The researcher conducted RAN (Rapid Automatized Naming) tests, which are individually administered measures designed to estimate an individual's ability to recognize and name a visual symbol accurately and rapidly.

Four rapid automatized naming tasks were employed in this study. These included the rapid automatized naming of common objects, rapid automatized naming of colors, rapid automatized naming of numbers, and rapid automatized naming of Hebrew letters.

The Letters, Numbers, Colors, and Objects tests are comprised of five high-frequency stimuli that are randomly repeated ten times in an array of five rows of 10 items each, for a total of fifty stimulus items.

In these tasks, the subjects were instructed to rapidly name the letters, numbers, colors, and objects. All subjects demonstrated their ability to name each of the pictures, in isolation prior to the actual tests. Subjects were then instructed to name as quickly as possible each item on the chart, proceeding right to left, (as reading procedure in Hebrew) row by row. A stopwatch was used to measure the total duration of time necessary to name all 50 items on every chart.

Scores are based on the amount of time required to name all of the stimulus items on each chart.

Instructions to "just say the name" were repeated as necessary.

2. Verbal Fluency Tests:

The researcher conducted tests for verbal fluency. The verbal fluency task was first introduced as a mean of evaluating the overall productivity among brain damaged subjects (Thurstone, 1938 Hécaen and Albert, 1978 in Szatkowska, Grabowska & Szymanska, 2000).

Verbal fluency tests of word production require retrieval and access to semantic lexical and phonological information. This function is usually defined as the number of words produced within a restricted category and over a limited period of time - usually 60 seconds (Lezak, 1995 in Hurks, Hendriksen & Vles, 2004).

Two types of Verbal Fluency Tests were employed in which words are elicited according to either a phonological criterion (words beginning with a given syllable) or a semantic criterion (items belonging to a specific semantic category).

Although both phonological and semantic fluency require an access to lexical memory and retrieval of lexical items following the instruction given to the subject, it is possible to distinguish between search strategies according to the phonological or semantic nature of the considered task.

In the phonological fluency task, one has to suppress the ordinary way of retrieving words from memory according to their meaning (Perret, 1974 Birri and Perret, 1985 Ahola et al., 1996 in Szatkowska, Grabowska, & Szymanska 2000). Such a task forces the subject to use a search strategy based mainly on lexical representations. In contrast, the semantic fluency task requires first an exploration of the conceptual knowledge and then a search strategy based on a semantic category.

In the Phonologic Fluency task, the subject was requested to generate as many Hebrew words as possible beginning with the Hebrew letters Mem and Taf or Tet (/M/ and /T/) in consecutive 1-minute intervals. This test was based on the Controlled Oral Word Fluency Test from the Multilingual Aphasia Examination (Benton & Hamsher, 1976 in Abernethy et al, 1999) which requires the naming of words that begin with the letters F, A, and S, for 60 seconds each. Here the researcher used syllables instead of phonemes in order to avoid frustration and to facilitate the task for the children.

The dependent measure was the number of words retrieved, exclusive of perseverations, repetitions of a word root, words that begin with a letter other than the one specified (words that do not belong to the category requested), nonsense words, words in the plural (e.g. boy and boys) and different tenses and diminutive forms or words. The phonological fluency score was the total number of different correct words produced across the three trials.

The Semantic Naming task was based on the Animal Naming subtest from the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan,

1972 in Abernethy et al, 1999) requiring the naming of animals in 90 seconds. However, this was adapted for the present study allowing participants 60 seconds rather than 90 seconds to make the scores more directly comparable with scores on the Phonologic Fluency Test.

In the semantic task participants were instructed to generate names of clothes over 60 seconds for a practice trial, followed by the naming of animals and food in the actual test. The results from this practice trial were not included in the final analyses.

The semantic fluency score was the number of correct unique responses given across the two trials.

The participants' responses were written down by the experimenter.

3. TWF-2 (Test of Word Finding)

The researcher also submitted parts of the TWF-2 (word finding) test. The TWF-2 is a nationally, standardized, individually administered diagnostic tool for the assessment of children's word finding skills. It uses four different naming sections to test a subject's word finding ability: Picture Naming Nouns, Sentence Completion Naming, Picture Naming Verbs, and Picture Naming Categories.

The researcher adapted parts of the test in which the pictures were suitable for children in Israel. The TWF-2 was administered in one session according to its manual. Within each section the examiner began with the example items which helped the children respond to each test item.

The children were required to answer in less then 4 seconds. The answers were classified according to three categories:

Correct and quick responses

Incorrect responses

Slow (more then 4 sec.) responses.

Section 1 was designed to assess accuracy and speed when naming picture referents of noun target words. Target words consisted of compound words and one to four syllable target words from different semantic categories. The children were required to names the items on the pictures in front of them. (They were asked to name one object on each picture).

Section 2 was designed to assess accuracy when naming target words in an auditory close-procedure format. Children were asked to complete a sentence read by the examiner by naming the target word that would best complete the sentence.

Section 3 was designed to assess accuracy in naming action words. The children were shown pictures depicting different verbs. The examiner asked the child to tell what the person in the picture is doing by saying "What is she (or he) doing?" All the verbs used appear in present tense.

Section 4 is designed to check whether the child is familiar with the target items in the entire test. This part of the test is important because a naming error cannot be defined as a word finding error unless one is reasonably sure that the child knows the target word (in comprehension and production).

The researcher placed a big analogical clock behind the participant, to measure the reaction time for each answer. The participant couldn't see the clock so it didn't disturb the test procedure.

C: The Testing Procedure

The procedure of each test was fully explained to all participants and to their parents or guardians. Consent to participate in the research was obtained from participants and their parents or guardians. Participation in the research was anonymous. There is no mention of the children's names in the course of the research or its documentation.

The tests were administered according to instructions contained in the administration of each manual. The researcher of this study, who is a certified speech-language pathologist, administered the standardized measures. Administration was conducted over three 30-minute sessions scheduled on different days within a 1-month period. Each test session was separated from the next one by a week. The testing time had to be kept to a minimum to accommodate the attention span of the autistic children. At the end of each session the child got a tangible reinforcement to motivate him/her for the next session. The order of presenting the tests was the same for all the participants.

Each child was tested individually in a face-to-face situation, in a quiet and well-lighted room which serves for speech, language and communication therapy.

For students on the Autism Spectrum (ASD), standardized assessments present many difficulties. When testing children with ASD, it may be difficult or impossible to follow the administration guidelines as is and still gain student's best performance. Students with ASD, regardless of their functioning level, have deficits in social skills. Standardized tests require some level of social interaction. It may be difficult to perform well on an individually administered assessment without reciprocal social interaction skills.

Thus, prior to the test, the examiner conversed with the child in order to create a pleasant and non-threatening atmosphere.

The researcher took into consideration the student's sensory needs when conducting the tests. An effort made to minimize all distractions that could influence the child's performance. Open window blinds, noisy heating vents, unusual smells and other environmental distractions may have a significant impact on the student's scores.

Considering the auditory processing delays of students with ASD, standardized directions are often lengthy and confusing. Tests are highly dependent on language comprehension and may be biased against students with ASD (Watson & Marcus, 1995). Receptive language skills are required to understand the directions. The communication deficit faced by all students with ASD puts them at a disadvantage on tests dependent on receptive and expressive language use. We tried to make the verbal directions as clear and concise as possible.

Breaks were provided when needed, following the testing procedures outlined for each test. The examiners actively worked at ensuring that the children were always engaged in the test and attentive to the stimuli.

Koegel, Koegel & Smith (1997) suggest assessing whether the student exhibits certain behavior that may interfere with the testing situation and then using positive reinforcers to reduce the rate of the interfering behavior. For a student who engaged in the obsessive, self-stimulatory verbal behavior of speaking in a "cartoon-like" voice, we followed Koegel, Koegel and Smith who allowed the voice only when responding to the test stimuli.

When needed, reinforcers such as stickers or stars were used to maintain the child's motivation. Typically, the examiner followed the children's lead during the assessment in order to maximize their performance (as in Koegel et al., 1997).

We are aware of the fact that employing such strategies can break the standardization of the assessment tool. However, if we wish to gain information about the real abilities of the child, it is crucial to make effective intervention and programming decisions.

The tester ascertained the child's familiarity with the test stimuli, in order to make certain that in case of a naming problem, it is not caused by the child's ignorance of the object's name, but rather by word retrieval difficulty. The time and accuracy of retrieval of each of the stimuli was noted down in every test.

CHAPTER 4: RESULTS

The primary purpose of this study was to investigate word retrieval ability among children on the autistic spectrum and to examine word retrieval ability among a population of children diagnosed with PDD NOS and Asperger syndrome, vis-à-vis word retrieval ability among a group of children with typical development of communication, language and speech (TDCLS).

In addition the researcher was interested in the impact of an intervention plan on retrieval ability of children on the autistic spectrum.

This chapter will present the results of the research.

Part A: Comparison between group's scores

1. Rapid Automatized Naming (RAN)

Table 2: Results of RAN Tests by Group.

	Ran Objects (in seconds)	**Ran Colors (in seconds)**	**Ran Numbers (in seconds)**	**Ran Letters (in seconds)**
	Mean (Std. Error)	**Mean (Std. Error)**	**Mean (Std. Error)**	**Mean (Std. Error)**
Group	**AS TDCLS**	**AS TDCLS**	**AS TDCLS**	**AS TDCLS**
PDD n=20	80.22 (4.70) *** ***	59.09 (4.32) * ***	46.16 (3.16) *** ***	64.85 (5.73) *** ***
ASPERGER n=20	53.49 (2.63) n.s.	47.58 (1.64) *	31.65 (1.75) n.s.	39.56 (2.22) *
TDCLS n=20	52.30 (2.95)	41.66 (1.55)	28.95 (1.78)	36.14 (2.38)

* p<0.05
** p<0.01
*** p<0.001

Table 2 shows the Univariant Analysis of the mean reaction time required to name all the stimulus items in the RAN Test. (Objects, Colors, Numbers and Letters). In each task the retrieval time was found to be significantly longer among the PDD group in comparison with the other groups.

Objects Naming task: The mean reaction time in Objects naming was 80.22 sec. (S.E. 4.70) in the PDD group, 53.49 sec. (S.E. 2.63) in the Asperger group, and 52.30 sec (S.E. 2.95) in the TDCLS group.

The mean reaction time of the PDD group is significantly longer than the mean reaction time of the Asperger and TDCLS group ($p<0.001$)

The mean reaction time is longer in the Asperger group than in the TDCLS group. The difference between Asperger and TDCLS groups was not statistically significant.

Colors Naming task: The mean reaction time in Colors naming was 59.09 sec. (S.E. 4.32) in the PDD group, 47.58 sec. (S.E. 1.64) in the Asperger group and 41.66 sec. (S.E. 1.55) in the TDCLS group.

The mean reaction time of the PDD group is significantly longer than the mean reaction time of the Asperger group ($p<0.05$) and TDCLS group ($p<0.001$).

The mean reaction time of the Asperger group was also found to be significantly longer ($p<0.05$) than the mean reaction time of the TDCLS group.

Numbers Naming task: The mean reaction time in Numbers naming task was 46.16 sec. (S.E. 3.16) in the PDD group, 31.65 sec. (S.E. 1.75) in the Asperger group, and 28.95 sec. (S.E. 1.78) in the TDCLS group.

The mean reaction time of the PDD group is significantly longer than the mean reaction time of the Asperger and TDCLS group ($p<0.001$)

The mean reaction time is longer in the Asperger group than in the TDCLS group. The difference between Asperger group and TDCLS group was not statistically significant.

Letters Naming task: The mean reaction time of Letters naming was 64.85 sec. (S.E. 5.73) in the PDD group, 39.56 sec. (S.E. 2.22) in the Asperger group, and 36.14 sec. (S.E. 2.38) in the TDCLS group.

The mean reaction time of the PDD group is significantly longer than the reaction time of the Asperger and TDCLS group ($p<0.001$)

The mean reaction time of the Asperger group was also found to be significantly longer ($p<0.05$) than that of the TDCLS group.

Table 3: Results of RAN Tests among the TDCLS Group.

A comparison between low grades children and high grades children.

Variable	Grade	N	Mean	Std Err	P Value
Ran Objects	1-3	10	63.10	3.11	0.0002
Ran Objects	4-6	10	41.51	1.09	
Ran Colors	1-3	10	46.51	1.59	0.0011
Ran Colors	4-6	10	36.81	1.56	
Ran Numbers	1-3	10	34.63	2.44	0.0002
Ran Numbers	4-6	10	23.27	0.49	
Ran Letters	1-3	10	43.19	3.53	0.0002
Ran Letters	4-6	10	29.10	0.63	

Table 3 compares the mean retrieval time, required to name all stimulus items of the RAN Test by subject in low grades and subjects in high grades, in the TDCLS Group.

In univariant analysis, the mean retrieval time in the four parts of the RAN Test was found to be significantly longer in low grades than in high grades ($p<0.001$ in Objects Numbers and Letters naming tasks and $p<0.01$ in Colors naming task).

Table 4: Results of RAN Tests among the PDD Group.

A comparison between low grades children and high grades children.

Variable	Grade	N	Mean	Std Err	P. Value
Ran Objects	**1-3**	10	94.58	5.92	0.0011
Ran Objects	**4-6**	10	65.87	3.56	
Ran Colors	**1-3**	10	67.55	7.29	0.0538
Ran Colors	**4-6**	10	50.62	3.14	
Ran Numbers	**1-3**	10	52.51	5.35	0.0963
Ran Numbers	**4-6**	10	39.81	2.13	
Ran Letters	**1-3**	10	76.91	9.83	0.0821
Ran Letters	**4-6**	10	52.79	3.13	

Table 4 compares the mean retrieval time required to name all stimulus items of the Ran Test by subject in low grades and subjects in high grades, in the PDD Group.

In univariant analysis, the mean retrieval time in the object naming task of the Ran Test was found to be significantly longer in low grades than in high grades ($p<0.01$).

In univariant analysis, the mean retrieval time in the Colors, Numbers and Letters naming tasks, of the RAN Test was found to be longer in low grades than in high grades. This difference is not statistically significant.

Table 5: Results of RAN Tests among the Asperger Group.

A comparison between low grades children and high grades children.

Variable	Grade	N	Mean	Std Err	P Value
Ran Objects	**1-3**	10	63.75	2.22	0.0002
Ran Objects	**4-6**	10	43.24	0.99	
Ran Colors	**1-3**	10	53.45	1.38	0.0004
Ran Colors	**4-6**	10	41.72	1.34	
Ran Numbers	**1-3**	10	37.95	1.92	0.0002
Ran Numbers	**4-6**	10	25.36	0.61	
Ran Letters	**1-3**	10	46.52	3.03	0.0003
Ran Letters	**4-6**	10	32.60	0.88	

Table 5 compares the mean retrieval time required to name all stimulus items of the RAN Test by subject in low grades and subjects in high grades, in the Asperger Group.

In univariant analysis, the mean retrieval time in the four parts of the RAN Test was found to be significantly longer in low grades than in high grades ($p<0.001$).

2. Verbal Fluency Test

Table 6: Results of Verbal Fluency Tests by Group.

	Verbal Fluency (Semantic)				Verbal Fluency (Phonologic)			
	Mean	(Std. Error)			Mean	(Std. Error)		
Group			AS.	TDCLS			AS.	TDCLS
PDD	22.95	(1.05)	*	*	6.10	(0.46)	p=0.10	***
ASPERGER	19.90	(1.00)		***	8.40	(0.85)		**
TDCLS	26.95	(1.07)			14.35	(1.41)		

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

Table 6 shows the Univariant Analysis of the mean number of words which were produced in the two parts of the Verbal Fluency Test (semantic and phonologic tests), by the three groups of subjects.

Semantic fluency Test:

In the **semantic Fluency Test**, the mean number of words was 22.95 words (S.E. 1.05) in the PDD group, 19.90 words (S.E. 1.00) in the Asperger group, and 26.95 words (S.E. 1.07) in the TDCLS group.

The mean number of words produced by the PDD group is significantly higher ($p<0.05$) in comparison to the mean number of words which were produced by the Asperger group.

The mean number of words produced by the PDD group is significantly lower ($p<0.05$) in comparison to the mean number of words which were produced by the TDCLS group.

The mean number of words produced by the Asperger group was significantly lower ($p<0.001$) in comparison to the mean number of words which were produced by the TDCLS group.

In the **Phonologic fluency Test**, the PDD group produced a mean number of 6.10 words (S.E. 0.46). This score is low in comparison to the

mean number of words (8.40, S.E. 0.85) which were produced by the Asperger group. This difference is not statistically significant.

The mean number of 6.10 words (S.E. 0.46) produced by the PDD group was significantly lower ($p<0.001$) in comparison to the mean number of 14.35 words (S.E. 1.41) which were produced by the TDCLS group

The mean number of 8.40 words (S.E. 0.85) produced by the Asperger group was significantly lower ($p<0.01$) in comparison to the mean number of 14.35 words (S.E. 1.41) which were produced by the TDCLS group.

Table 7: Results of Verbal Fluency Test among the TDCLS Group.
A comparison between low grades children and high grades children

Variable	Grade	N	Mean	Std Err	P Value
Semantic Verbal Fluency	**1-3**	10	25.5	1.70	0.0839
Semantic Verbal Fluency	**4-6**	10	28.4	1.21	
Phonologic Verbal Fluency	**1-3**	10	8.8	0.81	0.0001
Phonologic Verbal Fluency	**4-6**	10	19.9	0.96	

Table 7 compares the mean number of words which were produced in the two parts of the Verbal Fluency Test (semantic and phonologic tests), by subjects in low grades and subjects in high grades, in the TDCLS Group.

In the part of **Semantic Verbal Fluency,** univariant analysis shows that the mean number of words produced by subjects in low grades is lower than the mean number of words produced by subjects in high grades.

The difference is not statistically significant. (P=0.0839)

In the part of **Phonologic Verbal Fluency,** univariant analysis shows that the mean number of words produced by subjects in low grades is significantly smaller than the mean number of words produced by subjects in high grades. ($p<0.001$)

Table 8: Results of Verbal Fluency Test among the PDD Group
A comparison between low grades children and high grades children

Variable	Grade	N	Mean	Std Err	P. Value
Semantic Verbal Fluency	**1-3**	10	22.3	1.53	n.s.
Semantic Verbal Fluency	**4-6**	10	23.6	1.49	
Phonologic Verbal Fluency	**1-3**	10	4.9	0.57	0.0071
Phonologic Verbal Fluency	**4-6**	10	7.3	0.50	

Table 8 compares the mean number of words which were produced in the two parts of the Verbal Fluency Test (semantic and phonologic tests), by low grades children and high grades children, in the PDD Group.

In the **Semantic Verbal Fluency** part univariant analysis shows that the mean number of words produced by subjects in low grades is lower than the mean number of words produced by subjects in high grades. The Difference is not statistically significant.

In the **Phonologic Verbal Fluency** part univariant analysis shows that the mean number of words produced by subjects in low grades is significantly lower than the mean number of words produced by subjects in high grades. ($p<0.01$)

Table 9: Results of Verbal Fluency Test among the Asperger Group.
A comparison between low grades children and high grades children.

