

## A Longitudinal Study on the Development of Reading Ability in Greek Primary School Students with School Performance Disorders: Preliminary Results Relating to Language Parameters

**K Sakellariou<sup>1\*</sup>, M Vlassopoulos<sup>2</sup>, Z Kalogerakis<sup>3</sup>, K Stavrou<sup>4</sup>, E Lazaratou<sup>5</sup> and D Anagnostopoulos<sup>6</sup>**

<sup>1</sup>Psychologist-educational Psychologist MS, Community Psychiatry/Child Psychiatry, PhD Candidate Medical School, National and Kapodistrian University of Athens, Community Mental Health Center Byron-Kesariani, Department of Child Psychiatry, Eginitio Hospital, Athens, Greece

<sup>2</sup>Assistant Professor of Language and Communication Pathology, National and Kapodistrian University of Athens Community Mental Health Center Byrona-Kesariani, Department of Child Psychiatry, Eginitio Hospital, Athens, Greece

<sup>3</sup>Occupational Therapist, MS in Statistical Methods Applied in Medicine and Pharmacy, Department of Statistics of Athens University of Economics and Business, PhD Candidate at Medical School, National and Kapodistrian University of Athens, Eginitio Hospital, Athens, Greece

<sup>4</sup>Special Education Teacher, MA Education and Autism, London, UK, MSc Special Bilingual Education, PhD Candidate at Medical School, National and Kapodistrian University of Athens, Greece

<sup>5</sup>Professor of Child Psychiatry, National and Kapodistrian University of Athens, 1st Department of Psychiatry, National and Kapodistrian University of Athens Community Mental Health Center Byron-Kesariani, Department of Child Psychiatry, Eginitio Hospital, Athens, Greece

<sup>6</sup>Professor of Child Psychiatry, National and Kapodistrian University of Athens, Greece

**\*Corresponding Author:** K Sakellariou, Psychologist-educational Psychologist MS, Community Psychiatry/Child Psychiatry, PhD Candidate Medical School, National and Kapodistrian University of Athens, Community Mental Health Center Byron-Kesariani, Department of Child Psychiatry, Eginitio Hospital, Athens, Greece.

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### Abstract

The term “school performance disorder” is used to describe children who have specific difficulties in their academic abilities. The most recognizable form of this neurodevelopmental disorder is specific developmental reading ability (SDRA) disorder, which affects 4 - 7% of the student population. Although the development of SDRA has been studied extensively in many languages, there is a lack of evidence in the Greek language.

The aim of the present study is to explore the developmental process of this ability in Greek children with learning difficulties throughout primary education. Twenty-two (15 male; 7 female) children were evaluated from 2<sup>nd</sup> to 6<sup>th</sup> Grade in mainstream primary school (3 time-points), by a multidisciplinary team of professionals. Results showed that the children’s primary diagnoses and oral language deficits play a pivotal role in the developmental process. A statistically significant correlation was found between language development -especially in the field of phonological awareness- and the development of reading ability in the Greek language. Furthermore a correlation was found between language development and reading ability. 63.3% of the sample showed complex language difficulties (in semantics, syntax, morphology as well as phonology) at each of the three time-points of the evaluation process. Children with these complex language deficits were more likely to have persisting difficulties and made less progress despite intervention. This study confirms that phonological deficits have a direct impact on the development of specific reading disability/disorder in the Greek language.

Moreover a wider range of language deficits and reading ability are closely correlated, leading to incremental long-term difficulties and a poorer prognosis.

**Keywords:** Reading Disorder; Language Development; Phonological Awareness; Semantic Skills; Morphology; Syntax

### Introduction

The terms “school performance disorders” or “specific developmental disorders of scholastic skills” (according to ICD-10) or “specific learning disorders” (according to DSM-5) are used to describe those children who have specific difficulties in school achievement or in the attainment of academic skills.

According to some studies [1-3], a high proportion of children, 25 - 30% will present learning difficulties from the first year in primary school and will go on to face school failure either because of behavior problems or because of poor academic performance, or the combination of both [4,5].

