EFFICACY OF AN INNOVATIVE EFL TEACHING METHOD BASED ON THE BRAIN FUNCTION TO IMPROVE READING ACCURACY IN STUDENTS WITH DYSLEXIA: A MIXED METHOD, MULTIPLE CASE STUDY OF GREEK TEENAGERS AND ADULTS

ΑΠΟ ΤΗΝ

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ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ

ΜΑ ΕΠΙΣΤΗΜΕΣ ΤΗΣ ΑΓΩΓΗΣ: Ειδική (Ενιαία) Εκπαίδευση

(ΕΞ ΑΠΟΣΤΑΣΕΩΣ)

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Γαρυφαλλιά Σαπουναδέλη

Διπλωματική εργασία
για μερική ικανοποίηση των όρων για απόκτηση
Μεταπτυχιακού Τίτλου
στις ΕΠΙΣΤΗΜΕΣ ΤΗΣ ΑΓΩΓΗΣ: Ειδική (Ενιαία)

Εκπαίδευση

(Εξ Αποστάσεως)

ΛΕΥΚΩΣΙΑ

Ιούλιος, 2017

ΕΥΡΩΠΑΪΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΥΠΡΟΥ
Τμήμα Επιστημών της Αγωγής

ΔΗΛΩΣΗ ΑΠΟΔΟΧΗΣ

Η Διπλωματική Εργασία με θέμα «Efficacy of an innovative EFL teaching method based on the brain function to improve reading accuracy in students with dyslexia: A mixed method, multiple case study of Greek teenagers and adults», η οποία εκπονήθηκε από την Γαρυφαλλιά Σαπουναδέλη για την απόκτηση μεταπτυχιακού τίτλου στις Επιστήμες της Αγωγής: Ειδική (Ενιαία) Εκπαίδευση (Εξ Αποστάσεως), εγκρίθηκε στις ..... ύστερα από εισήγηση των ακόλουθων Μελών της Επιτροπής Αξιολόγησης:

1. Δρ. Βασιλική Φούφη
2. Δρ. Λευκή Κουρέα

Ο/Η Πρόεδρος του Τμήματος

_____

Ημερομηνία

_____

ΥΠΕΥΘΥΝΗ ΔΗΛΩΣΗ

Η Γαρυφαλλιά Σαπουναδέλη, γνωρίζοντας τις συνέπειες της λογοκλοπής, δηλώνω υπεύθυνα ότι η παρούσα εργασία με τίτλο «Efficacy of an innovative EFL teaching method based on the brain function to improve reading accuracy in students with dyslexia: A mixed method, multiple case study of Greek teenagers and adults.», αποτελεί προϊόν αυστηρά προσωπικής εργασίας και όλες οι πηγές που έχω χρησιμοποιήσει, έχουν δηλωθεί κατάλληλα στις βιβλιογραφικές παραπομπές και αναφορές. Τα σημεία όπου έχω χρησιμοποιήσει ιδέες, κείμενο ή/και πηγές άλλων συγγραφέων, αναφέρονται ευδιάκριτα στο κείμενο με την κατάλληλη παραπομπή και η σχετική αναφορά περιλαμβάνεται στο τμήμα των βιβλιογραφικών αναφορών με πλήρη περιγραφή.

Η δηλούσα

Γαρυφαλλιά Σαπουναδέλη

ABSTRACT

The aim of this study was to examine a) the efficacy of an innovative EFL teaching method ("ILD") which was designed based on the brain function of people with dyslexia and b) the participants' perspectives on the factors that positively influence the learning process. The method under study combines concurrent teaching of phonological and spelling awareness with the use of mnemonics and technology. The mixed method approach was followed having as dominant one the qualitative multiple case study. The sample is two teenagers and two adults with dyslexia who are studying English in the "i love dyslexia" organization. A pre-assessment test was conducted in order to evaluate the participants' reading skills prior to the intervention. After 12 hours of lessons, they were involved in the same test. The study found that all the students' reading skills improved from 33% - 60%. According to the participants' interviews the features of the "ILD" teaching method are more effective than the traditional methods since their reading accuracy really improved. Another positive factor for them is that the teachers were very patient and they showed both knowledge and respect for their needs.

ΠΕΡΙΛΗΨΗ

Σκοπός αυτής της έρευνας ήταν να εξετάσει α) την αποτελεσματικότητα μιας καινοτόμου μεθόδου διδασκαλίας ("ILD") για την αγγλική ως ξένη γλώσσα, η οποία βασίζεται στη λειτουργία του εγκεφάλου των ατόμων με δυσλεξία και β) τις απόψεις των συμμετεχόντων για τους παράγοντες που επηρεάζουν θετικά τη μαθησιακή διαδικασία. Η υπό έρευνα μέθοδος συνδυάζει την ταυτόχρονη διδασκαλία της φωνολογικής και ορθογραφικής ενημερότητας κάνοντας χρήση μνημοτεχνικών και τεχνολογίας. Επιλέχθηκε η μεικτή μέθοδος με επικρατέστερη την ποιοτική πολλαπλή μελέτη περίπτωσης. Το δείγμα είναι δύο έφηβοι και δύο ενήλικες με δυσλεξία οι οποίοι μαθαίνουν αγγλικά στον οργανισμό "i love dyslexia". Διεξήχθη τεστ αξιολόγησης πριν την έναρξη του προγράμματος ώστε να εκτιμηθεί η αναγνωστική ικανότητα των συμμετεχόντων. Μετά από 12 ώρες μαθημάτων τούς δόθηκε το ίδιο τεστ. Η έρευνα έδειξε ότι η αναγνωστική ικανότητα όλων των μαθητών βελτιώθηκε από 33% ως 60%. Σύμφωνα με τις συνεντεύξεις των συμμετεχόντων, η μέθοδος διδασκαλίας "ILD" είναι πιο αποτελεσματική από τις παραδοσιακές μεθόδους εφόσον η ανάγνωση βελτιώθηκε και έγινε πιο ακριβής. Κατά τη γνώμη τους, ένας ακόμα θετικός παράγοντας είναι ότι οι καθηγητές ήταν πολύ υπομονετικοί και έδειχναν τόσο γνώση όσο και σεβασμό για τις ανάγκες τους.

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The current study is the result of an extended research. I would like to express my gratitude to my advisor Prof. Vasiliki Foufi for her guidance and her meaningful help in all the time of research and writing of this thesis.

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Finally, I must express my very profound gratitude to my parents for providing me with understanding and support through the process of writing this thesis. I thank them for always being by my side because without their support it would not have been possible to make my dreams come true.

ΕΥΧΑΡΙΣΤΙΕΣ

Η παρούσα εργασία είναι αποτέλεσμα εκτενούς αναζήτησης και έρευνας. Θα ήθελα να απευθύνω θερμές ευχαριστίες στην επιβλέπουσα καθηγήτρια μου κ. Βασιλική Φούφη για την καθοδήγηση και την άμεση και ουσιαστική βοήθεια που μου παρείχε κατά τη διάρκεια της εκπόνησης της εργασίας.