Variable	Grade	N	Mean	Std Err	P Value
Semantic Verbal Fluency	**1-3**	10	17.2	1.33	0.0099
Semantic Verbal Fluency	**4-6**	10	22.6	0.93	
Phonologic Verbal Fluency	**1-3**	10	6.1	0.67	0.0070
Phonologic Verbal Fluency	**4-6**	10	10.7	1.21	

Table 9 compares the mean number of words which were produced in the two parts of the Verbal Fluency Test (semantic and phonologic tests), by low grades and high grades, in the Asperger Group.

In the two parts of the Fluency Test, (**Semantic Verbal Fluency** and **Phonologic Verbal Fluency)** univariant analysis shows that the mean number of words produced by subjects in low grades is significantly lower than the mean number of words produced by subjects in high grades. ($p<0.01$)

3. Test of Word Finding -2

Table 10: Results of Test Word Finding-2,

Total Number of Correct and Quick Responses, by Group.

	TWF-2 Nouns Total No. of Correct and Quick Responses				**TWF-2 Sentences Total No. of Correct and Quick Responses**				**TWF-2 Verbs Total No. of Correct and Quick Responses**			
	Mean	**Std. Error**			**Mean**	**Std. Error**			**Mean**	**Std. Error**		
Group			**AS.**	**TDCLS**			**AS.**	**TDCLS**			**AS.**	**TDCLS**
PDD n=20	6.55	(0.41)	***	***	6.70	(0.41)	***	***	6.25	(0.37)	***	***
ASPERGER n=20	10.55	(0.26)		***	10.70	(0.31)		*	10.60	(0.29)		*
TDCLS n=20	11.95	(0.05)			11.60	(0.13)			11.50	(0.13)		

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

Table 10 shows the number of correct and quick responses in the three parts of TWF-2, (nouns, sentences and verbs), of each group.

In all the TWF-2 tasks, (nouns, sentences and verbs), the mean number of correct and quick (less than 4 seconds retrieval time) responses of the PDD group is significantly lower ($p<0.001$) in comparison to the mean number of correct and quick responses which were produced by the Asperger and the TDCLS groups.

When the subjects were asked to name nouns, the mean number of 10.55 (S.E. 0.26) correct and quick responses in the Asperger group, is significantly lower ($p<0.001$) in comparison to the mean number of 11.95 (S.E. 0.05) correct and quick responses in the TDCLS group.

When the subject were asked to complete sentences, the mean number of 10.70 (S.E. 0.31) correct and quick responses in the Asperger group is significantly lower ($p<0.05$) in comparison to 11.60 responses (S.E. 0.13) in the TDCLS group.

When the subject were asked to name verbs, the mean number of 10.60 (S.E. 0.29) correct and quick responses produced by the Asperger group

is significantly lower ($p<0.05$) in comparison to mean number of 11.50 (S.E. 0.13) correct and quick responses which were produced by the TDCLS group.

In the analysis of the results from the TWF-2, the answers were divided into two sets:

- Number of subjects who produced one or more delayed responses
- Number of subjects who produced one or more errors.

TWF-2: Nouns

Table 11: Results of TWF-2. Nouns.

	TWF-2 Nouns Total No. Of Errors >=1				**TWF-2 Nouns Total No. of Delayed Response >=1**			
	N	**%**			**N**	**%**		
Group			**AS.**	**TDCLS**			**AS.**	**TDCLS**
PDD n=20	20	100.0	***	***	20	100.0	*	***
ASPERGER n=20	9	45.0		***	14	70.0		***
TDCLS n=20	0	0.0			1	5.0		

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

A statistical analysis was performed to determine whether there is a significant difference between the groups.

In the PDD group all the subjects (100%) produced one or more errors. This score was significantly higher ($p<0.001$) in comparison to 9 subjects (45.0%) from the Asperger group, and no subject (0.0%) from the TDCLS group.

In the Asperger group, total number of 9 subjects (45.0%) produced one or more errors. This score was significantly higher ($p<0.001$) in comparison to no subject (0.0%) from the TDCLS group.

In the PDD group all the subjects (100%) produced one or more delayed responses. This score was significantly higher ($p<0.05$) in comparison to 14 subjects (70.0%) from the Asperger group, and significantly higher ($p<0.001$) in comparison to 1 subject (5.0%) from the TDCLS group.
In the Asperger group, total number of 14 subjects (70.0%) produced one or more delayed responses. This score was significantly higher ($p<0.001$) in comparison to 1 subject (5.0%) from the TDCLS group.

A statistical analysis was performed to compare the mean ratings between the number of correct and quick responses produced by the low graders and the high graders inside every group.

Table 12: The mean of correct and quick responses in TWF-2 – Nouns.
A comparison between low grades children and high grades children inside the three groups (TDCLS, Asperger and PDD) separately.

Group	Variable	Grade	N	Mean	Std Err	P Value
TDCLS	**TWF2– Nouns**	**1-3**	10	12	0	n.s.
TDCLS	**TWF2– Nouns**	**4-6**	10	11.9	0.1	
ASPERGER	**TWF2– Nouns**	**1-3**	10	10.2	0.42	n.s.
ASPERGER	**TWF2– Nouns**	**4-6**	10	10.9	0.28	
PDD	**TWF2– Nouns**	**1-3**	10	6.7	0.50	n.s.
PDD	**TWF2– Nouns**	**4-6**	10	6.4	0.67	

Table 12 shows that inside all the groups (PDD, Asperger and TDCLS) there is no significant difference between the high grades and the low grades in producing correct and quick responses.

TWF-2– sentences

Table 13: Results of TWF-2: Sentences, by Group.

	TWF-2 Sentences Total No. of Errors>=1				TWF-2 Sentences Total No. of Delayed Response>=1			
	No.	%			No.	%		
Group			AS.	TDCLS			AS.	TDCLS
PDD n=20	19	95.0	***	***	20	100.0	***	***
ASPERGER n=20	8	40.0		*	10	50.0		n.s.
TDCLS n=20	1	5.0			6	30.0		

* p<0.05
** p<0.01
*** p<0.001

Univariant analysis shows in Table 13 that in the PDD group 19 subjects (95.0%) produced one or more errors, This score was significantly higher (p<0.001) in comparison to 8 subjects (40.0%) from the Asperger group, and 1 subject (5.0%) from the TDCLS group.

In the Asperger group, total number of 8 subjects (40.0%) produced one or more errors. This score was significantly higher (p<0.05) in comparison to 1 subject (5.0%) from the TDCLS group.

In the PDD group all the subjects (100%) produced one or more delayed responses. This score was significantly higher (p<0.001) in comparison to 10 subjects (50.0%) from the Asperger group, and 6 subject (30.0%) from the TDCLS group.

The difference between Asperger group and TDCLS group is not statistically significant.

For all the subjects in the research, the difference in the production of one or more errors, and one or more delayed responses, by low graders in comparison to high graders was found not statistically significant

A comparison was made between the number of correct and quick responses produced by the low graders and the high graders inside every group.

Table 14: The mean of correct and quick responses in TWF-2 Sentences. A comparison between low grades children and high grades children inside each of the groups (TDCLS, Asperger and PDD) separately.

Group	Variable	Grade	N	Mean	Std Err	P Value
TDCLS	**TWF2– Sentences**	**1-3**	10	11.3	0.21	0.0212
TDCLS	**TWF2– Sentences**	**4-6**	10	11.9	0.10	
Asperger	**TWF2– Sentences**	**1-3**	10	10.0	0.47	0.0178
Asperger	**TWF2– Sentences**	**4-6**	10	11.4	0.27	
PDD	**TWF2– Sentences**	**1-3**	10	7.20	0.61	n.s.
PDD	**TWF2– Sentences**	**4-6**	10	6.20	0.53	

Table 14 shows that in Asperger and TDCLS groups, there is significant difference ($p<0.05$) between the high grades and the low grades in producing correct and quick responses.

In PDD group there is no significant difference between the high grades and the low grades.

TWF-2- verbs

Table 15: Results of TWF-2: Verbs, by Group

	TWF-2 Verbs No. of Errors>=1				TWF-2 Verbs No. of Delayed Responses>=1			
	No.	%			No.	%		
Group			Asp.	Nor.			Asp.	Nor.
PPD n=20	20	100.0	***	***	20	100.0	*	***
Asperger n=20	8	40.0		*	14	70.0		*
NDCLS n=20	2	10.0			7	35.0		

* p<0.05
** p<0.01
*** p<0.001

Analysis shows in Table 15 that in the PDD group 20 subjects (100.0%) produced one or more errors, This score was significantly higher (p<0.001) in comparison to 8 subjects (40.0%) from the Asperger group, and 1 subject (5.0%) from the TDCLS group.

.

In the PDD group all the subjects (100.0%) produced one or more delayed responses. This score was significantly higher in comparison to 14 subjects (70.0%) from the Asperger group (p<0.05), and 7 subject (35.0%) from the TDCLS group (p<0.001).

In the Asperger group, total number of 14 subjects (70.0%) produced one or more errors. This score was significantly higher (p<0.05) in comparison to 7 subject (35.0%) from the TDCLS group

The difference in the production one or more delayed response was found not statistically significant.

A comparison was made between the number of correct and quick responses produced by the low graders and the high graders inside every group.

Table 16: The mean of correct and quick responses in TWF-2 **Verbs.**
A comparison between low grades children and high grades children inside each of the three groups (TDCLS, Asperger and PDD) separately.

Group	Variable	Grade	N	Mean	Std Err	P Value
TDCLS	**TWF2–Verbs**	**1-3**	10	11.4	0.22	n.s.
TDCLS	**TWF2– Verbs**	**4-6**	10	11.6	0.16	
Asperger	**TWF2– Verbs**	**1-3**	10	10.0	0.47	0.0417
Asperger	**TWF2– Verbs**	**4-6**	10	11.2	0.25	
PDD	**TWF2– Verbs**	**1-3**	10	6.2	0.44	n.s.
PDD	**TWF2– Verbs**	**4-6**	10	6.3	0.62	

We can see in Table 16 that in PDD group, there is significant difference ($p<0.05$) between the high grades and the low grades in producing correct and quick responses.

In Asperger and TDCLS groups there is no significant difference between the high grades and the low grades.

Part B- Impact of Intervention Therapy

Five children from Asperger group and five children from PDD group were engaging in an Intervention plan dealing with word finding difficulties. All of them were from low grades.

Following four months of treatment the tests were implied again to all the ten children engaged in the therapy intervention, as well as to ten low grade children (five asperger and five PDD) who didn't get any therapy dealing with word retrieval.

1.Rapid Automatized Naming (RAN)

Figure 1: Rapid Automatized Naming (RAN)-Objects. Asperger Group.

Asperger-Before and after treatment Asperger- without treatment

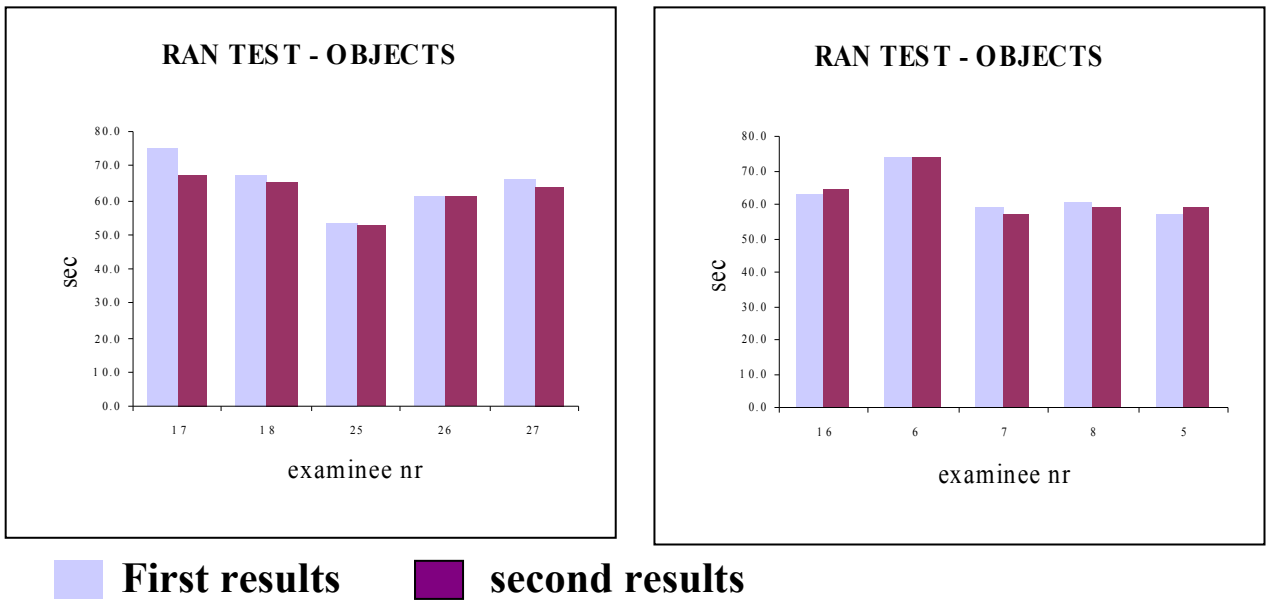
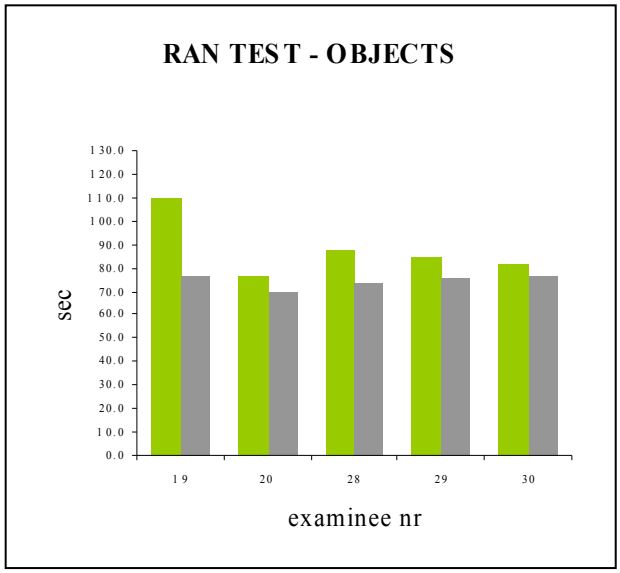
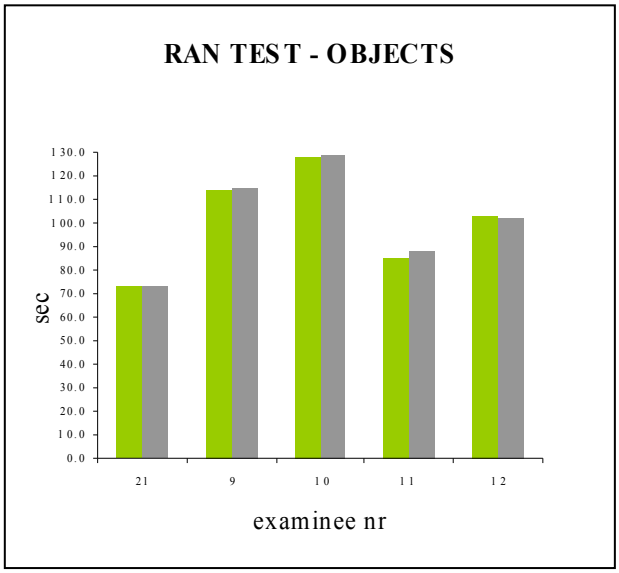


Figure 2: Rapid Automatized Naming (RAN)-Objects. PDD Group.

PDD-Before and after treatment PDD- without treatment





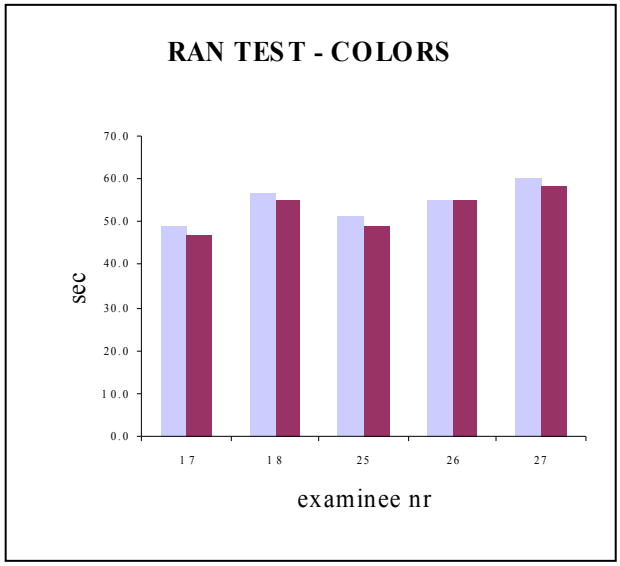
First results **second results**

In Figure 1 and 2, we can see that four children from Asperger group and all five children from PDD group were more successful in rapid naming of objects after therapy. One child from Asperger group had the same score after treatment.

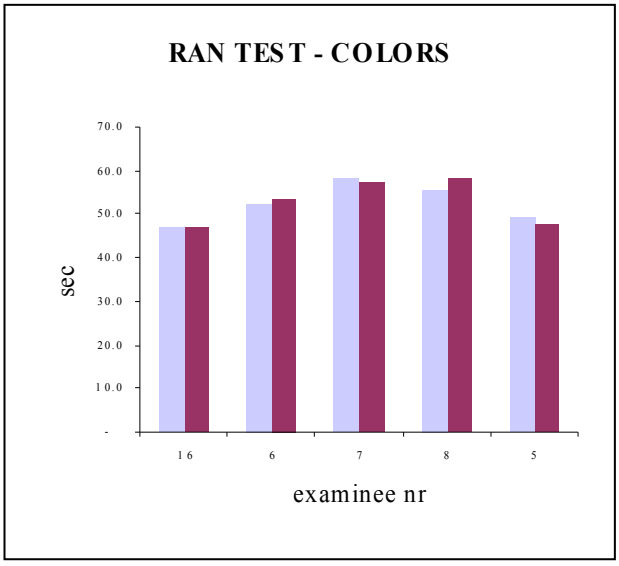
Among the children who were tested again without any intervention, only two children from Asperger group and no child from PDD group had been more successful in the second test.

Figure 3: Rapid Automatized Naming (RAN)- Colors. Asperger Group.