Children with learning disorders can be divided broadly speaking into three groups: The first one includes children whose difficulties are due to reduced cognitive abilities, and depending on the degree, the student may attend a regular school or a special one if required. The second one is composed of children whose school difficulties are mainly due to other mental disorders, such as emotional disturbances (anxiety, depression, behavioral disorders and/or ADHD [6-8]. The third group is the one with specific developmental learning disorders or "specific developmental disorders of school abilities (skills)" as referred to by the ICD-10 [9], which estimates that 3 - 9% of school age children are included in this category [10].

The diagnosis "specific developmental disorders of school abilities (skills)" refers to children with normal or higher intelligence and concerns a group of disorders which present significant difficulties in reading, math skills and the use of written language.

Research has shown that children with speech delay may also later present disorders in school abilities [11]. These disorders have a neuro-developmental aetiology and often have a familial or genetic basis as they are more prevalent in certain families [10,12-14].

Specific developmental reading disorder, better known as dyslexia, is the most recognizable form of specific developmental disorder and affects 4 - 7% of the student population according to age [15]. Specific developmental reading disorder is expressed mainly as a difficulty in learning how to read and write, despite adequate educational opportunities, average intelligence and an appropriate social and cultural environment. Many studies have shown that this disorder is based on cognitive deficits regarding phonological awareness, namely the ability to represent and modify the sounds that make up a given language. However, some researchers argue that the cognitive deficits which relate to phonological awareness, are due to primary neurological deficits in the processing of acoustic stimuli. Supporters of large-cell theory invoke neuroanatomic and neuroimaging findings which suggest that people with specific developmental reading disorder have differences regarding the size and functioning of the large cell systems in the brain compared to the normal population. These large-cell systems are involved in visual and acoustic perception [16].

Furthermore specific developmental reading disorder frequently co-occurs with emotional disorders and conduct disorders in adolescence. Although this disorder is diagnosed relatively early in a child's academic career, it may affect the child on the long-term, through adolescence and adulthood [17-19].

According to the International Dyslexia Association (IDA) [20], dyslexia "is characterized by a difficulty in the precise and fluent recognition of words and a low performance in spelling and decoding of the meaning of words. These disorders come from a formal deficit in the phonological component of language and are evaluated in relation to other cognitive abilities (appropriate to the child's age) and in relation to effective classroom teaching".

Reading is a complex kinetic, perceptual, cognitive and linguistic procedure. The child, in order to gain reading ability, must have mastered a series of different skills and moreover, s/he must be able to utilize them during reading. These abilities are: a) the differentiation of phonemes, b) adequate short-term verbal memory, c) the ability to distinguish the structure of phrases and sentences, d) the ability to understand the symbolic meanings of words and sentences, and e) spatial discrimination (right-left, up-down). Furthermore, the child must be able to match sounds to letters and transform letters back into sounds, in other words to learn to transform the schematic representation of the letters into a voice representation and vice versa. Phonological awareness is a necessary prerequisite for decoding and encoding skills in reading [21,22] and is a skill which commences well before formal education during the preschool years. Phonological awareness refers to an individual's ability to manipulate the phonological components of language and is a prerequisite skill for reading readiness, it comprises a set of subskills: syllable and sound matching, and manipulation, in various positions in the word as well as rhyming [23].

This interrelationship has also been seen in other alphabetic languages including Greek. The phonological awareness abilities of Greek children have been studied and some differences have been found with English-speaking children e.g. Greek children recognize /m/, /s/ and /z/ before /k/ [24].

Many researchers note that morphological awareness is also a prerequisite for reading development, as well as phonological awareness [25,26]. The Greek language is a morphologically rich clitic language, with a relatively transparent orthographic system consequently morphological awareness is not related to reading accuracy, but concerns fluency and comprehension as the clitic morphology reflects

and influences meaning (for instance, “η καλή φίλη» (feminine singular)- the good friend /i kali fili/ as opposed to «οι καλοί φίλοι» (masculine plural)- the good friends /i kali fili/) [27]. Furthermore in Greek lexical representations are not only stored in lexical memory syllabically, but also morphologically, which is why morphological awareness is of paramount importance for spelling in Greek [28]. Research has shown that for Greek readers morphological components are utilized when reading pseudowords or complex nouns [29]. In English it has been found that poor readers had lower morphological awareness which affected their reading comprehension [30,31]. In Greek, Filippatou [32] found that syntactic awareness is related to reading ability.