Θα ήθελα να ευχαριστήσω θερμά την κ. Αγγελική Παππά, αρχικά για το γεγονός ότι δέχθηκε να διεξαχθεί η έρευνα στο χώρο του "i love dyslexia" τον οποίο διευθύνει. Την ευχαριστώ επίσης για τη βοήθεια που μου παρείχε κατά τη διαδικασία συγκέντρωσης των δεδομένων αλλά και για την απεριόριστη στήριξη της καθόλη την διάρκεια εκπόνησης της εργασίας.

Ένα πολύ μεγάλο ευχαριστώ ανήκει στους γονείς μου οι οποίοι με στήριξαν ηθικά δείχνοντας αμέριστη κατανόηση και συμπαράσταση σε αυτή την πολύμηνη προσπάθειά μου. Τους ευχαριστώ που είναι πάντα δίπλα μου γιατί χωρίς τη στήριξή τους δε θα ήταν δυνατό να πραγματοποιήσω τα όνειρά μου.

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Introduction

In the 21st century the new challenges of a globalized and interconnected world demand that all citizens should be able to communicate fact that can only be achieved when speaking a common language. Since English has become a lingua franca, it is imperative that English as a foreign language (EFL) become a prerequisite for everyone. However, there are people who may be excluded from learning foreign languages, the English language included, because they deal with specific learning difficulties such as dyslexia[1]. According to "Dyslexia International",[2] 10% of any given population have dyslexia, putting more than 700 million children and adults worldwide at risk of life-long illiteracy and social exclusion.

The main prerequisite to help learners with dyslexia is to thoroughly study the characteristics of dyslexia, even if this is quite complicated, since not only are there various symptoms depending on the person, but there are also different theoretical research perspectives (neurological/biological, cognitive, educational) which prevent us from giving an one and only definition (Lawrence, 2009). However, while reviewing the official definitions of the International (2002)[3] and British[4] (2007) Association of Dyslexia, we notice that dyslexia is neurobiological in origin and defined as a difficulty that affects skills related to language acquisition such as decoding words, reading, spelling and writing with difficulties in phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up to an individual's other cognitive abilities. Consequently, adopting

[1] "Dyslexia, also known as specific reading difficulties, is the most common form of learning difficulty with a prevalence of 10 percent or more of any given population […]"
[2] http://www.dyslexia-international.org/the-problem/
[3] https://dyslexiaida.org/definition-of-dyslexia/
[4] http://www.bdadyslexia.org.uk/dyslexic/definitions

efficient methods for teaching the English language to students with dyslexia is of vital importance.

As mentioned above, dyslexia influences and differentiates the learning process for students. Therefore, teachers should know how to accommodate them in the classroom and how to facilitate the lesson for them. However, teachers find it difficult to teach English as a foreign language because most of the times not only do they lack sufficient understanding of the nature of dyslexia and the difficulties it causes but they also need more training and familiarization with appropriate teaching techniques so as to enable them learn the target language (Nijakowska, 2016, Smith, 2006). The abovementioned teachers' inefficiency is reported in numerous, recent studies from different countries around the world such as Bosnia and Herzegovina and Montenegro (Duranovic, Dedeic, Huseinbasic & Tinjic, 2011), Greece (Lemperou, Chostelidou & Griva, 2011, Riga, 2012, Rontou, 2010, 2012), Hungary (Kontra & Kormos, n.d), India (Shetty & Rai, 2014), Mexico (Breton Velasco, 2015), New Zeland (Elias, 2014) and Zimbabwe (Chitsa & Mpofu, 2016). Taking into consideration the teachers' need for an appropriate and effective teaching approach in order to facilitate the learning process for students with dyslexia, I decided to conduct the current study so as to explore the efficiency of an intervention program which is based on a teaching method designed to satisfy the "dyslexic" students' needs. Previously published studies related to intervention programs for students with dyslexia select as cases young children who are at primary school since this is the time when they start learning to read and the first deficits appear (Fälth, Gustafson, Tjus, Heimann & Svensson, 2013, Gillon & Dodd, 1995, González et al., 2015, Ise & Schulte-Körne, 2010, Pape-Neumann, Marbach, Grande, Willmes & Heim, 2015, Suárez-Coalla, Ramos, Álvarez-Cañizo & Cuetos, 2014, O'Brien, Wolf, Miller, Lovett & Morris, 2011). Therefore, there is a gap in the

literature when it comes to teaching English as a foreign language to teenagers and adults with dyslexia and that is why the participants of the present study were selected based on their age and the time they had previously spent on learning the target language. What should also be mentioned is the fact that previous studies are about intervention programs which focus on one of the elements that are supposed to help "dyslexic" students. For instance, there are studies proving the need for teaching explicitly phonological awareness (Gillon & Dodd, 1995, Oviedo & Gonzalez, 2013, Pape-Neumann, Ermingen-Marbach, Grande, Willmes, & Heim, 2015, Ritter, Park, Saxon, & Colson, 2013, Winkler, 2016), others that prove the need for teaching orthographic awareness or both (Cataldo & Ellis, 1988, Ehri & Snowling, 2004 as cited in Moats, 2005, Ehri & Wilce, 1982, Felton, n.d., Johnson, 2013, O'Brien, 2011) and others proving the need for using mnemonics (Condus, Marshall, & Miller, 1986, Mastropieri & Scruggs, 1998, Mastropieri, Sweda, & Scruggs, 2000, Shaeffer, 2011) or technology (Saine, Lerkkanen, Ahonen, Tolvanen & Lyytine, 2011, Fälth, Gustafson, Tjus, Heimann & Svensson, 2013, Gonzalez et al., 2015). The intervention program of the current study combines all the aforementioned teaching techniques simultaneously.

Therefore, the aim of this case study is to examine the efficiency of a method which was created by using and combining the abundant findings regarding the "dyslexic" students' cognitive strengths and weaknesses. All participants take part in the intervention program which is based on this method and they are expected to improve their reading skills until the end of the program.

The research questions arising are:

1) What teaching strategies are considered a prerequisite for improving "dyslexic" students' reading skills in English?

a) To what extent can explicit and systematic teaching of both phonological and orthographic awareness improve the students' reading skills?
b) How can the use of mnemonics help the students improve their reading skills?
c) How can the use of technology help the students improve their reading skills?

2) What factors influence positively the students' learning process?
a) How do the students describe their previous experience of learning English?
b) How do the students describe their experience of the intervention program?

In chapter 2 there is an analysis of the causes of dyslexia and of the difficulties that students face because of them. In chapters 3 and 4 we proceed to a detailed explanation why learning English as a foreign language is so hard for students with dyslexia and what is the case in Greece. In chapter 5 the "ILD" method is presented and chapter 6 is dedicated to the research design, the choice of methodology and samples, the collection of data and the analysis of the intervention program. Finally, the findings and their analysis are presented at the end of the thesis.