Asperger-Before and after treatment



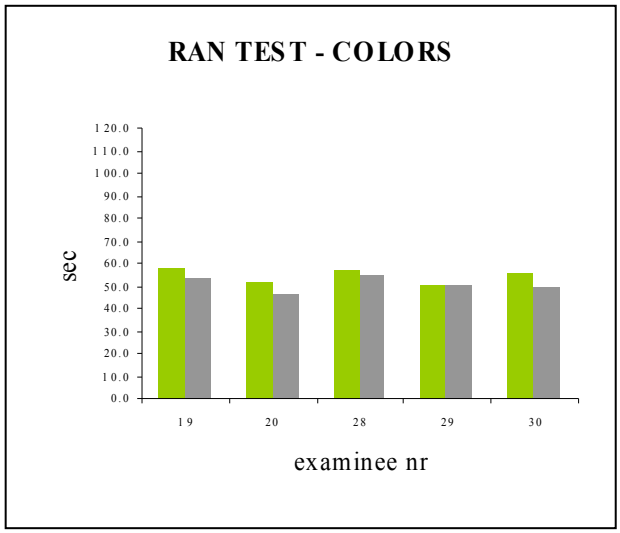
Asperger- without treatment



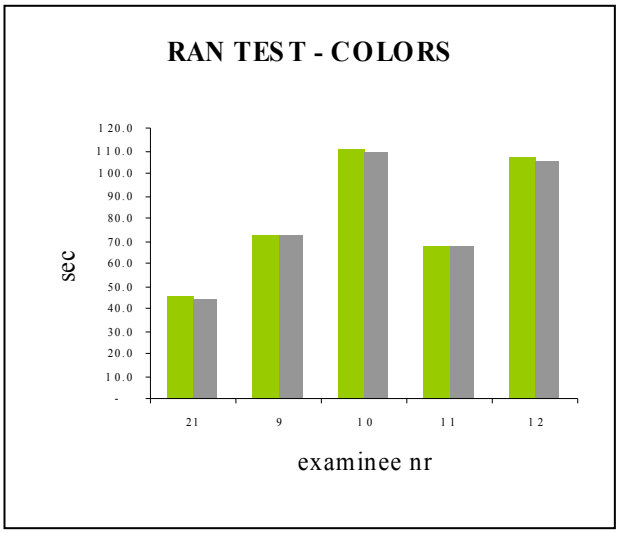
First results **second results**

Figure 4: Rapid Automatized Naming (RAN)- Colors. PDD Group.

PDD-Before and after treatment



PDD- without treatment



First results **second results**

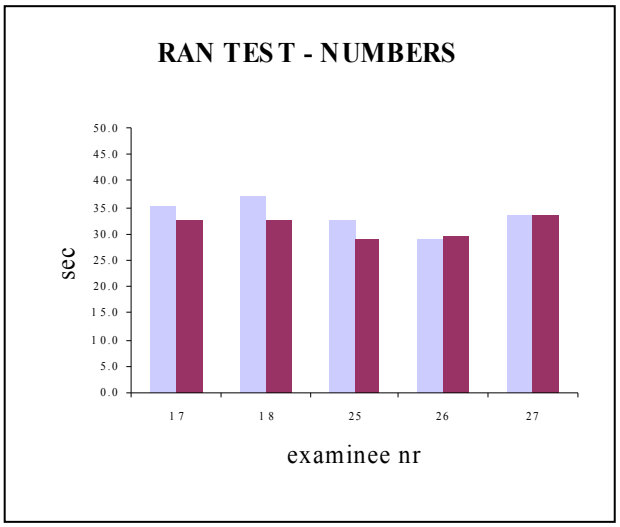
In Figure 3 and 4 we can see that four children from Asperger group and four children from PDD group were more successful in rapid naming of colors after treatment. One child from Asperger group and one child from PDD group had the same score after treatment.

Among the children who were tested again without any intervention, only one child from Asperger group and three children from PDD group had been more successful in the second test

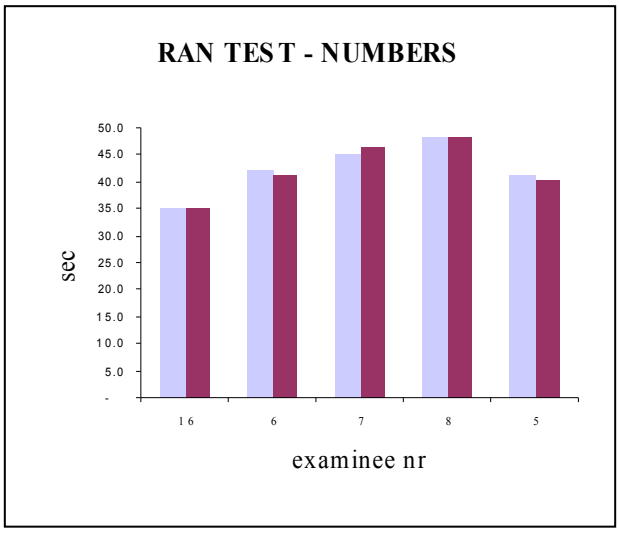
Figure 5: Rapid Automatized Naming (RAN) – Numbers.

Asperger Group

Asperger-Before and after treatment



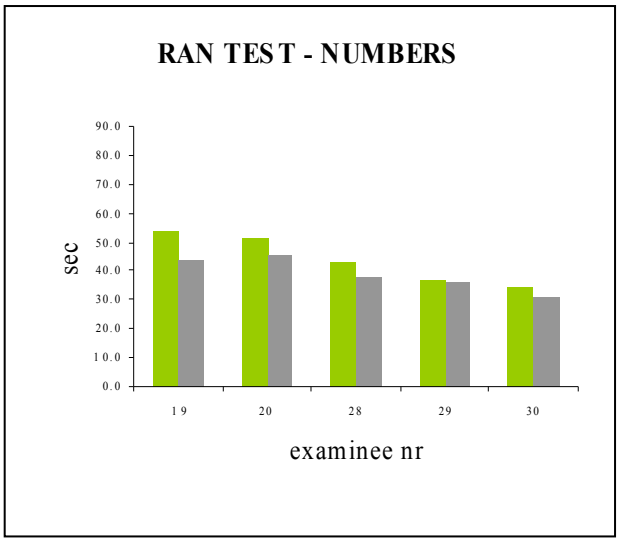
Asperger- without treatment



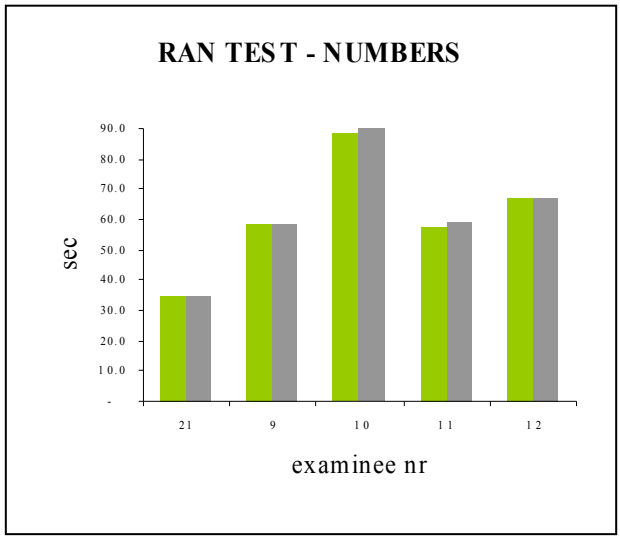
First results **second results**

Figure 6: Rapid Automatized Naming (RAN) – Numbers. PDD Group

PDD-Before and after treatment



PDD- without treatment



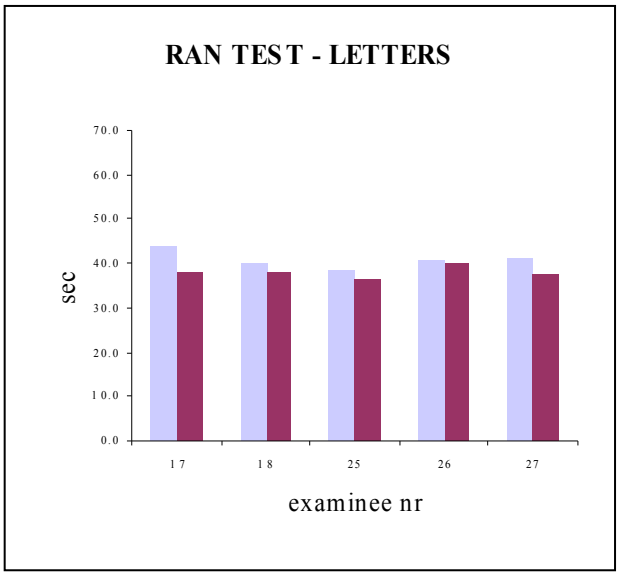
First results **second results**

In Figure 5 and 6 we can see that three children from Asperger group and all five children from PDD group were more successful in rapid naming of numbers after treatment. One child from Asperger group had the same score after treatment.

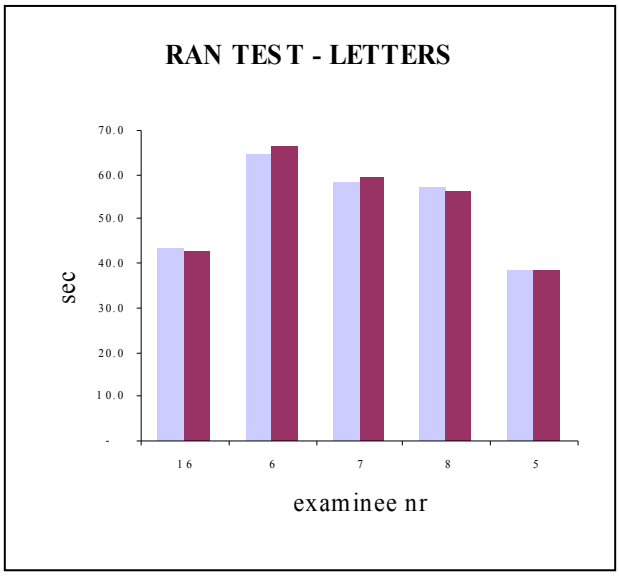
Among the children who were tested again without any intervention, two children from Asperger group and no child from PDD group had been more successful in the second test

Figure 7: Rapid Automatized Naming (RAN): Letters. Asperger Group

Asperger-Before and after treatment



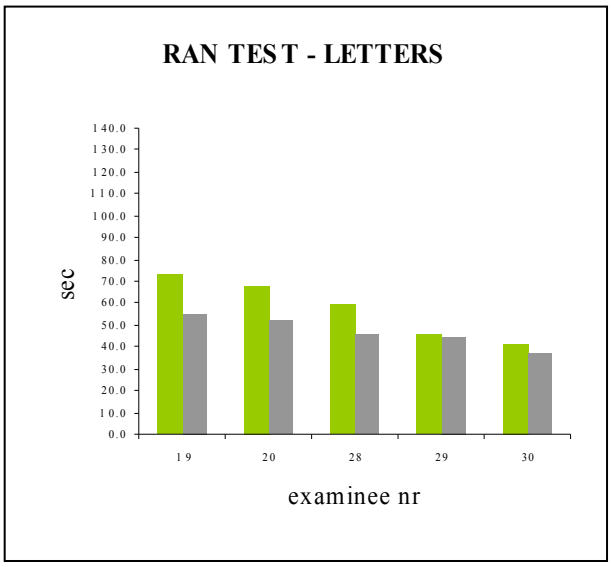
Asperger- without treatment



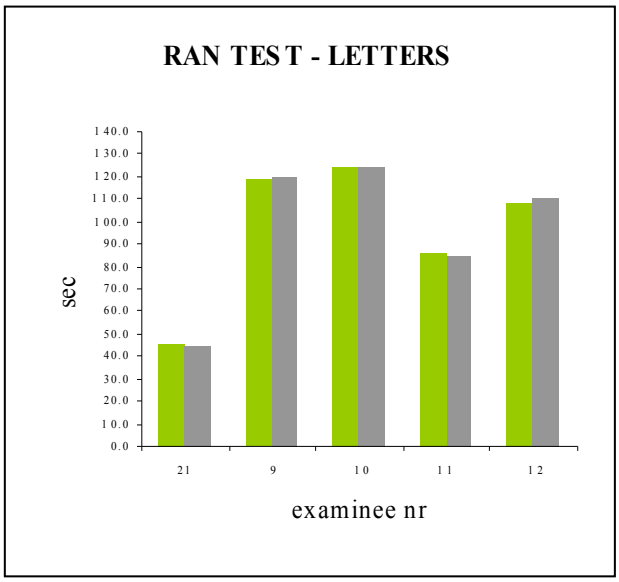
First results **second results**

Figure 8: Rapid Automatized Naming (RAN): Letters. PDD Group

PDD-Before and after treatment



PDD- without treatment



First results **second results**

In Figure 7 and 8 we can see that all five children from Asperger group and all five children from PDD group were more successful in rapid naming of numbers after treatment.

Among the children who were tested again without any intervention, two children from Asperger group and two children from PDD group had been more successful in the second test

Figure 9: Rapid Automatized Naming (RAN). Mean changes (in percentages) between first and second tests. Asperger Group.

- with treatment - without treatment

Asperger Group:

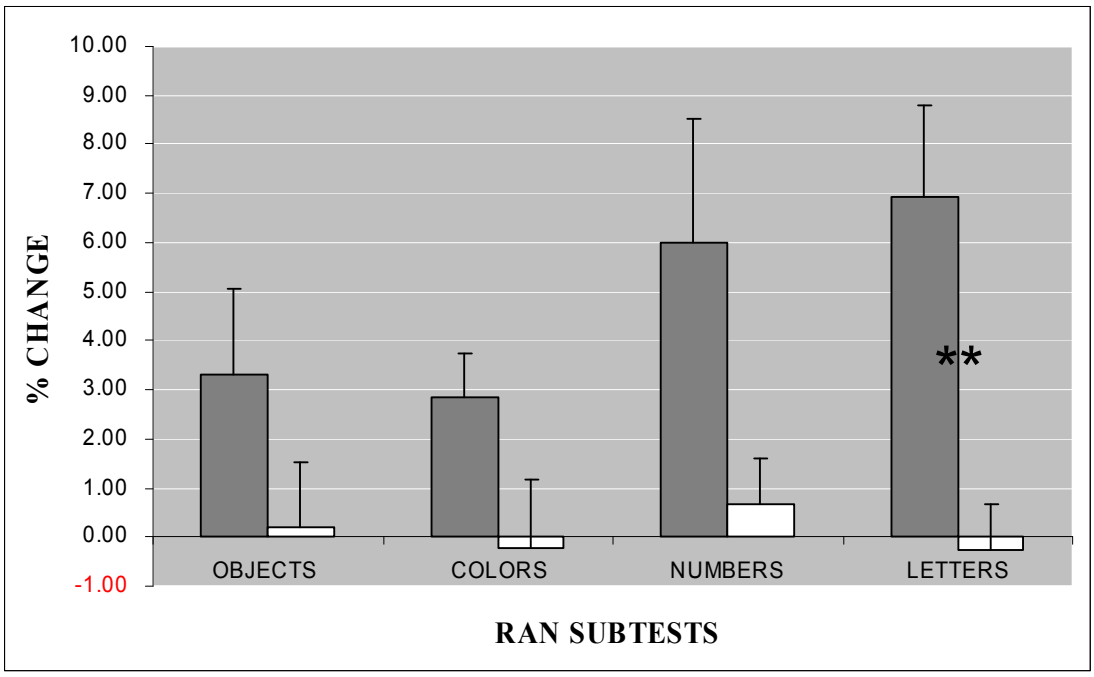
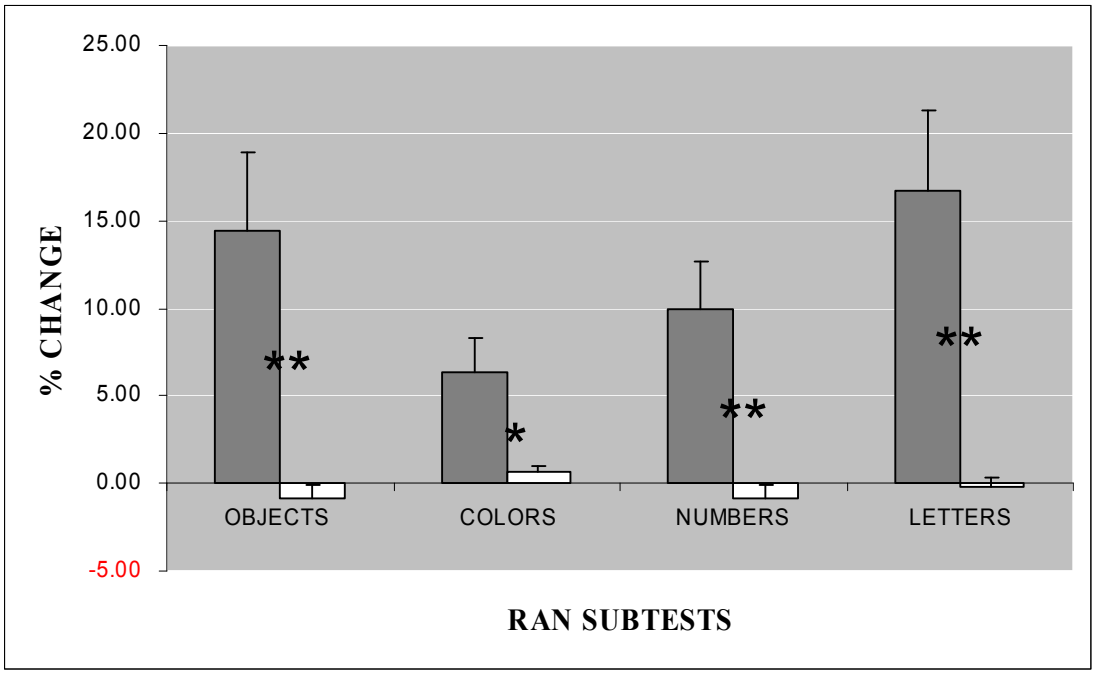


Figure 10: Rapid Automatized Naming (RAN). Mean changes (in percentages) between first and second tests. PDD Group.



Asperger Group:

In Rapid Automatized Naming (RAN) - Objects and Colors, the difference between mean changes (in percentages) with and without treatment is not statistically significant.

In Rapid Automatized Naming (RAN) - Numbers, the difference by conventional criteria is considered to be not quite statistically significant (The two-tailed P value equals 0.0857)

In Rapid Automatized Naming (RAN) - Letters the two-tailed P value equals 0.0094. By conventional criteria, this difference is considered to be very statistically significant.