In the last few years the relationship between morphological knowledge and reading ability has been the subject of investigation. Morphological awareness is considered a part of metalinguistic skills and is defined as “the child’s ability to reflect upon and use the structures of spoken language”. It does not pertain to language comprehension nor to language expression, but is a necessary skill in the development of novel meanings and concepts [33]. Studies in non-alphabetic languages, such as Chinese, show that the role of morphological awareness is much more important than phonological awareness for reading development (reference). In research concerning the English language, it appears that phonological awareness is more important than morphological awareness till the 3rd Grade, but this changes from the 4<sup>th</sup> Grade [34].

Furthermore, although phonological awareness at the age of 6 seems to have the greatest influence on reading at the beginning, on all other measures over time, semantic variables seem to have the greatest influence [35,36]. In English, it is argued that knowledge of the semantic features of suffixes allows the identification of words that have similarities in meaning and affects reading comprehension and vocabulary development. Moreover, children’s ability to identify semantic relationships improves with age and is associated with decoding in reading, while vocabulary has been found to explain an important part of fluency in reading single words [34,37-40].

The relative importance of all of these linguistic factors in reading disability have an intrinsic value for both theoretical and clinical reasons. Each language has its own characteristics which allow the clinician to make sound decisions for the intervention procedures to be followed. Furthermore, the study of these disorders over time, in other words the differentiations observed in the symptoms over a time period, may further enhance the intervention methods implemented.

## **Aim of the Research**

The most common demand of parents applying to the Child Psychiatric Unit of the 1st Athens Psychiatric Clinic is the investigation of their child’s learning difficulties. The Unit is a community-based public service, offering prevention, diagnostic/assessment and intervention services to families and children from 4 Athenian boroughs, as well as close collaboration with schools and other community services. The aim of this study was the longitudinal investigation of reading development in children with specific developmental disorders of scholastic skills (ICD-10) throughout primary school (from 2nd grade to 6th Grade). The present study which part of a wider study on learning disorders is focused on the interrelationship between these disorders and underlying mechanisms related to linguistic factors. Initial diagnosis, as well as oral language difficulties, were determined and compared to each of the consequent follow-up evaluations in reading and text comprehension.

## **Research hypotheses**

The study’s research hypotheses were the following:

- Participants with semantic deficits will show better progress in reading longitudinally compared to children who have disorders only in phonology [14,22,30,41].
- Participants with morphological deficits will show better progress in reading longitudinally compared to children who have disorders only in phonology [38-40].
- Participants with semantic deficits will have more difficulties in text comprehension compared to those children who have disorders only in phonology [30].
- Participants with complex language deficits (in semantics, morphology and syntactic structures) will have greater difficulties in reading [42,43].
- Participants with greater difficulties in their developmental histories e.g. perinatal difficulties, developmental delays particularly in speech and language are more likely to show specific developmental learning disorders and particularly specific developmental reading disorder [44].
- Developmental patterns from one time point to the other will reflect both the severity of the linguistic symptoms and compliance with therapy, as well as individual variations.

## **Methods**

### **Participants and procedure**

The participants were part of a wider longitudinal study. In this part of the study, the sample included 22 children examined at the Child and Adolescent Psychiatric Service of the Community Mental Health Centre (CMHC) Byron-Kessariani in Athens, Greece. The participants had all applied to the CMHC for evaluation of their learning difficulties at 2<sup>nd</sup> Grade of Primary School. Children with intellectual impairments and serious psychopathology were excluded at the initial phase. The participants were re-evaluated at two further time-points, in 4<sup>th</sup> and 6<sup>th</sup> Grades of Primary School. The participants were evaluated at the following three time-points for the following reasons: 1) 2<sup>nd</sup> Grade is the most appropriate Grade for the timely diagnosis and intervention for reading disorder. 2) In 4<sup>th</sup> Grade children should have mastered reading and are not considered beginning readers any longer. Their vocabulary is richer, they are able to apply orthographic and