Dyslexia – Theoretical framework and Literature review

2.1 Reading processes and neurobiology of Dyslexia

While spoken language is an instinctive human ability, reading is an artificial process which was never part of the brain's original design (Chomsky, 1995, Milne, 2005, Pinker, 1994) and there was no preprogrammed setup for it (Wolf, 2010). Over the years most of the oral languages worldwide have been turned into alphabetic written systems in a way that they suit their phonetic structures. Therefore, besides speaking, reading has become one of the most fundamental skills of communication and

represents one of the most powerful, cultural inventions that humans have ever created. Yet acquiring the reading skill is a complex and long-term process which is also based on the acquisition of other skills. While learning to read, the child must understand that a visual symbol corresponds to a specific sound, syllable, word or concept (Wolf, Gottwald, Galyean, Morris, & Breazeal, 2014, Vellutino, & Scanlon, 1982, Willis,2008). The beginning reader must achieve to recode graphemes (letters) into their corresponding phonemes and become aware of the internal phonological structure of spoken words (Shaywitz, 1996) since speech sounds serve as the basis for reading (Sousa, 2005). These brain connections between phonemes and graphemes, or the squiggly lines on a page that represent printed letters cannot always be achieved, so there are children who develop reading problems (Bender & Larkin, 2009).

In order to understand the reasons why this happens, we have to examine the brain systems that we use and develop while reading. Until recently, this hasn't been an option but in the last few years, new advances in technology have given us the opportunity to view the working brain during its attempt to read (Shaywitz & Shaywitz, 2004). Dehaene (2011) mentions that learning to read combines the activation of both the visual areas of the brain coding for letter strings and the auditory areas coding for the phonological segments of speech. This means that the reading brain must convert the occipital region of the brain, which is designed to recognize objects, into one that recognizes letters and words, task that must be further coordinated with the auditory areas of the brain that process the sounds of language and assemble them into meaningful strings (Frey & Fischer, 2010).

However, thanks to the use of functional Magnetic Resonance Imaging[5] (fMRI), the neuroscientific findings have shown that the dyslexic brain works differently while reading (Christodoulou et al. 2014, Knight & Hynd, 2002, Richlan, 2012, Shaywitz & Shaywitz, 2004), fact that proves the neurobiological/neurodevelopmental disorder theories (Reid, 2011, Shaywitz & Shaywitz, 2005, Beaton, 2004). According to the results of the aforementioned studies for learners with dyslexia, there is an underactivation of areas of the brain which are involved in word analysis and fluent reading (Shaywitz & Shaywitz, 2004) such as the auditory module which is responsible for phonemic awareness and the visual module which is responsible for word recognition and letter shape identification (Milne, 2005). The most important finding is that a dyslexic brain relies more on the right hemisphere for support during a serial task like reading, which is not as effective as activating the left hemisphere, so there is a disconnection between the front (auditory module) and the back (visual module) of the brain (Milne, 2005, Shaywitz et al., 2002, Shaywitz & Shaywitz, 2004, Vlachos, Andreou, & Delliou, 2013). As Reid (2011) mentions, the left hemisphere is important for decoding tasks that are necessary for accurate reading while the right hemisphere processes information that incorporates a more holistic perspective such as processing pictures and other types of visual information.

Taking into account one of the latest definitions of dyslexia provided by the International Dyslexia Association (2002),

> {…} It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological

• "Functional MRI consists of a series of very rapidly repeated mini-scans that are designed to be sensitive to changes in the amount of oxygen in the blood." (Lishman in Snowling and Stackhouse, 2006, p. 44)

> component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction;{…}

numerous studies have taken place based on the phonological deficit hypothesis, using fMRI, Positron Emission Tomography (PET) scan or magnecoencephalography[6] (MEG) - otherwise known as Magnetic Source Imaging (MSI)[7] - and it is confirmed that the brain basis of phonological proceedings differs when it comes to children with dyslexia (Beaton, 2004, Georgiewa, 2002, Hadzibeganovic et al., 2010, Heim et al., 2010, Hoeft, 2006, Kovelman et al., 2011, - M. van Ermingen-Marbach, Grande, Pape-Neumann, Sass, & Heim, 2013, Moll, Hasko, Groth, Bartling, & Schulte-Körne, 2016, Norton, Beach, & Gabrielli, 2015, Pugh et al., 2000, Ramus, 2014, Shaywitz et al., 2002, Shaywitz, Lyon, & Shaywitz, 2006, Simos et al., 2000 -). The common outcome of all the aforementioned studies is that the brain activity of children or adults with dyslexia shows underactivation in the left inferior temporal-parietal regions as well as in the posterior temporal-parietal and occipito-temporal areas where a processing abnormality is noticed. In addition to reduced activation in left temporoparietal (TMP) areas, dyslexic children showed a marked increase in activation in homotopic areas of the right hemisphere (Simos et al., 2000, Simos et al., 2007, Papanicolaou et al., 2003) as well as greater activity in the right superior temporal gyrus (Papanicolaou, et al., 2003). It is also mentioned that between these two areas there is disrupted functional connectivity which reflects an impairment in fast visual word recognition (Elsevier, 2014, Richlan et al., 2009, 2011 as cited in Moll et al., 2016, Shaywitz et al., 2002, Temple, 2002) and influences the dyslectics' phonological skills. Converging evidence

[6] "MEG is a recent development for monitoring the electrical activity generated within the brain." (Lishman in Snowling and Stackhouse, 2006, p. 44)
[7] Papanicolaou et al., 2003, p. 595

from the studies also prove that there is greater activation in the Inferior Frontal Gyrus (IFG) and other frontal lobe areas. The greater engagement of these areas is often detected when readers were asked to complete tasks with explicit demands on phonological processing (pseudoword and word tasks). For children with adequate phonological skill, in contrast, the process of phonological assembly in word and pseudoword reading becomes highly automated and this phonological information continues to serve as an important component in rapid word identification (Van Orden, Pennington, & Stone, 1990; Lukatela and Turvey, 1994, as cited in Pugh et al., 2000). It could be concluded that the before-mentioned differences in phonological proceedings confirm that the phonological deficit hypothesis is one of the main causes of dyslexia.

2.2 Cognitive deficits responsible for Dyslexia

There is a broad consensus that human thinking, learning, and memory relies on a set of distinct, but interrelated, cognitive abilities. Some of these abilities, such as: auditory processing (correctly processing the sounds of our language, including phonological awareness), visual processing, short-term memory and working memory (including executive attentional skills) as well as long-term memory (placing information in and retrieving it from long-term memory), have to be adequately developed otherwise their weaknesses will affect the quality and rate of an individual's learning[8] (Common Cognitive Deficits in Dyslexic Students – Implications for Differentiated Instruction, 2009). As we have already mentioned, one of the most composite cognitive tasks is the reading process, which relies on brain systems that were originally devoted to other functions and during which a number of cognitive factors are activated, ranging from low-level sensory to high-level cognitive processes (Sela, Izzetoglu, Izzetoglu, &

[8] https://lincs.ed.gov/lincs/discussions/learningdisabilities/09Cognitive.html

Onaral, 2012). Since dyslexia mainly influences the reading process, the question is which variables are most critical in explaining reading abilities and disabilities and what is the nature of the interrelationships among these variables (Bell, McCallum, & Cox, 2003). Generally, students with dyslexia will perform relatively poorly on cognitive tests of phonemic awareness, phonological skills, sound blending, rapid automatized naming, auditory memory, certain types of visual memory, and decoding of nonsense words (Bell et al., 2003, Varvara, Varuzza, Sorrentino, Vicari, & Menghini, 2014). For the present study we need to thoroughly analyze the phonological deficit hypothesis and the working memory deficits.