PDD Group:

In Rapid Automatized Naming (RAN) - Objects, the difference between mean changes (in percentages) with and without treatment is by

conventional criteria, considered to be very statistically significant. (The two-tailed P value equals 0.0095)

In Rapid Automatized Naming (RAN) - Colors, the difference between mean changes (in percentages) with and without treatment is by conventional criteria, considered to be statistically significant. (The two-tailed P value equals 0.0217)

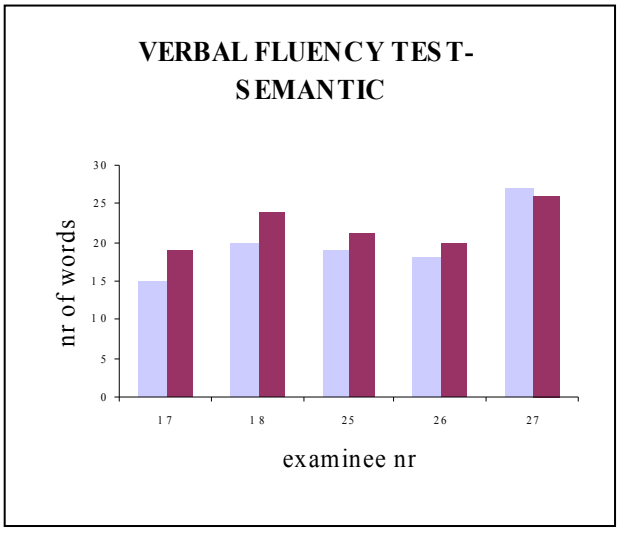
In Rapid Automatized Naming (RAN) - Numbers, the difference by conventional criteria is considered to be very statistically significant (The two-tailed P value equals 0.0051)

In Rapid Automatized Naming (RAN)- Letters, the two-tailed P value equals 0.0066. By conventional criteria, this difference is considered to be very statistically significant

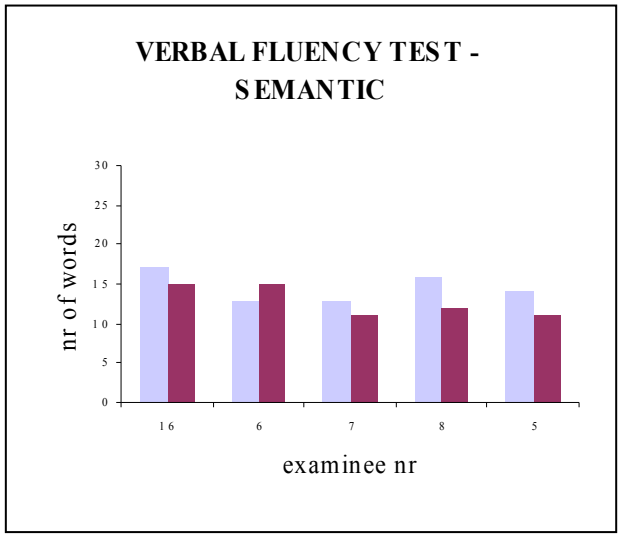
2. Verbal Fluency Test

Figure 11: Verbal Fluency Test- Semantic. Asperger Group.

Asperger-Before and after treatment



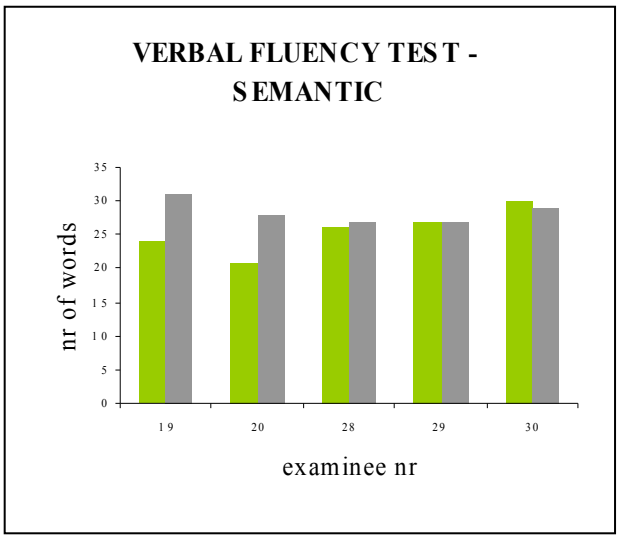
Asperger- without treatment



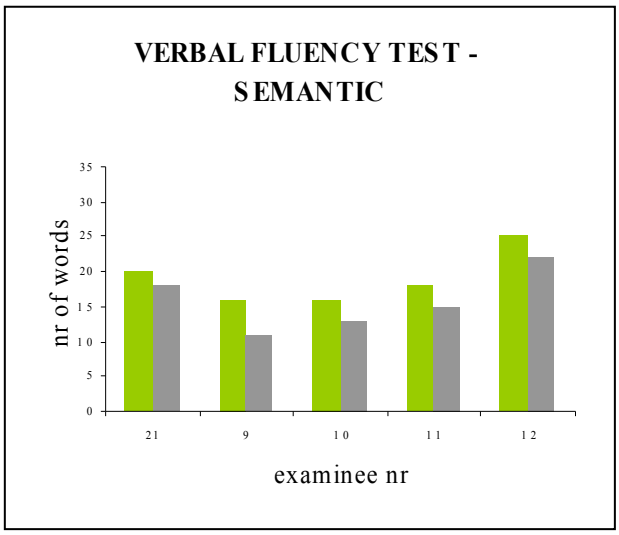
First results **second results**

Figure 12: Verbal Fluency Test- Semantic. PDD Group.

PDD-Before and after treatment



PDD- without treatment



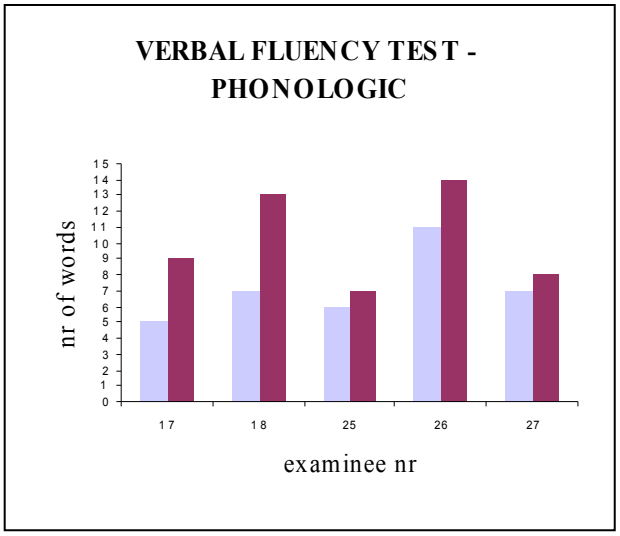
First results **second results**

In Figure 11 and 12 we can see that four children from Asperger group and three children from PDD group were more successful in retrieval of words after intervention therapy.

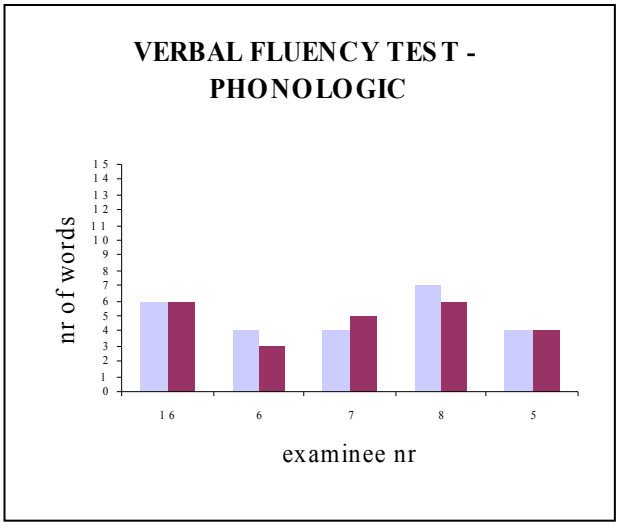
Among the children who were tested again without any intervention, one child from Asperger group and no children from PDD group had been more successful in the second test.

Figure 13: Verbal Fluency Test- Phonologic. Asperger Group.

Asperger-Before and after treatment



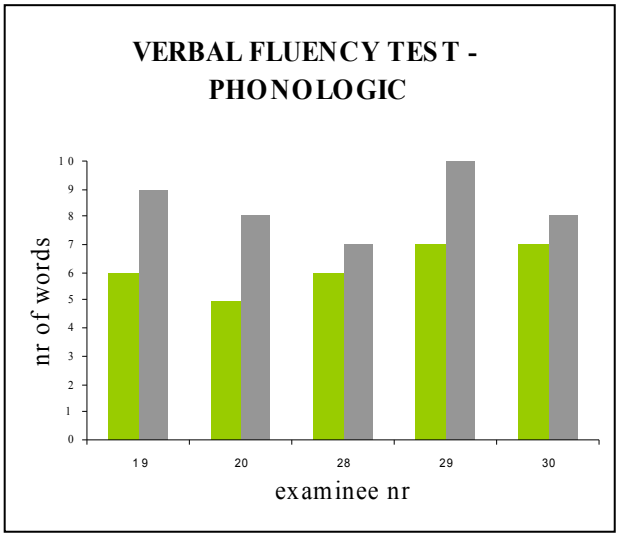
Asperger- without treatment



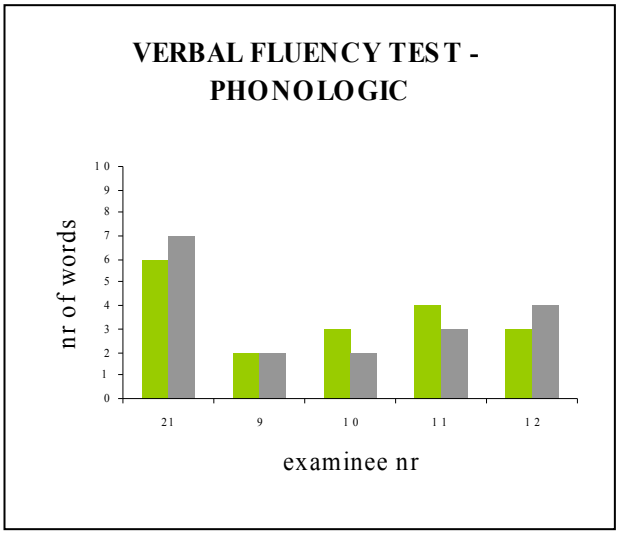
First results **second results**

Figure 14: Verbal Fluency Test- Phonologic. PDD Group.

PDD-Before and after treatment



PDD- without treatment



First results **second results**

In Figure 13 and 14 G we can see that all five children from Asperger group and all five children from PDD group were more successful in retrieval of words after intervention therapy.

Among the children who were tested again without any intervention, one child from Asperger group and two children from PDD group had been more successful in the second test.

Figure 15: Verbal Fluency Tests (Semantic +Phonologic). Mean changes (in percentages) between first and second tests. Asperger Group

- with treatment - without treatment

Asperger Group:

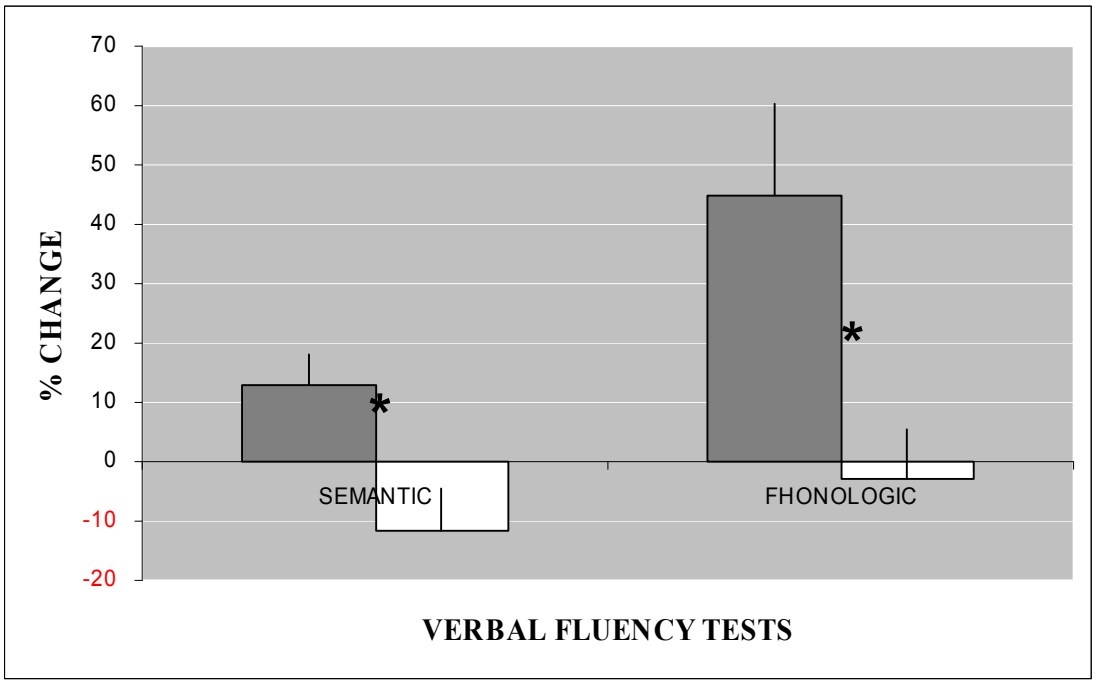
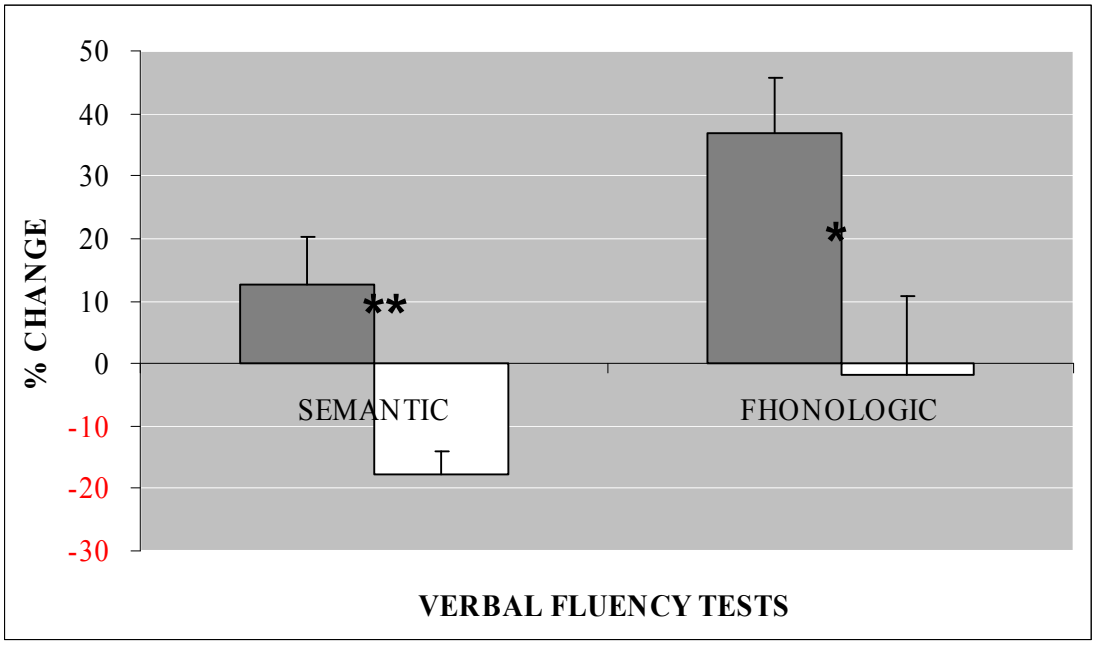


Figure 16: Verbal Fluency Tests (Semantic +Phonologic). Mean changes (in percentages) between first and second tests. PDD Group

- with treatment - without treatment

PDD Group:



Asperger Group:

In Verbal Fluency Test- Semantic, the two-tailed P value equals 0.0197.

The difference between mean changes (in percentages) with and without treatment is by conventional criteria, considered to be statistically significant.

In Verbal Fluency Test- Phonologic, the two-tailed P value equals 0.0278 by conventional criteria, this difference between mean changes (in percentages) with and without treatment is considered to be statistically significant

PDD Group:

In Verbal Fluency Test- Semantic, the two-tailed P value equals 0.0085

The difference between mean changes (in percentages) with and without treatment is by conventional criteria, considered to be very statistically significant.

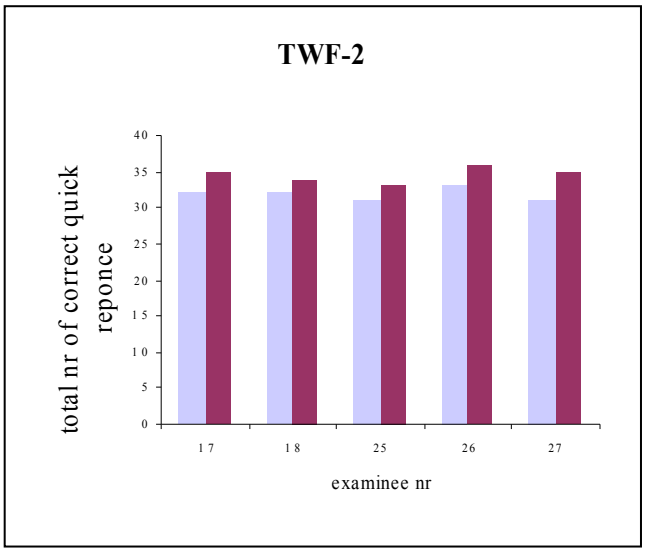
In Verbal Fluency Test- Phonologic, the two-tailed P value equals 0.0316.

By conventional criteria, this difference between mean changes (in percentages) with and without treatment is considered to be statistically significant.

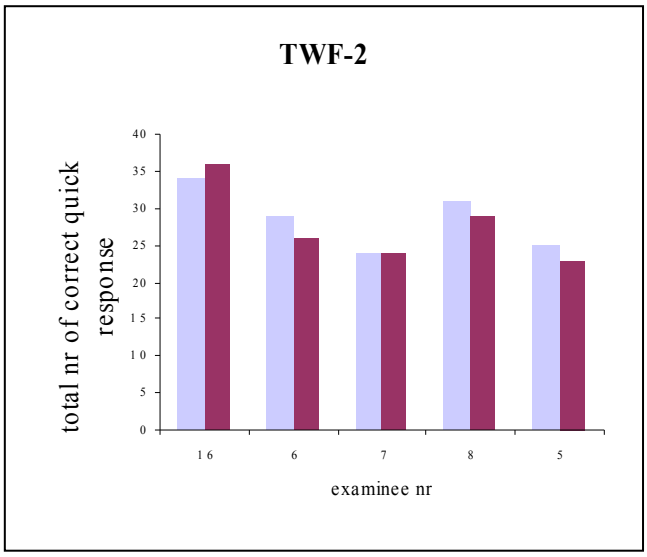
3.Test of Word Finding - 2

Figure 17: Test Word Finding-2. Total Number of Correct and Quick Responses. Asperger Group.

Asperger-Before and after treatment



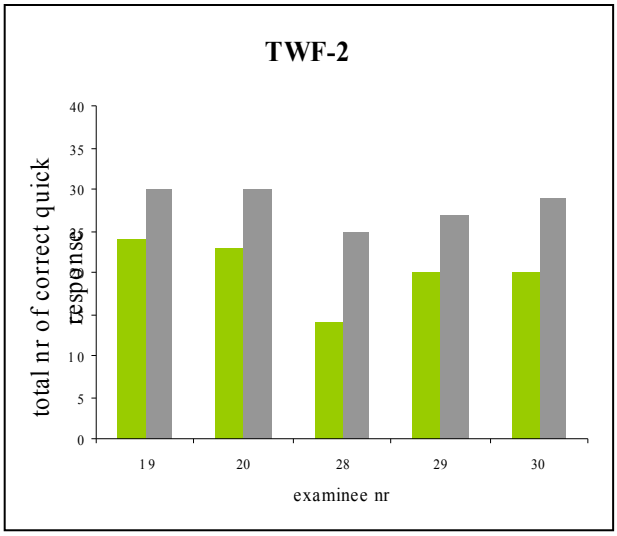
Asperger- without treatment



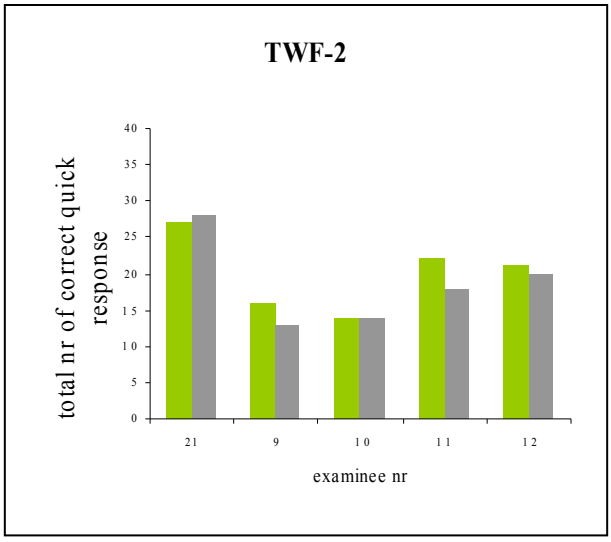
First results **second results**

Figure 18: Test Word Finding-2. Total Number of Correct and Quick Responses. PDD Group.