spelling rules, they have mastered morphological and syntactic rules while at the same time they have been introduced to text comprehension and analysis. 3) In 6<sup>th</sup> Grade children are considered experienced readers: they have completely mastered the technical aspects of reading and emphasis is now placed on reading comprehension, the understanding underlying meanings and the use of critical judgment. Initially three diagnostic categories were formed according to the prevailing language deficits in 2<sup>nd</sup> Grade and according to the follow-up evaluations, the participants were re-assigned to the same or different categories. The three categories consisted of students with a) primary phonological deficits, b) mainly semantic deficits, and c) complex linguistic deficits (semantic, morphology, syntax).

The 22 participants were part of a clinical sample according to predetermined characteristics. In particular, all children were students between 2<sup>nd</sup> and 6<sup>th</sup> grade of Primary school, aged 7 - 12 years old with average intelligence according to the WISC-III [45,46] and the only criterion was that they exhibited learning difficulties as defined by ICD -10 (F 81). There were 15 boys (68%) and 7 girls (32%) in the sample and the age at 1<sup>st</sup> evaluation was 7 years old.

The study began in 2005 and was completed in 2015. All the children and their families cooperated well and no drop outs were reported throughout the research. Since participation was voluntary, parents signed a consent form. The study was approved by the hospital's Board of Ethics.

### **Instruments**

The diagnostic procedure began with a parental interview during which the child's developmental history was taken. This was followed by a psycho-educational assessment, a speech-language assessment and a child psychiatry assessment.

The goal of the psycho-educational assessment is to describe the child's learning difficulties in reading and text understanding. In order for this to be accomplished the following must be evaluated: the child's developmental history, family functioning and history, the child's progress at school and adjustment, his/her medical history, cognitive functioning, language, behaviour, attention and motivation as well as reading/writing skills.

In particular reference to reading assessment and text comprehension the following are investigated: Reading development in all areas (syllable, word, diphthongs, etc.)

- Rate
- Hand movements, distance/ body
- Vocabulary (unknown vocabulary, word definitions)
- Text comprehension through questions.

For this purpose, three different standardized texts were used, according to the child's age and Grade [47] for the clinical assessment.

During the psycho-educational evaluation errors were identified, which were typical characteristics of the reading disorder. Regarding reading, these were located at the following four levels:

1. At the letter level: a) Replacing letters which look similar (b/d), b) confusing auditory differentiation of the sounds (f/v).
2. At the syllable level: a) reversal of letters (adn instead of and), b) missing letters (tink instead of think), c) replacing letters (boll instead of ball), d) adding syllables (aninimal instead of animal).
3. At the word level: a) syllable reversal, b) missing syllable (mike instead of mistake), c) confusion of symphonic complexes (enrty instead of entry), d) replacing syllable (pity instead of pretty), e) errors in intonation at the reading level (mispronunciation of words because accent was not taken into account).
4. At the sentence level: a) replacing words (competition instead of condition), b) missing words, c) misuse of punctuation points, d) series overrun.

Scores (number and type of errors) on each of these parameters were noted for each participant at all three time-points.

A crucial characteristic that completes the clinical picture of children with specific reading disorder is text comprehension. This may be presented as complete or partial failure to understand the meaning of the text, time concepts and causal relationships as well as the meaning overall.

Scores were noted for text and vocabulary comprehension at each time-point. Intellectual abilities were assessed through the use of the psychometric tool for children, WISC- III [45,46], whose goal is to estimate each child's cognitive potential.

The Logo-test [48] was used, in order to estimate phonological awareness, metaphonological skills as well as phonological memory. The Logo-test is a screening tool for the assessment of phonological awareness and consists of 6 subtests: syllabic sequencing, blending, decoding, manipulation, rhyme and short-term memory for syllables.