2.2.1 Phonological Deficit Hypothesis

Within the past decades, the explanation of the cognitive symptoms of dyslexia has become the subject of numerous studies around the world. Researchers, taking into consideration the difficulties that children with dyslexia face, have proposed theories such as the phonological theory, the visual theory, the cerebellar theory and the magnocellular one, in order to explain the diversity of the symptoms of dyslexia (Ramus et al., 2003). However, since the late 1970s, the predominant theory has been the one of the phonological language deficit (Castles & Friedmann, 2014) which is considered to be the most dominant causal view on dyslexia (Blau, Van Atteveldt, Ekkebus, Goebel, & Blomert, 2009, Dandache, Wouters, & Ghesquière, 2014, Dickie, Ota, & Clark, 2014, Georgiewaa et al., 2002, Kovelman et al., 2011, Lishman, 2003, M. van Ermingen-Marbact, Pape-Neumman, Sass, & Heim, 2013, Ramus, 2001, 2003, Ramus & Ahissar, 2012, Ramus et al., 2003, Shaywitz, 1996, Shaywitz & Shaywitz 2005, Snowling, 1981, Stanovich, 1994, Szenkovits & Ramus, 2005, Vellutino & Scanlon, 1987a, Vellutino et al., 1996, Vellutino, Fletcher, Snowling, & Scanlon, 2004,

Reid, 2011). This perspective has been derived from the substantial evidence that difficulties in phonological processing, particularly when related to phonological decoding, have been a major distinguishing factor between dyslexics and non-dyslexics from early literacy learning to adulthood (Reid, 2011). Additionally, it has been widely proven that children with poor phonology (irrespective of IQ) are at high risk of reading problems (Snowling, 2013, Ramus, 2003, Tanaka et al., 2011) since reading is the ability to access, process and manipulate sounds (Dandache et al., 2014).

In order to read, the beginning reader must recognize that the letters and letter strings (the orthography) represent the sounds of spoken language and he/she has to develop the insight that spoken words can be pulled apart into the elemental particles of speech (phonemes) and that the letters in a written word represent these sounds (Shaywitz & Shaywitz, 2005, Griffith & Olson, 1992). As discussed earlier, such awareness is largely missing in dyslexic children and adults (Bruck 1992, Fletcher, Stuebing, Shaywitz, & Shaywitz, 1994, Liberman, Shankweiler, 1989, Shankweiler et al., 1979, Shaywitz 2003, Wagner & Torgesen 1987 as cited in Shaywitz & Shaywitz, 2005) and that is the reason why an early expertise of phonological abilities is considered to be an essential prerequisite for the development of reading abilities, otherwise, a barrier to reading acquisition both in the native and in a foreign language will arise (Costenaro, 2013).

However, some objections have been raised regarding the generalization of the aforementioned hypothesis due to the fact that most of the research on developmental dyslexia comes from English-speaking countries. Many people argue that the hypothesis cannot be generalized since there is accumulating evidence that learning to read English (opaque language) is harder than learning to read other more shallow orthographies (Seymour, Aro, & Erskine, 2003), all of which have less irregular

spelling-to-sound correspondences than English. That is why, researches in more transparent languages have been made in the past two decades. Consistent with the findings about English, the phonological deficit hypothesis has also been proven to be the most dominant though more mild causal viewpoint about dyslexia even for languages with easier orthography (Navas, Ferraz, & Borges, 2014) such as Spanish (Soriano-Ferrer et al., 2014, Suarez-Coalla & Cuetos, 2015), Greek (Niolaki, Terzopoulos & Masterson, 2014, Papadopoulos, Georgiou & Kendeou, 2009, Zachou & Zachos, 2008,) Portuguese (Moura, Moreno, Pereira, & Simoes, 2014), German, (Landerl, 2001, Landerl et al., 2013, Paulesu et al., 2001, Steinbrink, Klatte, & Lachmann, 2014, Wimmer, 1996, Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Körne, 2003), French, Italian (Paulesu et al., 2001), Finnish, Hungarian, Dutch (Landerl et al., 2013, Moll et al., 2014) and even Chinese (Ho, Law, & Ng, 2000, Siok, Spinks, Jin, & Hai Tan, 2009).

2.2.1.1 Definitions of Phonological Core Deficit and its components

One may wonder what exactly the phonological core deficits are. They have been defined as difficulties making use of phonological information when processing written or oral language. The major components of phonological deficits involve phonemic awareness (one's understanding of and access to the sound structure of language), sound-symbol relationships, and storage and retrieval of phonological information in memory (overview).

While reading about this deficit, we come across to concepts such as phonological awareness, phonemic awareness and phonics which seem similar but they are not. In the present study there are frequent references related to these concepts so in order to

understand their differences and be able to distinguish them we need to mention the definition of each concept as cited in the Dystefl course[9].

> "Phonological awareness – is the broader awareness of sound and is auditory. Phonological awareness is the ability to perform explicit judgements with regard to the structure of spoken words and it refers to all kinds of operations on speech sounds, engaging memory, analysis and synthesis of phonological elements. It is basically defined as an ability to identify, distinguish between, detect and manipulate the sound structure of words with regard to different sizes of phonological units, including whole words, syllables, onsets, rimes and phonemes. It is common knowledge that spoken words are made of tiny segments – sounds; it is an ability to break apart and put together these sounds. This facility, in turn, forms a prerequisite for later successful mapping of the sounds on the appropriate symbols – letters."
>
> "Phonemic awareness – is a type of phonological awareness. While the latter deals with various sizes of phonological elements (words, syllables, onset, rimes, phonemes), the former is reduced in scope and related to identification and manipulation of individual phonemes. It is the awareness of individual phonemes in a word and the ability to segment, blend, isolate, and manipulate those smallest units of sound. It is auditory."
>
> "Phonics – is a method of reading instruction, aimed at familiarizing children with relationships between sounds and corresponding printed letters or clusters of letters (the relationship between phonemes and

[9] http://dystefl2.uni.lodz.pl/?page_id=536

graphemes). It is learning the rules and patterns of the letter-sound relationship."

Even if there is a distinction between phonological awareness and phonemic awareness, the two terms are often used interchangeably. For the most part both are used to refer to what is technically phonological awareness. The more common term used to encompass both skill sets is phonemic awareness. In the present study, as in most literature, "phonemic awareness" refers to "phonological awareness"[10].