PDD-Before and after treatment



PDD- without treatment



First results **second results**

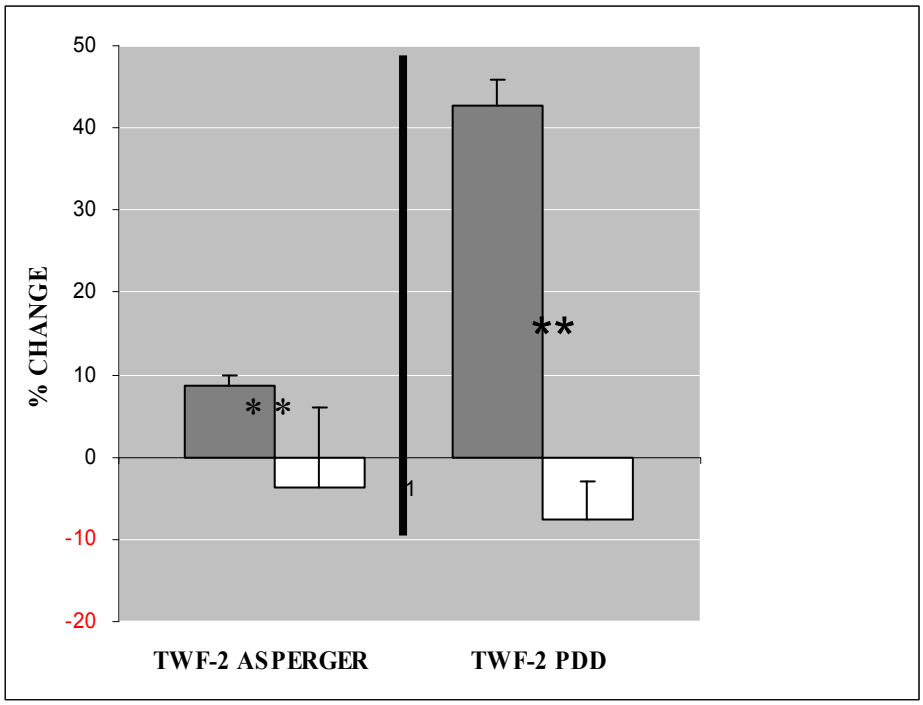
In Figure 17 and 18, we can see that all five children from Asperger group and all five children from PDD group were more successful in retrieval of words after intervention therapy.

Among the children who were tested again without any intervention, one child from Asperger group and one child from PDD group had been more successful in the second test.

Figure 19: TWF-2, Total Number of Correct and Quick Responses

Mean changes (in percentages) between first and second tests

- with treatment - without treatment



Asperger Group:

In TWF-2, the two-tailed P value equals 0.0034 by conventional criteria, this difference between mean changes (in percentages) with and without treatment is considered to be very statistically significant

PDD Group:

In TWF-2, the two-tailed P value equals 0.0018. By conventional criteria, this difference between mean changes (in percentages) with and without treatment is considered to be very statistically significant.

CHAPTER 5: SUMMARY AND DISCUSSION

Summary

The present research evaluates word retrieval ability among two groups of children on the autistic spectrum and a control group of typically developing children. The research is also concerned with the influence of therapy intervention on retrieval production of autistic children.

The two groups of autistic children contain twenty children who were diagnosed as PDD NOS and twenty children who were diagnosed as Asperger Syndrome. The control group contains twenty children with typical development of communication language and speech (NDCLS group).

All the children (the autistic and the typically developing) were administered the following three tests:

1. Rapid Automatized Naming (RAN) - including the rapid automatized naming of common objects, colors, numbers and letters.
2. Verbal fluency – including semantic and phonological naming tasks.
3. Word finding (TWF-2) – including picture naming of nouns and verbs, as well as sentence completion.

In addition, ten low-grade autistic children (five diagnosed as Asperger Syndrome and five diagnosed as PDD NOS) were engaged in a specific intervention therapy focused on rapid naming and word retrieval ability. The therapy sessions took place once a week for four months.

Four months after the first session of evaluation, twenty low grade autistic children were tested again. Ten of the children were tested after

the specific therapy intervention and ten of them without a specific therapy intervention.

The next chapter discusses the findings of the research regarding word retrieval ability among children on the autistic spectrum.

The discussion will also deal with application of the intervention therapy as a tool for achieving improved word retrieval ability among children on the Autistic spectrum.

Discussion

According to Filippo et al (2005), who researched Ran measures among children in first to sixth grade, performance on the tests improved steadily across aged tests. The ability to recognize visual symbols, name them accurately and rapidly and produce verbal fluency is considered developmental in nature. Thus, performance on the tests should be strongly correlated to chronological age. When we look at the raw score means and standard deviation of the RAN Test we can see that the measures are related to age and the means (the retrieval time) become smaller as the participants grow older (as they grow older children take less time to name stimulus items).

According to the developmental nature of retrieval abilities, the current research shows that among the typically developing children, there was a significant difference between retrieval time in the lower grades (first-third grade) and the upper grades (fourth-sixth grade) in all the subtests of the Rapid Automatized Naming (object, colors, numbers and letters). The retrieval time among the low grade group was significantly longer than the retrieval time among the high grade group.

These findings support those of Wolf & Denckla-Ran, Riva et al. (2000), and Kave (2006), who discussed the contribution of vocabulary

maturation and the development of efficient retrieval processes to performance on naming and fluency tasks.

In the Verbal Fluency Test the difference between the two grade levels (among the typically developing children) was significant in the phonologic verbal fluency test. The ability to retrieve words by a phonologic cue relates to phonological awareness and develops with age.

The ordinary speed of speech production is about 15 sounds or several words per second. The average adult may know more than 75,000 words in his mother tongue (Matlin, 1998 in Schwartz, 2002).

Namely, we are capable of retrieving two to three words per second from a lexicon containing tens of thousands of items, almost without erring (Butterworth, 1989 Levelt et al, 1991 in Biran & Friedmann, 2006; Levelt, Roelofs & Meyer, 1999). According to these claims, in the semantic verbal fluency test all the typically developing children retrieve words speedily during a one minute period. We can assume that if the duration of the test was longer than one minute, we could see a significant difference in the semantic test also.

In Word Finding Test-2, all the typically developing children managed to retrieve the right words in correct and quick naming of objects and verbs. There was a significant difference between children of low grades and high grades in producing correct and quick answers in the subtest of sentence completion. We can assume that the reason for this is that with age the ability to retrieve words associated with commonly used sentences increases.

In the Asperger group, similar to the typically developing children, there was a significant difference between retrieval time of the lower grades (first-third grade) and that of the upper grades (fourth-sixth grades) in all the subtests of the Rapid Automatized Naming (object, colors, numbers

and letters). The retrieval time among the low grade group was significantly longer than the retrieval time among the high graders.

In the Verbal Fluency Test (phonologic and semantic) there was a significant improvement in retrieval in the high grades in comparison to low grades.

In WFT-2, in the Asperger group, there was a significant difference between low and high grades in the number of correct and quick words naming of verbs and sentence completions.

This can be explained by the spontaneous improvement that the Asperger children undergo with age, even without focus therapy on word retrieval.

In the PDD NOS group, we can see that for most of the test material the children found the retrieval tasks hard to perform in low grades as in high grades. There is a significant difference in Object naming of the Rapid Automatized Naming Test, between the retrieval time among the low grades group and the retrieval time among the high grades. In colors, numbers and letters the retrieval time remained long even in high grades. Possibly, the reason for this lies in the fact that the language therapy of children diagnosed as PDD frequently exposes them to daily object names and not to colors, numbers and letters.

In the Verbal Fluency Test the difference between the two levels of grades (among PDD children) was significant in the phonologic verbal fluency test. The ability to retrieve words by a phonologic cue relates to phonological awareness and develops with age. (In the semantic verbal fluency test all the PDD NOS children retrieved many words. We can assume that had the test duration been longer, we could have observed a significant difference in the semantic test, as well).

The successful retrieval of words by a semantic cue might be explained by the focusing on daily categories such as animals and food in the language intervention therapy that the children are receiving.

In all the TWF-2 subtests (picture naming of nouns and verbs, as well as sentence completion) the retrieval abilities of correct and quick naming among the PDD NOS group were inadequate in low as well as high grades.

Limitations of the research: Although there was positive evidence of the impact of intervention therapy on retrieval abilities, it was only assessed among a small group of children and in low grades of elementary school. We assume that evaluating word retrieval in a small group does not capture the full range of intervention impact and limits the generalness of the study.

In addition, during the process of managing the tests, we tried to minimize the distractions originating in the limited ability of children on the autistic spectrum to manage test situation. Nevertheless, the inability to test the children without attention to their way of performing the tests causes reservations regarding the research results.

The hypothesis of the research

Dealing with rapid naming, Muller et al (1999) found that when Autistic subjects were asked to name pictures as rapidly as possible (rapid automatic naming) a mixed profile emerged, with some subjects showing normal performance whereas others were impaired.

The first hypothesis of the current research assumed that children on the Autistic spectrum will demonstrate more problems with word retrieval than typically developing children.

The research findings support this hypothesis. The children on the Autistic spectrum (the PDD NOS group and the Asperger group) demonstrated more problems with word retrieval than the typically developing children (TDCLS group).

These findings support Walenski et al. in their paper “Language in Autism” (2006), where they claim that there seem to be deficits in

retrieving lexical knowledge, particularly when a speedy reaction is required, among people on the autistic spectrum. Williams (1995) also noted in her article “In the Real World” that people on the autistic spectrum tend to have dominant difficulties in producing word retrieval.

When we differentiated the PDD group from the Asperger group and compared each of the groups to the typically developing group we found that in all the Rapid Automatized Naming subtests, (objects, colors, numbers and letters) the retrieval time among the PDD group was significantly longer than that of the typically developing group. The difference between the Asperger group and the typically developing group was statistically significant only where rapid naming of colors and letters was concerned.

Normal performance in semantic and phonologic verbal fluency among autistic subjects was found in Minshew et al (1995, 1997), and Muller et al. (1999).

In contrast, our results support the findings of other studies, which have reported deficits in both types of verbal fluency tasks (Rumsey,et al, 1990 in Walenski et al., 2006), as well as in unconstrained ("miscellaneous") verbal fluency *(*e.g. "Say as many words as you can think of, any words at all”) (Boucher, 1988).

The current research found that in the Verbal Fluency Test – (semantic and phonological naming tasks) both the PDD group as well as the Asperger group produced significantly fewer words than the typically developing group.

These finding support Stoddart who claimed in his book “Children, Youth and Adults with Asperger Syndrome” (2008), that there is significant word retrieval deficit among Asperger speakers.

In all the Word Finding Test subtests (picture naming of nouns and verbs, as well as sentence completion), the PDD group as well as the Asperger group produced significantly fewer correct and quick answers than the typically developing group. These findings support those of Rapin (2000) who listed in her article on the neurological basis of autism that children on the autism spectrum may have language processing deficits that result in an atypically organized lexicon and word retrieval difficulties.

In all the Word Finding Test subtests (picture naming of nouns and verbs, as well as sentence completion), in both the PDD group as well as the Asperger group, significantly more children made at least one mistake in naming, in comparison with the typically developing group.

More children on the autistic spectrum produced at least one delayed response than typically developing children. The difference between the PDD and typically developing groups was statistically significant in all the subtests. Nevertheless, the difference between the Asperger group and the typically developing group was significant only in noun and verb production.

The second hypothesis of the research assumed that PDD NOS children will demonstrate more problems with word retrieval than the Asperger children.

As the research results show, in the entire Rapid Automatized Naming Test (objects, colors, numbers and letters) the retrieval time among the PDD group was significantly longer than that of the Asperger group.

In the Verbal Fluency Test – semantic naming tasks, surprisingly the PDD group produced more words than the Asperger group. The difference was statistically significant.

The two categories chosen for word retrieval (animals and food) comprise commonly used words. A possible explanation of the puzzling

fact that the PDD group retrieved more words that the Asperger group could be that the PDD group children were treated regularly from an early age, due to the language development deficit (contrary to the Asperger group children). They were exposed to these semantic categories very frequently and they heard and used words belonging to the two categories more often than the Asperger group. Possibly, had the requested verbal retrieval concerned less accessible semantic categories, the findings may have been different.

The fact that words to which the children had been exposed frequently were retrieved more efficiently is also supported by the research of Milianti & Cullinan, (I974 in Leonard et al 83) and Rudel, Denckla, Bro-man, & Hirsch, (1980), who examined word retrieval ability among children, they showed that the retrieval process was faster when the target words were more frequently used in the speaker's language experience.

In the Verbal Fluency Test – phonologic naming tasks, the PDD group produced fewer words than the Asperger group.

In all the subtests of the Word Finding Test (picture naming of nouns and verbs, as well as sentence completion), the children in the PDD group produced significantly fewer correct and quick answers than the children in the Asperger group.

In all the subtests of the Word Finding Test (picture naming of nouns and verbs, as well as sentence completion), significantly more children of the PDD group made at least one mistake in naming, in comparison to the children of the Asperger group.

In all the Word Finding Test subtests (picture naming of nouns and verbs, as well as sentence completion), significantly more children of the PDD group produced at least one delayed response in comparison to the children in the Asperger group

Five low graders from the PDD group and five low graders from the Asperger group were engaged in an intervention plan which lasted four months and was intended to enhance the effectiveness of retrieval production.

All the low graders (ten PDD children and ten Asperger children) were submitted again to the tests after four months.

Wright et al. (1993) researched the impact of therapy on word-finding difficulties. In their study those subjects receiving the semantic treatment showed a highly significant improvement even in naming pictures which had not been part of the research.

The third and fourth hypotheses of the current research deal with the impact of therapy intervention on word retrieval ability in Asperger and PDD groups. The hypotheses assumed that the children who participate in the therapy will improve their retrieval skills following the intervention plan while the children who were tested again without any intervention therapy will have a similar score as their initial results.

We can see from the results that most of the children who were engaged in the therapy intervention managed to improve their retrieval abilities after treatment.

These results support the findings of Best (2005) who examined the intervention impact on children with word-finding difficulties. Best found that the children who differed from one another in their language development and non-verbal abilities, showed significant improvement in naming intervention items after therapy. German (2002) also mentioned improvement in word-finding abilities in third-grade students following treatment.

Among the children of the PDD group the most impressive improvement was observed in the RAN Tests and Word Finding Test.

Among the children of the Asperger group the most impressive improvement was observed in the Verbal fluency Test and Word Finding Test.

There was no significant change in the retrieval abilities of the children who were not engaged in the therapy sessions.

We measured the difference between the two sessions of tests (the first session and the second session that took place four months later) for each of the twenty low-grade children on the autistic spectrum.

We compared the test results of the children who were engaged in the intervention plan to those of the children who were not engaged in the intervention plan.

Among the PDD group the change in the ability to retrieve words, after treatment, was more significant than the change in the ability to retrieve words without treatment. The difference between the changes in children who received therapy and children who did not was statistically significant in all the research tests.

Among the Asperger group the change in the ability to retrieve words after treatment was more significant than the change in the ability to retrieve words without treatment. The difference between the changes in children who received therapy and children who did not was statistically significant in the subtest of letters of the RAN Test, in Verbal Fluency Tests (Semantic + Phonologic) and in producing Correct and Quick Responses in Word Finding-2 Test.

Conclusions and Implications for Clinical Practice and further Research: Productive verbal communication process as well as reading requires efficient word retrieval from the mental lexicon (Snyder & Godley, 1992 in Tingley et al, 2003).

In order to produce effective oral-verbal interaction (speech for communication purposes), one requires word retrieval – the ability to find the requested word as rapidly as possible, in order to convey the desired message in the most precise and intelligible manner. Word retrieval plays a central role in language processing and cognitive development.

In conclusion, the most compelling evidence for the present research was the difference in word retrieval ability between children on the autistic spectrum and typically developing children. Furthermore, the research findings show a significant difference between PDD NOS children and Asperger children on rapid naming abilities.

Children who were diagnosed as PDD NOS were not able to retrieve words rapidly and sufficiently, even in high grades of elementary school. Children who were diagnosed as Asperger Syndrome produced rapid naming better than PDD NOS. The difference between Asperger children and typically developing children which was dominant in low grades tends to lessen with age.

Overall, these results do offer strong support for the notion that among children on the autistic spectrum (Asperger and PDD NOS) there are children for whom lexical retrieval problems impede the normal pattern of language development and use. These problems include accurately and rapidly producing the correct word even when the word is in their mental lexicon.

The research found a positive impact of intervention therapy on retrieval abilities among children diagnosed as PDD NOS, and Asperger

Syndrome. The findings suggest that children on the autistic spectrum, especially those who were diagnosed as PDD NOS and have word retrieval difficulties can gain and improve verbal skills and discourse from therapy intervention focused on word finding and rapid naming skills.

Thus we recommend that language therapy comprise a specific intervention plan dealing with word retrieval, to be administered to children on the Autistic Spectrum who have language skills enabling language and oral communication interaction.

Future research can benefit from the problems which surfaced while conducting this study. A larger group should be engaged, producing language intervention focused on retrieval abilities over a longer period and with longer measurement intervals.

The current study does not claim to be more the first stage in the research of word retrieval among children on the autistic spectrum. Nevertheless, it suggests that a more focused intervention approach to word retrieval abilities is required, aimed to provide the basis for improved semantic and pragmatic language production among autistic children.

In light of the importance of these research findings we propose to continue in this research direction and place particular emphasis on professional intervention dealing with word finding materials.

REFERENCES

Abernethy, D., Donovan, K., Mcdowall, J. & Siegert, R. (1999) Clustering and Switching in Verbal Fluency in Parkinson's disease. New Zealand Journal of Psychology, Vol. 28.

Aitchison, J. (2002) Words in the Mind: An Introduction to the Mental Lexicon. Oxford, UK; New York: Blackwell.

Allen, D. (1989) Developmental language disorders in preschool children: Clinical subtypes and syndromes. School Psychology Review, 18, 442–451.