Finally the child psychiatry examination was conducted in order to exclude primary psychiatric disorders. After initial assessment in 2nd Grade, an intervention programme was proposed to all children. This consisted of speech-language therapy, occupational therapy and special education according to each child’s individual needs, as well as parental counseling and collaboration with the school. It is important to note that the intervention programme proposed to each child was individualized [49], keeping in mind that this was a clinical sample with language and cognitive deficits. The purpose was to intervene on the specific deficits impeding each child’s learning difficulties [50-52].

**Statistical analysis**

For the statistical analysis of the data the SPSS (version 23) was used through which descriptive statistics were applied (mean values, standard deviations, statistical error of the breakdowns). The level of significance was set at  $P < 0.05$ . However the measurements concerned the values between 0.051 and 0.099 owing to the small number of participants. In case of a sample increase, this allows the possibility of converting a trend to a statistically significant relationship.

**Results**

Key variables in our research were “language delay”, which emerged through data collected through the child’s developmental history, “phonological deficits”, “complex linguistic deficits”, that is, concurrent deficits in many linguistic areas, such as in phonology, semantics, morphology and syntax, and finally “reading deficits”. Independent variables were gender and age.

Table 1 shows the variables “language delay” and “specific developmental reading disorder”, where the children that had language delay in their developmental history were more likely to have a specific developmental reading disorder in the final evaluation conducted in 6<sup>th</sup> Grade. Nevertheless, this correlation was not statistically significant.

	Yes	No	P
	N (%)	N (%)	0.099
Language delay			
Yes	8 (61.5)	5 (38.5)	
No	2 (22.2)	7 (77.8)	

**Table 1:** Correlation of language delay with specific developmental disorder in reading (N = 22) specific developmental disorder of reading.

Table 2 shows the statistically significant correlation between the variables “phonological deficits” during the initial evaluation (2<sup>nd</sup> Grade) and “reading disorder” during the final evaluation (6<sup>th</sup> grade), indicating that those children with phonological deficits appeared more frequently to exhibit a specific developmental reading disorder during the final evaluation in the 6<sup>th</sup> grade.

	Yes	No	P
	N (%)	N (%)	0.05
Phonological deficits			
Yes	9 (64.3)	5 (35.7)	
No	1 (12.5)	7 (87.5)	

**Table 2:** Correlation of phonological deficits during the initial evaluation (2<sup>nd</sup> grade of Primary school) and “reading disorder” during the final evaluation (6<sup>th</sup> grade of Primary school), reading disorder.

Table 3 shows the correlation between the variables “complex linguistic difficulties”, that is, the appearance of deficits in multiple oral language aspects (phonology, semantics, morphology and structure) and “specific developmental reading disorder” in the final evaluation at 6<sup>th</sup> Grade. However this correlation was not statistically significant.

Table 4 shows the correlation of the variables “complex linguistic deficits” and “outcome”. The comparison between the initial and the final evaluation, was defined as outcome, taking into account the following parameters: initial and final clinical evaluation as it emerged from the full diagnostic process (psycho-educational assessment, psychological examination, speech-language assessment and child psychiatric examination), the initial and final diagnosis and compliance with the proposed treatment.

	Yes	No	
	N (%)	N (%)	P
Complex linguistic difficulties			0.087
Yes	7 (63.6)	4 (36.4)	
No	3 (27.3)	8 (72.7)	

**Table 3:** Correlation of the diagnosis for complex linguistic difficulties during the initial evaluation (2<sup>nd</sup> grade) with the diagnosis of reading disorder during the final evaluation (6<sup>th</sup> grade). Specific reading disorder.

	Outcome	Improvement	Decline	
	N (%)	N (%)	N (%)	P
Complex Linguistic deficits				0.698
Yes	0 (0.0)	1 (33.3)	2 (66.7)	
No	3 (15.8)	11 (57.9)	5 (26.3)	

**Table 4:** Correlation of the diagnosis for complex linguistic deficits during the initial evaluation (2<sup>nd</sup> grade) with reading during the final evaluation (6<sup>th</sup> grade).

In table 5 we present the variance of linguistics characteristics from the 1st evaluation through the 3<sup>rd</sup> evaluation among the children with linguistics deficits (17 out of 22). In relation to the results, the phonological deficits and the morphological deficits declined from the initial evaluation whereas the semantic deficits appeared persistent across the three evaluations. Finally, it is worth to notice that the morphological deficits remained unaffected between evaluation 2 and evaluation 3 regardless of the therapeutic intervention.