Either way, they are both considered as the major components of the aforementioned hypothesis and as Torgesen (2002) mentions, phonological awareness deficit is one of the most important discoveries in the last 20 years. That is why the volume of research on this topic is enormous and many support that it is difficult to imagine any research on dyslexia with no reference to the role of phonological awareness (Foorman et al., 2003; Uhry & Clark, 2005). This belief results from the fact that the specific deficit has been proven to be the direct cause of the reading disability. In particular, phonological awareness is seen as a major cognitive prerequisite for the acquisition of the mappings between graphemes (letters or groups of letters) and phonemes, which themselves consist the foundation of reading acquisition (Ramus, 2013), especially while learning an alphabetic writing system for which children also have to become familiar with the alphabetic principle which is the idea that written words symbolize spoken words (Costenaro, 2013). Another important factor related to reading that is worth mentioning is that dyslexic individuals also have a poor ability to pronounce nonwords / pseudowords which are

"A pronounceable combination of graphic characters, usually trigrams that do not make a real word (according to dictionaries) but do have all

[10] http://www.k12reader.com/phonemic-awareness-vs-phonological-awareness/

> the characteristics of a known real word. They are sometimes used in reading to test phonics knowledge and in spelling to test for desired syllabic patterns while avoiding known words (Harris & Hodges, 1995 as cited in Cardenas, 2009).

Their difficulty derives from the fact that they cannot use the lexical route and they depend entirely on the sub-lexical phonological route, which also makes their reading rate particularly slow (Costenaro, 2013). The procedure of producing new pronunciations for visually unfamiliar letter sequences, or nonwords is very critical for reading development (Wimmer, 1996) and it also helps older children to become fluent readers.

2.2.1.2 Phonologically-based Intervention

Taking into consideration the importance of phonological deficits, numerous studies have been conducted so that it can be tested if phonological instruction can ameliorate children's reading abilities and consequently fluency. Besides the obvious results of reading assessment, some studies have also attempted to discover if changes happen to the underactivated areas of the brain, which are responsible for the phonological deficit and have also been mentioned in the present study. The results of the studies are quite consistent and they prove that instruction based on phonemic awareness influences positively both reading skills and brain function.

2.2.1.3 Improving Reading Skills

The importance of the development of phonological skills in order to improve children's reading ability is officially stated in two reports. The first one[11] was submitted

[11] https://www.nichd.nih.gov/publications/pubs/nrp/documents/report.pdf

in 2000 by the National Reading Panel[12] (NRP) (USA) which had evaluated existing research and evidence to find the best ways of teaching children how to read. the second and most recent one[13] (2009) was completed by Sir Jim Rose in the UK by collecting and analyzing 863 responses following a call for views.

The purpose of the report of the NRP was to examine the scientific evidence related to the impact of phonemic awareness (PA) instruction and training on reading and spelling development. The reason why phonemic awareness instruction was selected for review and analysis is that several studies have identified phonemic awareness and letter knowledge as the two best school entry predictors of how well children will learn to read in school, especially during the two first years. The results confirmed that PA instruction helped all types of children -even those who were at risk for future reading problems and those who were already characterized as "disabled readers"- improve their reading skills. Additionally, it has been noticed that PA instruction affected positively both word reading and pseudoword reading, indicating that not only does PA help children decode novel words but it also helps them remember how to read familiar words.

Another aspect that was pointed out in the report is that in order to ensure that instruction in PA is effective, it needs to include instruction in graphemes as well as instruction in the connections between graphemes and phonemes to read and spell words. The NRP analysis showed that PA instruction was more effective when it was taught with letters (phonics instruction) because this helps children apply their PA skills to reading and writing. The findings proved that systematic phonics instruction helps to prevent reading difficulties among at risk students and remediate reading difficulties in

[12] "Significant improvement in reading skills following PA instruction was observed both in studies involving classroom teachers and in computer formats […]"

[13] http://webarchive.nationalarchives.gov.uk/20130401151715/http://www.education.gov.uk/publications/eOrderingDownload/00659-2009DOM-EN.pdf

"disabled readers". It is also important to mention that PA training contributes to children's ability to read and spell for months, if not years, after the training has ended.

The panel also supports the need for a balanced teaching approach that not only does it incorporate PA and phonics but also fluency, guided oral reading, vocabulary development and comprehension. It is mentioned that when the students are exposed to the words in the texts they read, they can recognize the printed words with ease and speed and word recognition is becoming increasingly automatic. The fact that they read in context, while receiving guidance or feedback from the teacher, is also considered effective in improving a variety of reading skills. Another important part of balanced teaching, which occupies an important position in learning to read, is vocabulary. A student will understand a text by applying letter-sound correspondences to printed material only if the target word is in his oral vocabulary, which is the key to learning to make the transition from oral to written forms. Reading vocabulary is also a prerequisite to the comprehension processes so students should be encouraged to do wide reading in order to enrich vocabulary.

In the second report similar evidence is presented with a focus on the effectiveness of intervention programs which systematically prioritize phonological skills for teaching reading to children with dyslexia. These children particularly benefit from the teaching that adheres to the following principles: highly structured, systematic, 'little and often'[14], using graphic representation, allowing time for reinforcement and encouraging generalization (Brooks, 2007, as cited in Rose, 2009). There is also reference to the recommendation from the Review of the teaching of early reading that high quality systematic phonics should be the prime approach for teaching children to read and when

[14] "An example of little and often is a reading intervention for 20 minutes a day, for 4 days a week over a period of 2 years." (Rose, 2009, p. 14)

children are not learning to read, the first thing to ensure is that they are receiving a good program in which phonic work is taught systematically.

Given the above mentioned reports which have accumulated a big number of researches and reviews, it is generally agreed that phonemic awareness and phonics instruction are the prerequisite components of efficiently learning to read not only for children with dyslexia but for all potential readers.

2.2.1.4 Activating the Brain

As discussed earlier, the results of phonological deficit while reading are also depicted in some areas of the brain which are underactivated. The fact that phonological processing has been proven to ameliorate reading, researchers tried to shed light on the hypothesis that there is a development of the brain thanks to phonologically-based interventions. In most studies the changes accomplished in the brain have been quite impressive. For example, increased activity after remediation was observed in left hemisphere temporo-parietal cortex and inferior frontal gyrus, both regions that showed activity in the normal reading children performing this task. Remediation resulted in improved language, reading performance, and increased activation in multiple brain regions during phonological processing (Eden et al., 2004, Gaab, 2007, Meyler, Keller, Cherkassky, Gabrieli, & Just, 2008, Papanicolaou et al., 2007, Shaywitz et al., 2004, Temple et al., 2003, Trei, 2003). Consistent with this finding, other studies show that when successful intervention occurs, neural systems are altered (Papanicolaou et al., 2003) and the brain physically rewires itself, creating new white matter that improves communication within the brain (Krafnick, Flowers, Napoliello, & Eden, 2011, Keller & Just, 2009, Mellon, 2009). As Shaywitz et al. (2004) mention, such findings have important implications for understanding the effect on neural systems of phonologically-based reading programs which bring about significant and durable

changes in brain organization, so that brain activation patterns resemble those of typical readers (Mellon, 2008, Shaywitz et al., 2004).