Allott, R. (2001) Autism and the Motor Theory of Language, in The Great Mosaic Eye: Language and Evolution, chapter VI, pages pp. 93-113. Book Guild.

Autism Society of America. (1995) PDD information package. Washington, D. C. Author. 7910 Woodmont Avenue, Suite 650, Bethesda, MD 20814.

Baddeley, A. (1982) Your memory: A user's guide. Penguin.

Badian, N. A. (1993) Phonemic awareness, naming, visual symbol processing, and reading.. Writing Interdisc. J, .5:87–101.

Barry, C. Hirsh, K.W. Johnston, R.A. & Williams, C.L. (2001) Age of Acquisition, Word Frequency, and the Locus of Repetition Priming of Picture Naming. Journal of Memory and Language, Volume 44, Number 3, April, pp. 350-375(26)

Best, W., (2005) Investigation of a new intervention for children with word finding problems. Int J Lang Commun Disord. 40 (3):279-318

Biklen, D. (1993a). Notes on validation studies of facilitated communication. Facilitated Communication Digest, Vol. 1 No. 2

Biklen, D. (1993b). Questions and answers about facilitated communication. Facilitated Communication Digest, 2, 10-14.

Biran, M. & Friedmann, N. (2002) The effect of semantic and phonological cueing on the naming of aphasics with deficits in various levels of lexical processing. Israeli Journal of Language speech and Hearing Disorders 24, 21-40. (In Hebrew).

Biran, M. & Friedmann, N. (2006) Learning from mistakes: naming errors and phonological lexical retrieval". Balshanut Ivrit, 57, 23-47. (in Hebrew).

Bloom, L. Lahey, M. (1978) Language Development and Language Disorders .New-York: John Wiley & Sons.

Bock, K. & Levelt W. (1994) Language Production: Grammatical Encoding. In Gernsbacher M. (ed.) Handbook of Psycholinguistics. New York: Academic Press pp. 945-983.

Bock, K., Konopka, A. & Middleton, E. (2006) Spoken Language Production: A Psycholinguistic Approach. Article Number: LALI: 00799, University of Illinois, Champaign, IL, USA 2006

Broderick, A. A. & Kasa-Hendrickson, C. (2001) The Emergence of Reliable Speech In A Student Labeled With Autism. Journal of the Association for Persons with Severe Handicaps (JASH) , 26(1), 13-24.

Boucher, J. (1988) Word fluency in high-functioning autistic children. Journal of Autism and Developmental Disorders. 18(4), 637-645

Bowers, P. G. & Wolf, M. (1993) Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. Reading and Writing: An Interdisciplinary Journal, 5(1), 69-85.

Brown, A. S. (1991) A review of the tip-of-the-tongue experience. Psychological Bulletin, 109(2), 204-223.

Burke, D. M., MacKay, D. G., Worthley, J. S. & Wade, E. (1991) On the tip of the tongue: What causes word finding failures in young and older adults? Journal of Memory and Language, 30, 542-579.

Butterworth, B. (1992) Disorders of phonological encoding. cognition 42. 261-286

Caramazza, A. (1997) How many levels of processing are there in lexical access? Cognitive Neuropsychology. 14, 177–208.

Caramazza, A. & Miozzo, M. (1997) The relation between syntactic and phonological knowledge in lexical access: Evidence from the "tip-of-the-tongue" phenomenon. Cognition, 64, 309–343.

Casby, M. (1992) An intervention approach for naming problems in children. American Journal of Speech-Language Pathology, 1(3), 35–42.

Catts, H. W. & Kamhi, A. G. (1986). The linguistic basis of reading disorders: Implications for the speech-language pathologist. Language, Speech, and Hearing Services in Schools. 17, 329-341.

Catts, H. W. (1989). Speech production deficits in developmental dyslexia. Journal of Speech and Hearing Disorders, 54, 422-428

Catts, H. (1993) The relation between speech-language impairments and reading disabilities. Journal of Speech and Hearing Research, 36, 948–958.

Catts, H. W. (1996) Defining dyslexia as a developmental language disorder: An expanded view. Topics in Language Disorders, 16(2), 14-29.

Catts, H.W., Fey, E.M., Zhang, X., Tomblin, J.B. (2001) Estimating the Risk of Future Reading Difficulties in Kindergarten Children: A Research-Based Model and Its Clinical Implementation. Language, Speech and Hearing Services In School. Vol. 32. 38-50

Clark, E. V. (2002) First language acquisition. Cambridge, England: Cambridge University Press.

Constable, A., Stackhouse, J., Wells, B., (1997) Developmental word-finding Difficulties and Phonological processing. The case of missing handcuffs. Applied psycholinguistics. 18, 507-536

Craik, E. & Lockhart, R. S. (1972) Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 11, 671-684.

Craik, F., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. Journal of Experimental Psychology: General, 104, 268–294

Dapretto, M. & Bjork, E. L. (2000) The development of word retrieval abilities in the second year and its relation to early vocabulary growth. Child Development, May-Jun; 71(3):635-48.

Davis C., Gayan J., Knopik V. (2001) Etiology of reading difficulties and rapid naming: the Colorado Twin Study of Reading Disability. Behav Genet, 31**:** 625–35

de Jong, P. F. & Vrielink, L. O. (2004) Rapid Automatic naming: Easy to measure, hard to improve (quickly). Annals of Dyslexia*,* 54*,* 1, 65-88

Dell G. S. (1986) A spreading activation theory of retrieval in sentence production. Psychological Review, pp, 283—321.

Dell, G. S. (1988) The retrieval of phonological forms in production: Tests of predictions from a connectionist model. Journal of Memory and Language, 27, 124 – 142.

Denckla, M. B. & Rudel, R. G. (1976) Rapid 'automatized' naming (R.A.N.): Dyslexia differentiated from other learning disabilities. Neuropsychologia 14: 471-479.

Diagnostic and Statistical Manual of Mental Disorders DSM-IV-TR (2000). American Psychiatric Association (Pub.)

Di Filippo, G., Brizzolara, D., Chilosi, A., et al. (2005) Rapid Naming, not cancellation speed or articulation rate, predicts reading in an orthographically regular language (Italian). Child Neuropsychol. 11: 349-361.

Dirks, D. D., Takayanagi, S., Moshfegh, A., Noffsinger, P. D. & Fausti, S. A. (2001) Examination of the neighborhood activation theory in normal and hearing-impaired listeners. Ear and Hearing, 22, 1–13.

Dobbinson, S., Perkins, M. & Boucher, J. (1998) Structural patterns in conversations with a woman who has autism, Journal of Communication Disorders 31 (1998) 1 –22.

Dockrell, J. E., Messer D., George, R., Wilson, G**.** (1998) Children with word-finding difficulties – prevalence, presentation and naming problems. International Journal of Language and Communication Disorders, 33, (4) 445-455.

Elman, J. L. (2004) An alternative view of the mental Lexicon. TRENDS in Cognitive Sciences Vol.8 No.7.

Eskes, G., Bryson, S. & McCormick, T. (1990) Comprehension of concrete and abstract words in autistic children, Journal of Autism and Developmental Disorders 20 (1990) 61–73.

Fay, W. H. & Schuler, A. L., (1980) Emerging Language in Autistic Children. Baltimore: University Park Press.

Faust, M., Dimitrovsky, L. & Davidi, S. (1997) Naming difficulties in language-disabled children: Preliminary findings with the application of the tip-of-the-tongue paradigm. Journal of Speech, Language, and Hearing Research, 40, 1026–1036.

Fine, J., Bartolucci, G., Szatmari, P., & Ginsberg, G. (1994) Cohesive discourse in pervasive developmental disorders, Journal of Autism and Developmental Disorders, 24, 315– 329.

Fromkin, V. A. (1971). The non-anomalous nature of anomalous utterances. Language, Vol. 47, pp. 27-52.

Fromkin, V.) (Ed.) (1973) Speech errors as linguistic evidence. The Hague: Mouton Publishers.

Garrett, M. (1975) The analysis of sentence production. In Bower, G. (Ed.), The psychology of learning and motivation: Advances in research and theory. New York: Academic Press. Vol. 9.133-177

Garrett, M. (1992) Disorders of lexical selections. Cognition. 42, 143-180.

Gaskell, M. G., & Dumay, N. (2003) Lexical competition and the acquisition of novel words. Cognition, **89,** 105-132.

German, D. J. (1979) Word finding skills in children with learning disabilities. Journal of Learning Disabilities, 12, 43–48.

German, D. (1982) Word-finding substitutions in children with learning disabilities. Language, Speech, and Hearing Services in Schools, 13, 223–230.

German, D. J. (1984) Diagnosis of word-finding disorders in children with learning disabilities. Journal of Learning Disabilities, 17, 353 – 358.

German, D. J. (1987) Spontaneous language profiles of children with word-finding problems. Language, Speech, and Hearing Services in Schools, 18, 217–230.

German, D. J.; Simone, E. (1991) Analysis of children's word finding skills in discourse. J. Speech Hear. Res., v. 34, p. 309-316,

German, D. J. (2001) It's on the tip of my tongue: Word-finding strategies to remember names and words you often forget. Chicago: Word Finding Materials

German, D.J. (2002) A phonologically based strategy to improve word-finding abilities in children. Communication Disorders Quarterly, 23, 179-192.

Gershkoff-Stowe, L. (2002) Object Naming, Vocabulary Growth, and the Development of Word Retrieval Abilities. Journal of Memory and Language 46**,** 665–687

Gilhooly, K. J. & Gilhooly, M. L. (1979) Age-of-acquisition effects in lexical and episodic memory tasks. Memory & Cognition, 7(3), 214 – 223.

Gollan, T. H. & Silverberg, N. B. (2001) Tip-of-the-tongue states in Hebrew–English bilinguals. Bilingualism: Language and Cognition, 4, 63–84.

Gósy, M., Kovács, M. (2002) The mental lexicon: results of some word association experiments . Acta Linguistica Hungarica, Volume 49, Number 2, 12, pp. 179-224(46).

Happe, F. (1994) Autism: An Introduction to Psychological Theory, University College Press, London, 1994.

Harris, S. L. & Glasberg, B. (1996) Pervasive developmental disorders: distinguishing among subtypes. School Psychology Review, 25, 308-316.

Heward, W. L. & Orlansky, M. D. (1992) Exceptional children: An introductory survey of special education (4th Ed.). New York: Merrill.

Hurks, P.P.M., Hendriksen, J.G.M. & Vles, J.S.H. (2004) Verbal fluency over time as a measure of automatic and controlled processing in children with ADHD. Brain and Cognition, 55:535–544

ICD-10, World Health Organization, International Classification of Diseases: 10th Revision), Author, Geneva, 1993

Jacobson, J. W., Mulick, J. A. & Schwartz, A. A. (1995) A History of Facilitated Communication: Science, Pseudoscience, and Antiscience: Science Working Group on Facilitated Communication. American Psychologist Vol. 50, No. 9, pp. 750-765

James, L. & Bruke, D. (2000) Phonological Priming Effects on Word Retrieval and Tip-of-the-Tongue Experiences in Young and Older Adults. Journal of Experimental Psychology-Learning, Memory, and Cognition. 26 (6) 1378-1391.

Jescheniak, J. D. & Levelt, W. J. M. (1994) Word frequency effects in speech production: Retrieval of syntactic information and of phonological form. Journal of Experimental Psychology: Learning, Memory, & Cognition, 20(4), 824 – 843

Jolliffe, T., Lansdown, R. & Robinson, C. (1992) Autism: a personal account, Communication, 26, 12–19.

Jones, G. V. & Langford, S. (1987) Phonological blocking the tip of the tongue state. Cognition, 26, 115-122

Jones, G. V. (1989) Back to Woodworth Role of interlopers in the tip of the tongue phenomenon. Memory and Cognition, 17, 69-76

Kail, R. & Leonard, L. (1986) Word finding abilities in language-impaired children (ASHA Monographs 25). Rockville, MD: American Speech-Language-Hearing Association

Kamhi, A. G., Catts, H. W., Mauer, D., Apel, K., & Gentry, B. F. (1988) Phonological and spatial processing abilities in language- and reading-impaired children. Journal of Speech and Hearing Disorders, 53, 316-327.

Kasher, A. & Meilijson, S. (2003) Autism and Pragmatics of Language (in Hebrew). Dash (Speech and Hearing), Journal of the Israeli Speech, Language and Hearing Association.

Kave', G. (2006). The development of naming and word fluency: evidence from Hebrew-speaking children between ages 8 and 17. Developmental Neuropsychology, 29 (3), 493-508.

Kempen, G. & Hoenkamp, E. (1987) An incremental procedural grammar for sentence formulation. Cognitive Science 11, 201–258.

Kjelgaard, M., & Tager–Flusberg, H. (2001) An investigation of language impairment in autism: implications for genetic subgroups, Language and Cognitive Processes 16, 287– 308.

Koegel, L.K., Koegel, R.L., & Smith, A. (1997). Variables related to differences in standardized test outcomes for children with ASD. Journal of Autism and Developmental Disorders, 27, 233-243.

Korhonen, T. T. (1995) The persistence of rapid naming problems in children with reading disabilities: A nine-year follow-up. J. Learn. Disabil. 28:232–239.

Koriat. A., (2000) The Feeling of Knowing: Some Metatheoretical Implications for Consciousness and Control. Consciousness and Cognition 9**,** 149–171.

Koriat A., Levy-Sadot, R., Edry, E., de Marcas, S. (2003) What do we know about what we cannot remember? Accessing the semantic attributes of words that cannot be recalled. Journal of Experimental Psychology: Learning, Memory, and Cognition, Nov; 29(6):1095-105

Lachman, R., Shaffer, J. P. & Hennrikus, D. (1974). Language and cognition: Effects of stimulus codability, name-word frequency, and age of acquisition on lexical reaction time. Journal of Verbal Learning and Verbal Behavior, 13, 613 – 625.

Lahey, M. (1988). Language disorders and language development. New York: Macmillan

Lahey, M. & Edwards, J. (1996) Why do children with specific language impairment name pictures more slowly than their peers? Journal of Speech and Hearing Research, 39, 1081–1098.

Lahey, M. & Edwards, J. (1999) Naming Errors of Children with Specific Language Impairment. Journal of Speech, Language, and Hearing Research, 42, 195-205.

Landa, R. (2000) Social language use in Asperger syndrome and high-functioning autism. In A. Kim, F. Volkmar, & Sparrow, S. (Eds.), Asperger Syndrome. New York: Guilford Press.

Leonard, L. B., Nippold, M. A., Kall, R. & Hale, C. A. (1983) Picture naming in language-impaired children. Journal of Speech and Hearing Research, 26, 609-615.

Leonard, L. (1999) Introduction. In Leonard, L. Children with specific Language Impairment, (pp3-25). Cambridge, Massachusetts, MIT press.

Levelt, W. J. M. (1989) Speaking: From intention to articulation. Cambridge, MA: MIT Press.

Levelt, W. J. M. (1992) Accessing words in speech production: stages, processes and representations. Cognition 42. 1-22

Levelt, W. J. M. (1999) Models of word production. Trends in Cognitive Sciences, 3 (6), 223-232.

Levelt, W. J. M., Roelofs, A. & Meyer, A. S. (1999) A theory of lexical access in speech production. Behavioral and Brain Sciences, 22, 1–75.

Lord, C. & Paul, R. (1997) Language and communication in autism. In D. Cohen and F. Volkmar (Eds.), Handbook of autism and pervasive developmental disorders (2nd Ed.) (pp. 195-225). New York: John Wiley & Sons.

Loveland, K. Tunali-Kotoski, B. (1997) The school-age child with autism, in: D. Cohen, F. Volkmar (Eds.), Handbook of Autism and Pervasive Developmental Disorders, 2nd ed., Wiley, New York, pp. 283–308.

Luce, P. A. & Pisoni, D. B. (1998) Recognizing spoken words: The Neighborhood Activation Model. Ear & Hearing, 19(1), 1 – 36.

McGregor, K. K. (1994) Use of Phonological Information in A Word Finding Treatment Children. Journal of Speech and Hearing Research, 37, 1381-1393.

McGregor, K. K. & Windsor, J. (1996) Effects of priming on the naming accuracy of preschoolers with word-finding deficits. Journal of Speech and Hearing Research, 39, 1048–1058.

McGregor, K. K. (1997) The nature of word-finding errors of preschoolers with and without word-finding deficit. Journal of Speech and Hearing Research, 40, 123-1244.

McGregor, K. K., & Leonard, L. B. (1989). Facilitating word-finding skills of language-impaired children. Journal of Speech and Hearing Disorders, 54, 141–147.

Messer, D. & Dockrell, J. E. (2006) Children's naming and word-finding difficulties: descriptions and explanations. Journal of Speech and Hearing Research. 2006 Apr; 49(2):309-24.

Meyer, D. E. & Schvaneveldt, R. W. (1971) Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. Journal of Experimental Psychology, 90, 227-234.

Meyer, M. S., Wood, F. B., Hart, L. A. & Felton, R. H. (1998) Selective predictive value of rapid automatized naming in poor readers. Journal of Learning Disabilities, 31, 106–117.

Minshew, N. J., Goldstein, G. & Siegel, D. J. (1995) Speech and language in high functioning autistic individuals. Neuropsychology, 9, 255-261.

Minshew, N.J., Goldstein, G. & Siegel, D.J. (1997). Neuropsychologic functioning in autism: Profile of a complex information processing disorder. Journal of the International Neuropsychological society, 3, 303-316

Miozzo, M. & Caramazza, A. (1997) Retrieval of lexical-syntactic features in tip-of-the-tongue states. Journal of Experimental Psychology: Learning, Memory, and Cognition, 23, 1410–1423.

Miozzo, M. & Caramazza, A. (1997) On knowing the auxiliary of a verb that cannot be named: evidence for the independence of grammatical and phonological aspects of lexical knowledge. Journal of Cognitive Neuroscience 9, 160–166.

Morton, J. (1969) Interaction of information in word recognition. Psychological Review, 76, 165-178

Muller, R., Chugani, D., Behen, M., Rothermel, R., Muzik, O., Chakraborty, P., & Chugani, H. (1998) Impairment of dentate-thalamo-cortical pathway in autistic men: Language activation data from PET. Neuroscience Letters, 245: 1-4.

Muller, R., Behen, M., Rothermel, R., Chugani, D., Muzik, O., Mangner, T., Chugani, D. (1999) Brain mapping of language and auditory perception in high-functioning autistic adults: a PET study. J Autism Dev. Disord., 29:19–31.

Neville, A. (1990) The Role of Unestablished Referent in the conversations of Young Communicatively Impaired Children http://www.nwalbion.u-net.com/neville/content.html

Newman, R. S. & German, D. (2002) Effects of lexical factors on lexical access among typical language learning children and children with word-finding difficulties. Language and Speech, 45, 285–317

Owens, R.E., (1992). Language Development: An Introduction. Allyn and Backon. pp. 6-14.

Rapin, I., (1991) Autistic children: Diagnostic and clinical features. Pediatrics, 87: 751- 760.

Rapin, I. (Ed.) (1996) Preschool children with inadequate communication (Clinics in developmental medicine, No. 139). London: Mac Keith Press.