Linguistic characteristics	Evaluation 1			Evaluation 2			Evaluation 3		
	Boys	Girls	Totals	Boys	Girls	Totals	Boys	Girls	Totals
Phonological	9	1	10	4	1	5	0	0	0
Semantic/vocabulary	11	1	12	12	1	13	12	1	13
morphology/syntax	4	1	5	2	0	2	2	0	2

**Table 5:** Linguistic characteristics at the tree time points for children with linguistic deficits.

“Same” notes an outcome where no major changes appeared in the clinical evaluation and diagnosis, although there was compliance with the treatment proposal. “Improvement” was noted for an outcome where there was a positive change in the clinical evaluation and “Decline” was noted for an outcome where there was a worsening in the final clinical evaluation (increase language deficits) which affected the final diagnosis, even though there was compliance with the treatment proposal. It appeared that the children who had been diagnosed with complex language disorders in their initial evaluation, appeared more frequently to exhibit a “decline” (decrease) regarding specific developmental reading disorder during the final evaluation, however this correlation was not statistically significant.

With regards to outcome of therapeutic intervention, it appears that 2 participants with complex linguistic deficits show the same clinical symptoms, 6 participants show an improvement, while in three participants a worsening of their symptoms is found.

## Discussion and Conclusion

This study presents the long-term development of reading ability in a group of children with learning difficulties attending Greek Primary School, through the prism of language deficits. The longitudinal follow-up evaluations of these children confirms the initial research hypothesis which states that children with developmental delay in oral language, according to their developmental history intake, will present specific developmental reading disorder over time [44].

The research hypothesis that children with phonological deficits more often show specific developmental reading disorder is also confirmed. This finding is in agreement with the international literature [14,22,41].

On the other hand, the hypothesis that children with complex language deficits, such as, poor vocabulary, word-finding difficulties, poor expressive skills, comprehension deficits, difficulties in syntax and morphology, and difficulties in the formation of abstract concepts,

would develop specific developmental reading disorder more often than those with phonological deficits, was not confirmed. This is in contrast to research which has shown the importance of morphosyntax and specifically morphological awareness in reading [31,33,38-40,53,54], a finding which is corroborated by research on the Greek language [27-29,32,55].

Moreover, our results show that children with complex linguistic disorders in semantics and vocabulary, have more persistent disorders which are more resistant to intervention during primary education. 63% of the sample had these kinds of deficits in all three time-points of the evaluation. Nevertheless the hypothesis that these children are negatively affected in text comprehension, is not confirmed.

Furthermore the hypothesis that children with complex linguistic difficulties have greater difficulties in reading development is not confirmed.

According to studies on reading development, in order to comprehend a text fully it is necessary to build either a mental model or a situation model, that is, a representation of the relationships and concepts described in the text [56,57].

This allows the reader to form conclusions based on a critical analysis of the text, as well as to understand the underlying message [58,59]. Contemporary research in the field of reading disorders show that these subjects have deficits in metalinguistic abilities, such as phonological and morphological awareness, as well the ability to build semantic relationships [22,37,39,43,60-71].

In conclusion, the analysis of the results of this study's sample shows the statistically significant correlation between language development and the development of reading ability.

It is confirmed that the existence of phonological deficits has statistically significant positive correlation with the diagnosis of specific developmental reading disorder in Greek, and that this deficit has long-term repercussions throughout Primary school. The question concerning the relationship between complex linguistic deficits in other aspects of language (semantics, morphology, syntax) with the diagnosis of the specific developmental reading disorder still needs further investigation.

It should be mentioned that the limitations in this study are the small sample size. This is possibly the reason that it is not possible to show significant correlations during the data statistical analysis.

The value of this study lies in its long-term characteristics, its clinical perspective and that it concerns a language, Greek, which has not been studied adequately in this area.

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Community Mental Health Center Byrona-Kesariani, Department of Child Psychiatry, Eginitio Hospital, Athens, Greece.

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