The most important finding that should be mentioned is that phonologically-based intervention programs not only do they activate the poor readers' brain areas but the specific neural gains become further solidified during the year following instruction resulting in a normalization of activation in two regions associated with reading (Mellon, 2008, Meyler et al., 2008). Given the emerging evidence that effective reading remediation has both immediate and more enduring effects on the development of the cortical network underlying reading, intervention programs based on phonological skills can help children with dyslexia improve their reading ability.

2.2.2 Memory

According to Carroll (1993), a cognitive ability is any ability that concerns some class of tasks in which correct or appropriate processing of mental information is critical to successful performance. Aspects of this mental functioning might be memorizing and remembering, inhibiting and focusing attention, speed of information processing and spatial and causal reasoning (Robinson, 2011). When it comes to reading, the cognitive abilities needed are attention, perception (visual, auditory) and working memory (Carroll, 1993, Verhoeven, Reitsma, & Siegel, 2011). The latter one is highly integrated into the process of learning how to read and that is why it should be taken into consideration when reading difficulties appear. Consequently, some of the basic facts about working memory should be reviewed in the present study.

2.2.2.1 The multicomponent subsystem model of Working Memory (WM)

The most prevalent theory about WM is the multicomponent subsystem model of WM initially presented by Baddeley and Hitch (1974). According to this model, the

term “working memory” (WM) refers to the brain system that provides temporary storage and manipulation of the information necessary for complex cognitive tasks (Baddeley, 1992). The term “multicomponent” refers to the fact that WM can be divided into 3 subcomponents: the central executive, the visuospatial sketch pad and the phonological loop (Baddeley & Hitch, 1974). In 2000, Baddeley revised the model by adding a fourth component named “episodic buffer”.

2.2.2.1.1 Central Executive

The central executive was envisioned as a control system of limited attentional capacity that is responsible for the manipulation of information within working memory. It was also assumed to be capable of attentional focus, storage, and decision making and for controlling two subsidiary storage systems: a phonological loop and a visuospatial sketchpad (Baddeley, 1986, 2000, 2010, 2012).

2.2.2.1.2 The phonological loop

The phonological (articulatory) loop is assumed to comprise two components, a phonological input store, whose primary function is speech perception, and an articulatory rehearsal process involving sub-vocal speech, which can be transformed at the user’s option into an active memory store (Baddeley, 1986). Since it stores mainly verbal information, Baddeley (1986) also uses the term Verbal Working Memory (VWM) / Verbal Short-Term Memory (VSTM)[15] which refers to the temporary maintenance and manipulation of verbally-coded material. It can maintain material within the phonological store by sub vocal repetition and it can take visually presented material such as words and register them in the phonological store by sub vocalization (Baddeley, 1992, 2000, 2003, 2010, 2012).

[15] “VSTM is related to vocabulary learning, whereas VWM is related to grammar learning” (Verhagen & Leseman, 2016, p. 65)

2.2.2.1.3 The visuospatial sketchpad

While both the phonological loop and the visuospatial sketchpad are essentially active input stores in which information can be maintained, they are specialized to maintain different information (Baddeley, 1986). The phonological loop holds verbal information whereas the visuospatial sketchpad is assumed to be capable of maintaining and manipulating visual and spatial information, a process that is crucial for performing a range of cognitive tasks (Repovš & Baddeley, 2006).

2.2.2.1.4 The episodic buffer

The episodic buffer comprises a limited capacity system that provides temporary storage of information held in a multimodal code (Baddeley, 2000). It holds and binds information from a range of systems including other working memory components and long-term memory into coherent complex structures: scenes or episodes. What is also important is that the input and maintenance of information within the episodic buffer depends on a limited capacity attentional system, namely the central executive one (Baddeley, 2000, 2006).

2.2.2.2 Working memory – Dyslexia – Foreign language learning

As we have already mentioned, dyslexia mainly affects language acquisition such as decoding words, reading, spelling and writing. These cognitive skills need a number of brain functions in order to be successful but children with dyslexia find it difficult to succeed. This happens because they present various deficits; one of them is that of WM since it is shorter and, therefore, less can be recorded at one time, for eventual transfer to storage in long-term memory (Hammond & MacPherson, 2007, Pickering, 2006).

In the present study we are mainly focusing on the components of WM which are responsible for the reading difficulties in both native and foreign language learning.

Poor readers usually recall fewer items when given a short list of digits, or letters, or words. They are often deficient in the ability to remember linguistic material mainly due to phonological processes involved in encoding or storing verbal information (Brady, 1991, Pae & Sevcik, 2011). This means that there are memory deficits mainly based on the phonological loop (VWM), fact that is also consistent with the phonological deficit hypothesis which is attributable to deficits in the phonological processes of the VWM (Berninger, 2008).

In general, the research literature review claims that children with dyslexia tend to show a WM profile with weakness mostly in two of the three components mentioned above. Because of the phonological deficit hypothesis, most of the studies focus on the VWM which has been proven to be the predominant impaired component (Berninger, 2008, Brady, 1991, Carvalho, Kida, Capellini, &Avila, 2014, Gathercole, Allowaya, Willis, & Adams, 2006, Ghani, 2013, Ghani & Gathercole, 2013, Isaki, Spaulding, & Plante, 2008, Jeffries & Everrat, 2004, Kibby, Marks, Morgan, & Long, 2004, Kibby, 2009, Kramer, Knee, & Delis, 2000, Schuchardt, Maehler, & Hasselhorn, 2008, 2011, Smith-Spark, Fisk, Fawcett, & Nicolson, 2003, Smith-Spark & Fisk, 2007). Some studies have also shown that there is also deficit in the central executive component (Smith-Spark et al., 2003, Spark & Fisk, 2007). What is worth mentioning is that there are results that provide direct evidence that the dyslexic readers rely on a visual strategy for the temporary retention of written words (Miller & Kupfermann, 2009) which means that their visuospatial sketch-pad[16] appears unaffected most of the times (Bacon & Handley, 2014, Gathercole et al., 2006, Isaki et al., 2008, Kibby, 2009, Kibby et al.,

[16] «It is the second component of Working Memory. It is specialized in maintaining and manipulating visuo-spatial images, and to resemble the articulatory loop in being essential an input store with active storage capabilities attributable to the regeneration of memory traces by a process external." (Baddeley, 1983, p. 319).

2013, Pickering, 2006, Robertson & Bakker, 2002, Schuchardt et al., 2008, 2011, Singleton, 2002, Smith-Spark et al., 2003, Vellutino, 1979, Vellutino & Fletcher, 2005). In order to explain the strength of the visuospatial sketchpad and localize brain areas which are activated for phonological versus spatial WM, several fMRI studies have been conducted. The results give evidence for a hemispheric organization of working memory, with dominance for processing of phonological information in the left hemisphere and frontal cortex, and spatial information in the right hemisphere and parietal cortex (Baddeley, 2003, Beneventi, Tonnessen, Ersland, & Hugdahl, 2010, Lycke, Specht, Ersland, & Hugdahl, 2008). These findings are consistent with the neuroscientific findings, already mentioned above, that a dyslexic brain relies more on the right hemisphere for support during a serial task like reading. The central executive component has not been extensively studied but the results have shown that there is also a deficit for people with dyslexia (Smith-Spark et al., 2003, Spark & Fisk, 2007).