Rapin, I., (2000) Neurologic Basis of Autism: Differential Diagnosis and Management, Jacksonville Medicine [On-line] http://www.dcmsonline.org/jaxmedicine/2000journals/march2000/autism.htm

Rastle, K. G. & Burke, D. M. (1996) Priming the tip of the tongue: Effects of prior processing on word retrieval in young and older adults. Journal of Memory and Language, 35, 586-605.

Rice, M. & Brooks, G. (2004) Developmental dyslexia in adults: A research review. London: NRDC

Rice, M. L., Warren, S. F., & Betz, S. K. (2005) Language symptoms of developmental language disorders: An overview of autism, Down syndrome, fragile X, specific language impairment, and Williams syndrome. Applied Psycholinguistics, 26, 7-27.

Rispens, J. (2004) Syntactic and Phonological Processing in Developmental Dyslexia. Groningen Dissertations in Linguistics 48 http://dissertations.ub.rug.nl/FILES/faculties/arts/2004/j.e.rispens/thesis.pdf

Riva, D., Nichelli, F., Devoti, M. (2000) Developmental aspects of verbal fluency and confrontation naming in children. Brain Lang. 1; 71 (2):267-84)

Roelofs, A. P. A., Meyer, A. S. & Levelt, W. J. M. (1998) A case for the lemma/lexeme distinction in models of speaking: Comments on Caramazza and Miozzo (1997). Cognition, 69 (2), 219-230.

Rudel, R., Denckla, M., Broman, M., & Hirsch, S. (1980) Word-finding as a function of stimulus context: Children compared with aphasic adults. Brain and Language, 10, 111–119

Scarborough, H. S. (1998) Predicting the future achievement of second graders with reading disabilities: Contributions of phonemic awareness, verbal memory, rapid naming, and IQ. Ann.Dyslex. 48:115–136.

Schwartz, B. L., (1999) Sparkling at the end of the tongue: the etiology of tip-of-the-tongue phenomenology. Psychonomic Bulletin & Review 6, 379-93

Schwartz, B. L. (2002) Tip-of-the-tongue states: Phenomenology, mechanism, and lexical retrieval. Hillsdale, NJ: Erlbaum

Schwartz, B.L. & Frazier, L. D. (2005) Tip-of-the-tongue states and aging: contrasting psycholinguistic and metacognitive perspective. Journal of General Psychology, 132, 377-391.

Seal B. & Bonvillian, J. (1997) Sign language and motor functioning in students with autistic disorder. Journal of Autism and Developmental Disorders 27 (1997) 437–466.

Siegel, L. S., & Ryan, E. B. (1988) Development of grammatical-sensitivity, phonological, and short-term memory skills in normally achieving and learning disabled children. Developmental Psychology, 24(1), 28-37.

Stoddart, K. P. (2008) Children, Youth and Adults with Asperger Syndrome Integrating Multiple Perspectives. Jessica Kingsley Publishers

Sverd, J., Dubey, D. R., Schweitzer, R., Ninan, R. (2003) Pervasive Developmental Disorders among Children and Adolescents Attending Psychiatric Day Treatment. Psychiatr Serv. Nov. 54(11): 1519-25.

Szatkowska, I., Grabowska, A, Szymanska, O. Phonological and semantic fluencies are mediated by different regions of the prefrontal cortex. Acta Neurobiol Exp (Wars) 2000; 60: 503–8

Tager-Flusberg, H. (1985) The conceptual basis for referential word meaning in children with autism. Child Development, 56, 1167-1178.

Tager-Flusberg H. & Sullivan, K. (1995) Attributing mental states to story characters: a comparison of narratives produced by autistic and mentally retarded individuals, Applied Psycholinguistics 16, 241– 256.

Tager-Flusberg, H., (1996) Current theory and research on language and communication in autism, Journal of Autism and Developmental Disorders, 26, 169– 172.

Tager-Flusberg, H. (1999). A psychological approach to understanding the social and language impairments in autism. International Review of Psychiatry, 11, 325–334.

Tager-Flusberg, H. (2000a) The challenge of studying language development in children with autism. In Menn, L. & Ratner, N. B.,

(Eds.), Methods for studying language production (pp. 313–331). Mahwah, NJ: Erlbaum.

Tager-Flusberg, H. (2000b) Understanding the language and communicative impairments in autism. In L. M. Glidden (Ed.), International review of research on mental retardation (Vol. 20, pp. 185–205). San Diego, CA: Academic Press.

Tantam, D., (1988). Asperger's syndrome or autistic personality disorder. Communication, 22, 37-39.

Tingley, S. J., Kyte, C. S., Johnson, C. J., Beitchman, J. H. (2003) Single-word and conversational measures of word-finding proficiency. Am J Speech Lang Pathol. Aug. 12(3):359-368.

Torgesen, J. K., Wagner, R., Rashotte, C. A., Burgess, S., & Hecht, S. (1997). Contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading skills in second to fifth-grade children. Scientific Studies of Reading, 1, 161-185.

Tweney, R. D., Tkacz, S., Zaruba S. (1975) Slips of the tongue and lexical storage. Lang Oct-Dec; 18(4):388-96.

Vigliocci, G. (2002) Tip-of-the-tongue: Psychology of. International Encyclopedia of the Social and Behavioral Science 23: 15759-62.

VITEVITCH, M. S. (1997) The neighborhood characteristics of malapropisms. Language & Speech, 40(3), 211 – 228.

VITEVITCH, M. S. (2002) The influence of phonological similarity neighborhoods on speech production. Journal of Experimental Psychology: Learning, Memory, & Cognition, 28,735 – 747.

Vitevitch, M. S. & Sommers, M. S. (1999) Neighborhood Density, the Tip-of-the-Tongue Phenomenon, and Aging. Research on Spoken Language, Processing Progress Report. No. 23, Indiana University.

Walenski, M., Tager-Flusberg, H., and Ullman, M. T. (2006). Language in Autism. In Understanding Autism: From Basic Neuroscience to Treatment. S. O. Moldin and J. L. R. Rubenstein (Eds.), Boca Raton, FL: Taylor and Francis Books.

Watson, L.R. & Marcus, L.M. (1995). Diagnosis and assessment of preschool children. In E. Schopler & G.B. Mesibov (Eds.). Diagnosis and assessment in ASD. (pp.271-301). New York: Plenum Press.

Wiig, E., Semel, E., & Nystrom, L. (1982). Comparison of rapid naming abilities in language-learning-disabled and academically achieving eight year olds. Language, Speech, and Hearing Services in the Schools, 13(1) 11-23

Wing, L., & Gould, J., (1979). Severe impairment of social interaction and associated abnormalities in children: epidemiology and classification. Journal of Autism and Developmental Disorders, 9: 11-20.

Wing, C. S. (1990). A preliminary investigation of generalization to untrained words following two treatments of children's word-finding problems. Language, Speech, and Hearing Services in Schools, 21, 151-156.

Williams, D., (1995) In the real world. The Facilitated Communication Digest Vol. 3 No. 2.

Williams, D. L., Goldstein, G. & Minshew, N. (2006) The profile of memory function in children with autism. Neuropsychology, Vol. 20, No. 1, 21–29

Wilkinson, K. M. (1998) Profiles of language and communications skills in autism. Mental Retardation and Developmental Disabilities, 473-79,

Wolf, M. (1982) The word-retrieval process and reading in children and aphasics. In K. Nelson (Ed.), Children's language, Vol. 3, pp. 437- 493. New York: Gardner Press

Wolf, M., & Bowers, P. G. (1999) The double-deficit hypothesis for the developmental dyslexias. Journal of Educational Psychology, 91(3), 124.

Wolf, M., Miller, L., & Donnelley, K. (2000) The Retrieval, Automaticity, Vocabulary Elaboration, Orthography (RAVE-O): A comprehensive fluency-based reading intervention program. Journal of Learning Disabilities, 33, 375–386.

Wolf, M., Bowers, P. G. & Biddle, K. (2000b) Naming-speed processes, timing, and reading: a conceptual review. Journal of Learning Disabilities, 33(4), 387–407.

Wolf, M. & Denckla, M.B. (2005) Rapid Automatized Naming and Rapid Alternating Stimulus Tests (RAN/RAS). Pro-Ed Publishers 8700 Shoal Creek Blvd. Austin, TX78757

Wright, S. H., Gorrie, B., Haynes, C., and Shipman, A. (1993) What's in a name? Comparative therapy for word-finding difficulties using semantic and phonological approaches. Child Language Teaching and Therapy, 9(3): 214 - 229.

Plaut, A. (1994) Hearing impaired students. Ahh Publishing Company. (In Hebrew).

APPENDICES

Appendix 1: RAN Test results in seconds

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	OBJECTS	COLORS	NUMBERS	LETTERS
1	NDCLS	M	6.9	first	regular class	58.2	48.1	41.5	53.6
2	NDCLS	F	6.4	first	regular class	73.1	51.8	43.6	58.3
3	NDCLS	M	6.8	first	regular class	73.2	43.8	44.3	55.4
4	NDCLS	M	6.3	first	regular class	81.2	51.3	43.3	56.6
5	Asperger	F	7.2	first	regular class	57.3	49.1	41.3	38.3
6	Asperger	M	6.6	first	regular class	74.1	52.3	42.1	64.4
7	Asperger	M	6.8	first	regular class	59.5	58.4	45.1	58.2
8	Asperger	F	6.8	first	regular class	60.5	55.4	48.4	57.2
9	PDD	M	6.3	first	special class	114.0	72.3	58.5	118.3
10	PDD	M	6.7	first	regular class	130.1	110.1	88.5	124.4
11	PDD	M	6.5	first	special class	85.1	67.5	57.3	85.6
12	PDD	M	7.2	first	regular class	103.0	107.1	67.3	108.3
13	NDCLS	M	8.2	second	regular class	59.0	47.1	31.3	34.3
14	NDCLS	F	7.9	second	regular class	63.1	48.3	33.4	37.1
15	NDCLS	F	7.6	second	regular class	55.9	33.8	29.6	36.7
16	Asperger	F	8.2	second	regular class	63.1	47.2	35.2	43.3
17	Asperger	M	8.3	second	regular class	75.0	49.0	35.2	43.6
18	Asperger	M	8.4	second	regular class	67.3	56.6	37.1	40.2
19	PDD	M	8.3	second	special class	110.3	58.2	54.2	73.1
20	PDD	M	7.3	second	regular class	76.1	51.5	51.1	68.4
21	PDD	M	8.5	second	regular class	73.5	45.1	34.5	45.1
22	NDCLS	F	8.7	third	regular class	48.3	46.2	25.7	32.1
23	NDCLS	M	8.4	third	regular class	58.5	47.1	27.3	34.1
24	NDCLS	M	8.7	third	regular class	60.5	47.6	26.3	33.7
25	Asperger	M	8.9	third	regular class	53.1	51.2	32.5	38.4
26	Asperger	M	8.8	third	regular class	61.3	55.0	29.1	40.6
27	Asperger	M	8.8	third	regular class	66.3	60.3	33.5	41.0
28	PDD	F	8.8	third	regular class	87.3	57.3	42.5	59.1
29	PDD	M	8.5	third	special class	85.1	50.3	36.9	45.5
30	PDD	M	8.8	third	special class	81.3	56.1	34.3	41.3

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	OBJECTS	COLORS	NUMBERS	LETTERS
31	NDCLS	F	10.2	forth	regular class	44.2	42.8	24.6	29.1
32	NDCLS	M	9.2	forth	regular class	40.3	38.2	23.3	29.6
33	NDCLS	M	9.6	forth	regular class	41.3	42.7	25.2	28.8
34	NDCLS	F	10	forth	regular class	41.6	40.7	23.9	31.6
35	Asperger	F	10.2	forth	regular class	43.5	42.5	27.1	39.2
36	Asperger	M	9.8	forth	regular class	42.6	43.2	25.3	31.2
37	Asperger	F	9.6	forth	regular class	44.1	41.1	23.4	32.6
38	Asperger	F	10.2	forth	regular class	48.1	50.1	27.6	35.1
39	PDD	M	9.3	forth	regular class	59.1	58.2	35.5	35.1
40	PDD	M	10.6	forth	special class	75.2	72.1	38.3	52.2
41	PDD	M	9.9	forth	regular class	69.5	50.4	42.2	56.1
42	PDD	M	10.7	forth	regular class	89.6	47.3	39.3	61.3
43	NDCLS	M	10.7	fifth	regular class	46.5	28.2	22.8	30.1
44	NDCLS	M	10.9	fifth	regular class	43.2	31.5	21.6	24.9
45	NDCLS	F	11	fifth	regular class	42.1	38.6	25.2	28.6
46	Asperger	M	11	fifth	regular class	42.4	41.3	27.5	31.0
47	Asperger	F	10.8	fifth	regular class	45.6	43.1	25.6	29.7
48	Asperger	M	10.7	fifth	regular class	47.3	45.1	27.1	30.5
49	PDD	F	11.2	fifth	regular class	58.2	46.2	45.1	51.6
50	PDD	M	10.1	fifth	regular class	63.7	51.1	47.6	54.7
51	PDD	M	10.9	fifth	regular class	65.1	53.2	48.2	53.4
52	NDCLS	M	11.7	sixth	regular class	33.1	31.8	20.3	27.1
53	NDCLS	M	11.9	sixth	regular class	41.1	36.8	23.1	31.6
54	NDCLS	F	12.1	sixth	regular class	41.7	36.8	22.7	29.6
55	Asperger	F	11.5	sixth	regular class	40.1	38.3	23.6	32.1
56	Asperger	M	12.9	sixth	regular class	39.5	37.3	24.1	33.2
57	Asperger	M	12.2	sixth	regular class	39.2	35.2	22.3	31.4
58	PDD	M	12.3	sixth	regular class	63.1	38.1	36.5	60.1
59	PDD	M	12.1	sixth	special class	47.1	37.5	25.3	37.1
60	PDD	M	11.6	sixth	special class	68.1	52.1	40.1	66.3

Appendix 2: Verbal Fluency Test. Results in number of words

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	SEMANTIC	FHONOLOGIC
1	NDCLS	M	6.9	first	regular class	19	6
2	NDCLS	F	6.4	first	regular class	38	6
3	NDCLS	M	6.8	first	regular class	21	5
4	NDCLS	M	6.3	first	regular class	29	8
5	Asperger	F	7.2	first	regular class	14	4
6	Asperger	M	6.6	first	regular class	13	4
7	Asperger	M	6.8	first	regular class	13	4
8	Asperger	F	6.8	first	regular class	16	7
9	PDD	M	6.3	first	special class	16	2
10	PDD	M	6.7	first	regular class	16	3
11	PDD	M	6.5	first	special class	18	4
12	PDD	M	7.2	first	regular class	25	3
13	NDCLS	M	8.2	second	regular class	22	10
14	NDCLS	F	7.9	second	regular class	27	8
15	NDCLS	F	7.6	second	regular class	25	12
16	Asperger	F	8.2	second	regular class	17	6
17	Asperger	M	8.3	second	regular class	15	5
18	Asperger	M	8.4	second	regular class	20	7
19	PDD	M	8.3	second	special class	24	6
20	PDD	M	7.3	second	regular class	21	5
21	PDD	M	8.5	second	regular class	20	6
22	NDCLS	F	8.7	third	regular class	27	11
23	NDCLS	M	8.4	third	regular class	22	10
24	NDCLS	M	8.7	third	regular class	25	12
25	Asperger	M	8.9	third	regular class	19	6
26	Asperger	M	8.8	third	regular class	18	11
27	Asperger	M	8.8	third	regular class	27	7
28	PDD	F	8.8	third	regular class	26	6
29	PDD	M	8.5	third	special class	27	7
30	PDD	M	8.8	third	special class	30	7

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	SEMANTIC	FHONOLOGIC
31	NDCLS	F	10.2	forth	regular class	30	19
32	NDCLS	M	9.2	forth	regular class	27	18
33	NDCLS	M	9.6	forth	regular class	38	16
34	NDCLS	F	10	forth	regular class	25	19
35	Asperger	F	10.2	forth	regular class	17	6
36	Asperger	M	9.8	forth	regular class	23	14
37	Asperger	F	9.6	forth	regular class	23	9
38	Asperger	F	10.2	forth	regular class	18	5
39	PDD	M	9.3	forth	regular class	22	9
40	PDD	M	10.6	forth	special class	24	7
41	PDD	M	9.9	forth	regular class	29	5
42	PDD	M	10.7	forth	regular class	12	5
43	NDCLS	M	10.7	fifth	regular class	27	25
44	NDCLS	M	10.9	fifth	regular class	26	21
45	NDCLS	F	11	fifth	regular class	27	17
46	Asperger	M	11	fifth	regular class	25	9
47	Asperger	F	10.8	fifth	regular class	23	15
48	Asperger	M	10.7	fifth	regular class	22	13
49	PDD	F	11.2	fifth	regular class	25	7
50	PDD	M	10.1	fifth	regular class	24	8
51	PDD	M	10.9	fifth	regular class	27	7
52	NDCLS	M	11.7	sixth	regular class	31	19
53	NDCLS	M	11.9	sixth	regular class	27	20
54	NDCLS	F	12.1	sixth	regular class	26	25
55	Asperger	F	11.5	sixth	regular class	25	12
56	Asperger	M	12.9	sixth	regular class	24	8
57	Asperger	M	12.2	sixth	regular class	26	16
58	PDD	M	12.3	sixth	regular class	25	7
59	PDD	M	12.1	sixth	special class	27	8
60	PDD	M	11.6	sixth	special class	21	10

Appendix 3: Test of Word Finding 2 – Nouns.