The WM is an essential cognitive ability for language acquisition; therefore the serious phonological loop deficit hinders the process of learning not only in the native language but also in the foreign one (Baddeley, 2003, Crombie, 1999, Simon, 2000). The aforementioned findings should be taken into serious consideration by teachers especially when their students have dyslexia. They can facilitate the learning process for them if they adapt the academic material to their strong visual spatial ability.

English as a Foreign Language (EFL) and Dyslexia

3.1 Reading and the alphabetic principle

As Frost (2005) mentions, a few thousand years ago people had to invent orthographies whether alphabetic (English), syllabic (Japanese Kana), or logographic (Chinese), with the sole purpose of communicating spoken language in graphic form.

In every written language those graphic signs represent phonological units and the characteristics of each language are those which determine the manner in which orthographies represent their spoken language (Frost, 2005). An alphabetic writing system is a system in which words consist of individual letters that correspond to spoken-language units at a similar level of analysis. The systematic relationships between units of these two systems are collectively referred to as the Alphabetic Principle (Uppstad & Tonnessen, 2011, p. 109) whose mastery is a prerequisite for reading (Liberman, Shankweiler, & Liberman, 1990). Learning how to read is a very demanding process which mainly involves learning how the writing system functions when encoding the spoken language (Katz & Frost, 1992, Perfetti, 2003, Ziegler & Goswami, 2005) and which also entails an awareness of the internal phonological structure of the words of the language ((Liberman et al., 1990). An alphabetic reader should acquire the system for mapping between symbol and sound in order to be able to access the thousands of words already present in their spoken lexicons (Ziegler & Goswami, 2005).

An important factor that may result in slow reading development is the degree of consistency[17] and completeness between letter and phoneme, which varies both between languages and different types of orthographic units (Andreou & Baseki, 2012, Davis, 2005, Ellis et al., 2004, Goswami, 2010, Katz & Frost, 1992, Protopapas & Vlachou, 2009, Seymour, Aro, & Erskine, 2003, Spencer, 2000, 2001, Ziegler & Goswami, 2005). When evaluated by the characteristic of phonological complexity, a

[17]"Consistency refers to the (lack of) variability in the correspondences between the phonological and orthographic units of a language." (Protopapas & Vlachou., 2009, p. 992)
"Ο όρος συνοχή αναφέρεται στην αντιστοιχία φωνήματος - γραφήματος και σε ποιο βαθμό κάθε γράφημα αντιπροσωπεύει ένα μοναδικό φώνημα." Retrieved, 5 June, 2017, http://grafwnimata.blogspot.gr/2014/01/blog-post_22.html

language that is not complex can be written (and generally will be written) in a shallow orthography, an orthography that tracks the phonology. Secondly, if the language is phonologically complex, then the orthography has the option of representing either morphological invariance (a deep orthography) or following grapheme-phoneme invariance (a shallow/transparent orthography) (Katz & Frost, 1992, p. 149). Readers of transparent orthographies tend to be more successful than those of the opaque ones, since the sound–spelling mappings present inconsistencies based on the fact that single orthographic units have multiple pronunciations or single phonological units have multiple spellings such as English (Brunswick, 2010, Davis, 2005, Ellis et al., 2004, Frith, Wimmer, & Landerl 1998, Landerl, Wimmwer, & Firth, 1997, Landerl et al., 2013, Marinelli, Roman, Burani, & Zoccolotti, 2015, Marinelli, Roman, Burani, McGowan, & Zoccolotti, 2016, Miles, 2000, Pillunat & Adone, 2009, Seymour et al., 2003, Tainturier, Roberts, & Leek, 2012, Wang, Castles, & Nickels, 2012, Wimmer & Schurtz, 2010, Yael, Tami, & Tali, 2014).

3.2 Reading and the cross-linguistic transfer

As mentioned in the previous chapter, reading acquisition incorporates a broad range of competencies and metalinguistic[18] awareness so that it can be acquired (Koda, 2008). The question is what happens with regard to foreign language reading. As Koda (2008) mentions, second-language reading acquisition is presumed to impose the same initial requisites as those for first-language learning to read. That is the reason why serious attention should be given to cross-linguistic transfer. The idea of transfer in second language acquisition can be traced back to the Contrastive Analysis approach which is based on the individual's tendency to transfer the forms and meanings of their

[18] "The ability to identify, analyze and manipulate language forms. […] The resulting metalinguistic awareness reflects the specific ways in which language elements are graphically encoded in the writing system and therefore, varies systematically across languages." (Koda, 2008, p. 69, 77)

native language and culture to the foreign language (Lado, 1957, as cited in Geva, 2016, p. 2). More recent research has evolved to Cummins' interdependence hypothesis (1981) (as cited in Kuo & Anderson, 2008, p. 56):

> To the extent that instruction in a certain language is effective in promoting proficiency in that language, transfer of this proficiency to another language will occur, provided there is adequate exposure to that other language (either in the school or environment) and adequate motivation to learn that language.

Multiple researches have been conducted regarding language transfer. It has been extensively proven that previous knowledge and skills are intimately involved in the acquisition of new knowledge and that mother tongue plays an important role in the process of learning (Corder, 1992). Even if there is a distinction in the literature between positive transfer (also known as facilitation) and negative transfer (also known as interference) (Gass & Selinker, 2008), Jarvis and Pavlenko (2008) classified transfer into two categories, including linguistic transfer (including phonological, orthographic, lexical semantic, morphological, syntactic and socio-linguistic transfer) and conceptual transfer. In the past decade, researchers have tried to find the aspects of language proficiency or cognitive ability that may be transferable across languages. In this research phonological awareness (Chow, McBride-Chang, & Burgess, 2005, Chung, McBride-Chang, Cheung, & Wong, 2013, Durgunoğlu, Nagy, & Hancin, 1991, Lafrance, & Gottardo, 2005, Melby-Lervåg, & Lervåg 2011, Mishra, & Stainthorp, 2007, Sousa, Greenop, & Fry, 2010, Sun-Alperin, 2007, Wei & Zhou, 2013), morphosyntactic awareness (Pasquarella, Chen, Lam, Luo, & Ramirez, 2011), word reading (Chuang, Joshi, & Dixon, 2012, Durgunoğlu, et al., 1991, Karim, 2010, Pasquarella, Deacon, Chen, Commissaire, & Au-Yeung, 2014, Pasquarella et al., 2015, Mishra, & Stainthorp, 2007, Sun-Alperin, 2007), reading comprehension (Pasquarella,

Chen, Lam, Luo, & Ramirez, 2011, Morvay, 2015) and reading strategies (Talebi, 2013) have presented cross-linguistic transfers.