EXAMI-NEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	TOTAL NR OF ERRORS	TOTTAL NR OF CORRECT QUICK RESPONSE	TOTTAL NR OF DELAYED RESPONSE
1	NDCLS	M	6.9	first	regular class	0	12	0
2	NDCLS	F	6.4	first	regular class	0	12	0
3	NDCLS	M	6.8	first	regular class	0	12	0
4	NDCLS	M	6.3	first	regular class	0	12	0
5	Asperger	F	7.2	first	regular class	0	8	4
6	Asperger	M	6.6	first	regular class	1	10	1
7	Asperger	M	6.8	first	regular class	1	9	2
8	Asperger	F	6.8	first	regular class	1	9	2
9	PDD	M	6.3	first	special class	3	6	3
10	PDD	M	6.7	first	regular class	5	5	2
11	PDD	M	6.5	first	special class	3	7	2
12	PDD	M	7.2	first	regular class	2	7	3
13	NDCLS	M	8.2	second	regular class	0	12	0
14	NDCLS	F	7.9	second	regular class	0	12	0
15	NDCLS	F	7.6	second	regular class	0	12	0
16	Asperger	F	8.2	second	regular class	0	12	0
17	Asperger	M	8.3	second	regular class	0	12	0
18	Asperger	M	8.4	second	regular class	1	10	1
19	PDD	M	8.3	second	special class	2	8	2
20	PDD	M	7.3	second	regular class	1	9	2
21	PDD	M	8.5	second	regular class	2	9	1
22	NDCLS	F	8.7	third	regular class	0	12	0
23	NDCLS	M	8.4	third	regular class	0	12	0
24	NDCLS	M	8.7	third	regular class	0	12	0
25	Asperger	M	8.9	third	regular class	0	11	1
26	Asperger	M	8.8	third	regular class	1	10	1
27	Asperger	M	8.8	third	regular class	0	11	1
28	PDD	F	8.8	third	regular class	3	5	4
29	PDD	M	8.5	third	special class	2	6	4
30	PDD	M	8.8	third	special class	2	5	5

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	TOTAL NR OF ERRORS	TOTTAL NR OF CORRECT QUICK ESPONSE	TOTTAL NR OF DELAYED RESPONSE
31	NDCLS	F	10.2	forth	regular class	0	12	0
32	NDCLS	M	9.2	forth	regular class	0	12	0
33	NDCLS	M	9.6	forth	regular class	0	11	1
34	NDCLS	F	10	forth	regular class	0	12	0
35	Asperger	F	10.2	forth	regular class	1	11	0
36	Asperger	M	9.8	forth	regular class	0	12	0
37	Asperger	F	9.6	forth	regular class	0	11	1
38	Asperger	F	10.2	forth	regular class	1	11	0
39	PDD	M	9.3	forth	regular class	1	8	3
40	PDD	M	10.6	forth	special class	2	7	3
41	PDD	M	9.9	forth	regular class	2	6	4
42	PDD	M	10.7	forth	regular class	4	2	6
43	NDCLS	M	10.7	fifth	regular class	0	12	0
44	NDCLS	M	10.9	fifth	regular class	0	12	0
45	NDCLS	F	11	fifth	regular class	0	12	0
46	Asperger	M	11	fifth	regular class	0	11	1
47	Asperger	F	10.8	fifth	regular class	0	11	1
48	Asperger	M	10.7	fifth	regular class	1	10	1
49	PDD	F	11.2	fifth	regular class	2	6	4
50	PDD	M	10.1	fifth	regular class	1	9	2
51	PDD	M	10.9	fifth	regular class	3	5	4
52	NDCLS	M	11.7	sixth	regular class	0	12	0
53	NDCLS	M	11.9	sixth	regular class	0	12	0
54	NDCLS	F	12.1	sixth	regular class	0	12	0
55	Asperger	F	11.5	sixth	regular class	0	12	0
56	Asperger	M	12.9	sixth	regular class	1	9	2
57	Asperger	M	12.2	sixth	regular class	0	11	1
58	PDD	M	12.3	sixth	regular class	2	7	3
59	PDD	M	12.1	sixth	special class	3	5	4
60	PDD	M	11.6	sixth	special class	1	9	2

Appendix 4: Test of Word Finding 2 – Sentences.

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	TOTAL NR OF ERRORS	TOTTAL NR OF CORRECT QUICK RESPONSE	TOTTAL NR OF DELAYED RESPONSE
1	NDCLS	M	6.9	first	regular class	0	11	1
2	NDCLS	F	6.4	first	regular class	0	11	1
3	NDCLS	M	6.8	first	regular class	0	11	1
4	NDCLS	M	6.3	first	regular class	0	10	2
5	Asperger	F	7.2	first	regular class	1	7	4
6	Asperger	M	6.6	first	regular class	2	10	0
7	Asperger	M	6.8	first	regular class	2	8	2
8	Asperger	F	6.8	first	regular class	1	10	1
9	PDD	M	6.3	first	special class	3	4	5
10	PDD	M	6.7	first	regular class	4	5	3
11	PDD	M	6.5	first	special class	2	8	2
12	PDD	M	7.2	first	regular class	2	8	2
13	NDCLS	M	8.2	second	regular class	1	11	0
14	NDCLS	F	7.9	second	regular class	0	12	0
15	NDCLS	F	7.6	second	regular class	0	12	0
16	Asperger	F	8.2	second	regular class	1	11	0
17	Asperger	M	8.3	second	regular class	0	10	2
18	Asperger	M	8.4	second	regular class	0	12	0
19	PDD	M	8.3	second	special class	1	9	2
20	PDD	M	7.3	second	regular class	2	8	2
21	PDD	M	8.5	second	regular class	0	10	2
22	NDCLS	F	8.7	third	regular class	0	11	1
23	NDCLS	M	8.4	third	regular class	0	12	0
24	NDCLS	M	8.7	third	regular class	0	12	0
25	Asperger	M	8.9	third	regular class	1	10	1
26	Asperger	M	8.8	third	regular class	1	11	0
27	Asperger	M	8.8	third	regular class	0	11	1
28	PDD	F	8.8	third	regular class	2	8	2
29	PDD	M	8.5	third	special class	3	5	4
30	PDD	M	8.8	third	special class	2	7	3

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	TOTAL NR OF ERRORS	TOTTAL NR OF CORRECT QUICK RESPONSE	TOTTAL NR OF DELAYED RESPONSE
31	NDCLS	F	10.2	forth	regular class	0	12	0
32	NDCLS	M	9.2	forth	regular class	0	12	0
33	NDCLS	M	9.6	forth	regular class	0	12	0
34	NDCLS	F	10	forth	regular class	0	12	0
35	Asperger	F	10.2	forth	regular class	0	12	0
36	Asperger	M	9.8	forth	regular class	0	12	0
37	Asperger	F	9.6	forth	regular class	0	12	0
38	Asperger	F	10.2	forth	regular class	0	12	0
39	PDD	M	9.3	forth	regular class	1	9	2
40	PDD	M	10.6	forth	special class	1	8	3
41	PDD	M	9.9	forth	regular class	2	8	2
42	PDD	M	10.7	forth	regular class	3	4	5
43	NDCLS	M	10.7	fifth	regular class	0	12	0
44	NDCLS	M	10.9	fifth	regular class	0	12	0
45	NDCLS	F	11	fifth	regular class	0	12	0
46	Asperger	M	11	fifth	regular class	0	12	0
47	Asperger	F	10.8	fifth	regular class	0	12	0
48	Asperger	M	10.7	fifth	regular class	0	11	1
49	PDD	F	11.2	fifth	regular class	3	5	4
50	PDD	M	10.1	fifth	regular class	2	6	4
51	PDD	M	10.9	fifth	regular class	2	5	5
52	NDCLS	M	11.7	sixth	regular class	0	12	0
53	NDCLS	M	11.9	sixth	regular class	0	11	1
54	NDCLS	F	12.1	sixth	regular class	0	12	0
55	Asperger	F	11.5	sixth	regular class	0	10	2
56	Asperger	M	12.9	sixth	regular class	0	11	1
57	Asperger	M	12.2	sixth	regular class	1	10	1
58	PDD	M	12.3	sixth	regular class	2	7	3
59	PDD	M	12.1	sixth	special class	3	5	4
60	PDD	M	11.6	sixth	special class	3	5	4

Appendix 5: Test of Word Finding 2 – Verbs.

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	TOTAL NR OF ERRORS	TOTTAL NR OF CORRECT QUICK RESPONSE	TOTTAL NR OF DELAYED RESPONSE
1	NDCLS	M	6.9	first	regular class	0	12	0
2	NDCLS	F	6.4	first	regular class	0	10	2
3	NDCLS	M	6.8	first	regular class	0	12	0
4	NDCLS	M	6.3	first	regular class	0	12	0
5	Asperger	F	7.2	first	regular class	1	10	1
6	Asperger	M	6.6	first	regular class	1	9	2
7	Asperger	M	6.8	first	regular class	3	7	2
8	Asperger	F	6.8	first	regular class	0	12	0
9	PDD	M	6.3	first	special class	4	6	2
10	PDD	M	6.7	first	regular class	4	4	4
11	PDD	M	6.5	first	special class	4	7	1
12	PDD	M	7.2	first	regular class	3	6	3
13	NDCLS	M	8.2	second	regular class	0	12	0
14	NDCLS	F	7.9	second	regular class	1	11	0
15	NDCLS	F	7.6	second	regular class	0	11	1
16	Asperger	F	8.2	second	regular class	0	11	1
17	Asperger	M	8.3	second	regular class	1	10	1
18	Asperger	M	8.4	second	regular class	1	10	1
19	PDD	M	8.3	second	special class	3	8	1
20	PDD	M	7.3	second	regular class	3	6	3
21	PDD	M	8.5	second	regular class	2	8	2
22	NDCLS	F	8.7	third	regular class	0	11	1
23	NDCLS	M	8.4	third	regular class	1	11	0
24	NDCLS	M	8.7	third	regular class	0	12	0
25	Asperger	M	8.9	third	regular class	1	10	1
26	Asperger	M	8.8	third	regular class	0	12	0
27	Asperger	M	8.8	third	regular class	2	9	1
28	PDD	F	8.8	third	regular class	3	4	5
29	PDD	M	8.5	third	special class	2	7	3
30	PDD	M	8.8	third	special class	2	6	4

EXAMINEE NR	GROUP	GENDER	AGE	GRADE	PLACE OF EDUCATION	TOTAL NR OF ERRORS	TOTTAL NR OF CORRECT QUICK RESPONSE	TOTTAL NR OF DELAYED RESPONSE
31	NDCLS	F	10.2	forth	regular class	0	11	1
32	NDCLS	M	9.2	forth	regular class	0	12	0
33	NDCLS	M	9.6	forth	regular class	0	11	1
34	NDCLS	F	10	forth	regular class	0	12	0
35	Asperger	F	10.2	forth	regular class	0	12	0
36	Asperger	M	9.8	forth	regular class	0	12	0
37	Asperger	F	9.6	forth	regular class	0	11	1
38	Asperger	F	10.2	forth	regular class	0	11	1
39	PDD	M	9.3	forth	regular class	2	7	3
40	PDD	M	10.6	forth	special class	3	7	2
41	PDD	M	9.9	forth	regular class	2	7	3
42	PDD	M	10.7	forth	regular class	4	3	5
43	NDCLS	M	10.7	fifth	regular class	0	12	0
44	NDCLS	M	10.9	fifth	regular class	0	12	0
45	NDCLS	F	11	fifth	regular class	0	12	0
46	Asperger	M	11	fifth	regular class	1	10	1
47	Asperger	F	10.8	fifth	regular class	0	11	1
48	Asperger	M	10.7	fifth	regular class	0	10	2
49	PDD	F	11.2	fifth	regular class	2	5	5
50	PDD	M	10.1	fifth	regular class	3	4	5
51	PDD	M	10.9	fifth	regular class	2	5	5
52	NDCLS	M	11.7	sixth	regular class	0	11	1
53	NDCLS	M	11.9	sixth	regular class	0	12	0
54	NDCLS	F	12.1	sixth	regular class	0	11	1
55	Asperger	F	11.5	sixth	regular class	0	11	1
56	Asperger	M	12.9	sixth	regular class	0	12	0
57	Asperger	M	12.2	sixth	regular class	0	12	0
58	PDD	M	12.3	sixth	regular class	2	8	2
59	PDD	M	12.1	sixth	special class	1	8	3
60	PDD	M	11.6	sixth	special class	2	9	1

Appendix 6: RAN Test results in seconds. Two measures before and after therapy.

		Measures No. 1				Measures No. 2				Changes in percentage			
EXAMINEE NR	**GROUP**	**OBJECTS**	**COLORS**	**NUMBERS**	**LETTERS**	**OBJECTS**	**COLORS**	**NUMBERS**	**LETTERS**	**OBJECTS**	**COLORS**	**NUMBERS**	**LETTERS**
17	Asperger	75.00	49.00	35.20	43.60	67.60	46.80	32.40	38.10	9.87	4.49	7.95	12.61
18	Asperger	67.30	56.60	37.10	40.20	65.30	55.20	32.80	37.80	2.97	2.47	11.59	5.97
25	Asperger	53.10	51.20	32.50	38.40	52.70	48.90	29.10	36.20	0.75	4.49	10.46	5.73
26	Asperger	61.30	55.00	29.10	40.60	61.40	55.20	29.30	40.10	-0.16	-0.36	-0.69	1.23
27	Asperger	66.30	60.30	33.50	41.00	64.20	58.40	33.30	37.30	3.17	3.15	0.60	9.02
19	PDD	110.30	58.20	54.20	73.10	76.30	54.10	43.90	55.10	30.83	7.04	19.00	24.62
20	PDD	76.10	51.50	51.10	68.40	69.70	46.80	45.80	51.60	8.41	9.13	10.37	24.56
28	PDD	87.30	57.29	42.50	59.10	73.30	55.20	38.10	45.80	16.04	3.65	10.35	22.50
29	PDD	85.10	50.30	36.90	45.50	75.70	50.10	36.20	44.60	11.05	0.40	1.90	1.98
30	PDD	81.30	56.10	34.30	41.30	76.60	49.60	31.50	37.30	5.78	11.59	8.16	9.69

Appendix 7: RAN Test results in seconds. Two measures without therapy.

	Measures No. 1				Measures No. 2				Changes in percentage			
EXAMINEE NR	**GROUP**	**OBJECTS**	**COLORS**	**NUMBERS**	**LETTERS**	**OBJECTS**	**COLORS**	**NUMBERS**	**LETTERS**	**OBJECTS**	**COLORS**	**NUMBERS**	**LETTERS**
16	Asperger	35.2	43.3	64.1	47.1	34.9	42.5	-1.58	0.21	0.85	1.85	34.9	42.5
6	Asperger	42.1	64.4	73.9	53.2	41.2	66.1	0.27	-1.72	2.14	-2.64	41.2	66.1
7	Asperger	45.1	58.2	57.0	57.3	46.3	59.3	4.20	1.88	-2.66	-1.89	46.3	59.3
8	Asperger	48.4	57.2	59.5	58.0	48.2	56.1	1.65	-4.69	0.41	1.92	48.2	56.1
5	Asperger	41.3	38.3	59.3	47.5	40.2	38.5	-3.49	3.26	2.66	-0.52	40.2	38.5
21	PDD	34.5	45.1	73.2	44.5	34.8	44.7	0.41	1.33	-0.87	0.89	34.9	42.5
9	PDD	58.5	118.3	114.7	72.5	58.1	120.2	-0.61	-0.28	0.68	-1.61	41.2	66.1
10	PDD	88.5	124.4	129.3	109.8	89.7	123.8	-0.86	0.27	-1.36	0.48	46.3	59.3
11	PDD	57.3	85.6	88.2	67.1	59.2	84.9	-3.64	0.59	-3.32	0.82	48.2	56.1
12	PDD	67.3	108.3	102.5	105.6	66.9	110.2	0.49	1.40	0.59	-1.75	40.2	38.5

Appendix 8: Verbal Fluency Tests results. Two measures before and after therapy.

					Measures No. 1		Measures No. 2		Changes in percentage	
EXAMINEE NR	**GROUP**	**AGE**	**GRADE**	**PLACE OF EDUCATION**	**SEMANTIC**	**FHONOLOGIC**	**SEMANTIC**	**FHONOLOGIC**	**SEMANTIC**	**FHONOLOGIC**
17	Asperger	8.3	second	regular class	15	5	19	9	27	80
18	Asperger	8.4	second	regular class	20	7	24	13	20	86
25	Asperger	8.9	third	regular class	19	6	21	7	11	17
26	Asperger	8.8	third	regular class	18	11	20	14	11	27
27	Asperger	8.8	third	regular class	27	7	26	8	-4	14
19	PDD	8.3	second	special class	24	6	31	9	29	50
20	PDD	7.3	second	regular class	21	5	28	8	33	60
28	PDD	8.8	third	regular class	26	6	27	7	4	17
29	PDD	8.5	third	special class	27	7	27	10	0	43
30	PDD	8.8	third	special class	30	7	29	8	-3	14

Appendix 9: Verbal Fluency Tests results. Two measures without therapy.

					Measures No. 1		Measures No. 2		Changes in percentage	
EXAMINEE NR	**GROUP**	**AGE**	**GRADE**	**PLACE OF EDUCATION**	**SEMANTIC**	**FHONOLOGIC**	**SEMANTIC**	**FHONOLOGIC**	**SEMANTIC**	**FHONOLOGIC**
16	Asperger	8.2	second	regular class	17	6	15	6	-12	0
6	Asperger	6.6	first	regular class	13	4	15	3	15	-25
7	Asperger	6.8	first	regular class	13	4	11	5	-15	25
8	Asperger	6.8	first	regular class	16	7	12	6	-25	-14
5	Asperger	7.2	first	regular class	14	4	11	4	-21	0
21	PDD	8.5	second	regular class	20	6	18	7	-10	17
9	PDD	6.3	first	special class	16	2	11	2	-31	0
10	PDD	6.7	first	regular class	16	3	13	2	-19	-33
11	PDD	6.5	first	special class	18	4	15	3	-17	-25
12	PDD	7.2	first	regular class	25	3	22	4	-12	33

Appendix 10: Test of Word Finding- 2 results, total number of Correct and Quick Responses.
Two measures before and after therapy

					Measures No. 1				Measures No. 2				
EXAMINEE NR	**GROUP**	**AGE**	**GRADE**	**PLACE OF EDUCATION**	**NOUNS**	**SENTENCES**	**VERBS**	**TOTAL**	**NOUNS**	**SENTENCES**	**VERBS**	**TOTAL**	**% CHANGE OF TOTAL**
17	Asperger	8.3	second	regular class	12	10	10	32	12	11	12	35	9
18	Asperger	8.4	second	regular class	10	12	10	32	11	12	11	34	6
25	Asperger	8.9	third	regular class	11	10	10	31	11	11	11	33	6
26	Asperger	8.8	third	regular class	10	11	12	33	12	12	12	36	9
27	Asperger	8.8	third	regular class	11	11	9	31	12	12	11	35	13
19	PDD	8.3	second	special class	8	8	8	24	11	9	10	30	25
20	PDD	7.3	second	regular class	9	8	6	23	11	10	9	30	30
28	PDD	8.8	third	regular class	5	5	4	14	9	8	8	25	79
29	PDD	8.5	third	special class	6	7	7	20	10	9	8	27	35
30	PDD	8.8	third	special class	5	9	6	20	7	11	11	29	45

Appendix 11: Test of Word Finding- 2 results, total number of Correct and Quick Responses.
Two measures without therapy.

					Measures. 1				Measures 2.				
EXAMINEE NR	**GROUP**	**AGE**	**GRADE**	**PLACE OF EDUCATION**	**NOUNS**	**SENTENCES**	**VERBS**	**TOTAL**	**NOUNS**	**SENTENCES**	**VERBS**	**TOTAL**	**% CHANGE OF TOTAL**
16	Asperger	8.2	second	regular class	12	11	11	34	13	11	12	36	6
6	Asperger	6.6	first	regular class	10	10	9	29	10	9	7	26	-10
7	Asperger	6.8	first	regular class	9	8	7	24	8	8	8	24	0
8	Asperger	6.8	first	regular class	9	10	12	31	9	9	11	29	-6
5	Asperger	7.2	first	regular class	8	7	10	25	7	6	10	23	-8
21	PDD	8.5	second	regular class	9	10	8	27	10	11	7	28	4
9	PDD	6.3	first	special class	6	4	6	16	5	3	5	13	-19
10	PDD	6.7	first	regular class	5	5	4	14	5	4	5	14	0
11	PDD	6.5	first	special class	7	8	7	22	6	7	5	18	-18
12	PDD	7.2	first	regular class	7	8	6	21	7	7	6	20	-5