3.3 Reading English – an opaque language

English is considered to be an opaque language with deep orthography since its writing system is extremely complex (Frost, 2005, Miles, 2000, Porpodas, 2006) fact that also influences reading, which in turn represents the most extreme case of spelling–sound complexity (Share, 2008). Therefore, because of the combined effects of phonological complexity and orthographic transparency, acquiring efficient reading skills in English becomes a rather difficult process (Goswami, 2010) and sometimes the acquisition is delayed (Costenaro, 2012).

As Frost mentions (2005) the main source of the aforementioned complexity in English not only does it derive from its rich vowel system (Pillunat & Adone, 2009), about 15 vowels, which are represented by fewer graphemes but it is also related to the fact that the vowels combined with the 24 consonant sounds have many possible structures (e.g., CV, VC, CVC, CCVC[19]). The 40 sounds of spoken English may be represented by somewhere in the region of 1120 possible letters or letter combinations (Nyikos, 1988 as cited in Brunswick, 2010). Treiman, Mullennix, Bijeljac-Babic, and Richmond-Welty (1995) estimating that the pronunciation of modern English written vowels is only 51% consistent over different words, whereas initial and final consonants are much more consistent (96% and 91%, respectively), than rime units (77%). Consequently, it is relatively difficult to learn about phonemes if a letter can be pronounced in multiple ways (e.g., the letter A in English, which maps onto a different

[19] "C stands for consonant. V stands for vowel."

phoneme in the highly familiar words (*cat, was, saw, made, and car*) or if a phoneme can be spelt in multiple ways (***c**at, **k**oala, s**ch**ool*) (Ziegler & Goswami, 2005).

The implications of the inconsistencies due to transparency of the English language have been studied in several cross-linguistic reading comparisons. In 1984, when Oney and Goldman compared reading acquisition between children speaking Turkish (shallow orthography) and American English (deep orthography), they found out that English speakers did poorly in reading pseudowords since phoneme-grapheme correspondence is quite inconsistent. Similar results, confirming that, since English is an opaque language reading it is harder to master, have been reported by Wimmer and Goswami (1994) as well as by Frith, Wimmer and Landerl (1998) who compared German and English speakers. In both studies the German children showed a big advantage in reading the nonsense words while the English ones were less efficient. Similarly, Seymour et al. (2003) conducted a study in which 12 European languages were compared in order to determine whether the orthographic depth effect becomes evident when it comes to reading acquisition. The English-speaking sample showed a relative delay in achievement of efficient reading of familiar words (the rate of development in English is more than twice as slow as in the shallow orthographies) and a special difficulty in developing effective nonword decoding. It seems that syllabic complexity selectively affects decoding, whereas orthographic depth affects both word reading and nonword reading fact also confirmed by Ellis et al. (2004) in her study of alphabetic, syllabic, and logographic scripts (Japanese Hiragana, Albanian, Greek, English, and kanji).

Taking into account the aforementioned findings, one can conclude that decoding skills varies substantially between orthographies with greater difficulty when it comes to less transparent ones such as English, which besides creating obstacles to typical

children it also hits dyslexic readers since it is harder for them to segment the sounds of speech and they find it difficult to learn the mapping between these sounds and letters (Frith, 1999).

3.4 Dyslexia and opaque orthographies

As discussed in the previous unit, English has been proven to be an opaque language which prevents children from acquiring reading skills as easily as children of more transparent orthographies do. As Spencer (2001) mentions, if orthographies were perfect, there would be one letter for each sound and the number of sounds would exactly match the number of letters, which certainly this is not the case with English. Consequently, if the task of phonological recoding becomes so difficult for the normally developing English-speaking reader, in the case of dyslexia the problem is vastly aggravated (Wimmer, 1993,). One can conclude that although dyslexic readers of shallow languages may succeed in their daily reading, the ones of deep orthographies present slow and impaired reading, spelling and phonological processing (Brunswick, 2010, Caravolas & Volin, 2001, Landerl et al., 1997, 2013, Ministry of Education New Zealnd, 2006, Paulesu et al., 2001, Ziegler & Goswami, 2005). Therefore, there is no wonder why dyslexia is particularly prominent in English-speaking countries and its research is particularly well developed there (Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Korne, 2003).

Most of the researches about dyslexia have been conducted in the English language that is why it is of great importance to know whether dyslexia is the same in countries that use different languages (Ziegler et al., 2003). In that event, cross-linguistic studies have been conducted among different languages with various degrees of transparency and English. The common result of the studies irrespective of transparency is the fact that phonological processing deficit is a universal problem and phonological awareness

is the key component of reading acquisition in all languages, since all the samples presented a deficit while reading pseudowords, whose decoding needs developed phonological skills (Andreou & Baseki, 2012, Dulude, 2012, Georgiou, Parrila, & Papadopoulos, 2008, Landerl, 2001, Landerl et al., 1997, 2013, Oren & Breznitz, 2005, Paulesu et al., 2001, Wimmer, 1996, Wydell, 2012, Ziegler & Goswami, 2005, Ziegler et al., 2003, 2010). Some of the studies, which compared the German and English language, presented similar findings when it comes to nonword reading. Landerl, 1997, Landerl et al., (1997) pointed out that the error rate for 3 syllable words was 70% for the English dyslexic children while for the German was only 20%.

Consistent with this finding are the ones from Landerl (2000) and Ziegler et al. (2003) in which error rates were 60% (English) to 27% (German) and 51% to 22% respectively. In another study, Andreou and Baseki (2012) stated that the mean scores of errors for English dyslexic children was 8.50 while for the Greeks, whose language is quite transparent (Porpodas, 2006) was only up to 1.50. Analogous findings have been found in studies comparing more than two languages such as English-French-Italian (Paulesu et al., 2001), Finnish-Hungarian-German-Dutch-French-English (Landerl et al., 2013) and Finnish-Hungarian-Dutch-Portuguese-French-English (Ziegler et al., 2010). The predominant conclusion of all the studies is that even if all dyslexic children have the same phonological deficits, those using the English language present a more severe impairment. The explanation emerging from the studies is that dyslexic children's reading behavior is more severe in English because it is an opaque language with a lot of orthographic inconsistencies, fact that prevents children from fully understanding the purpose of the alphabet (Landerl, 2000). If phonemes had highly predictable consistent forms of representation, English children would show the

same level of performance, irrespective of age, that is found with subjects using more regular orthographies (Spencer, 2000).

Therefore, it is generally agreed that English dyslexic children using English as an educational medium will be disadvantaged and the most disadvantaged group of all may be dyslexic children for whom English is an additional language[20] (Spencer, 2000), since they have to learn how to "crack the code" for all the irregular letter-sound correspondences (Oney & Goldman, 1984). Another important point that should be mentioned is that even if the "dyslexic" children's first language is a more transparent one, the same phonological deficiencies exist and due to the cross-linguistic transfer they are also transferred in the second language learning acquisition (Ganschow, Sparks, & Javorsky, 1998, Sparks, Patton, Ganschow, Humbach, & Javorsky, 2006).

English as a Foreign Language Curriculum in Greece

In the last few decades, Europe has set the objective for multilingualism and plurilingual citizenry. In this context, important changes have recently been introduced in Greece, aiming at providing more hours and enhanced opportunities for foreign language learning within state schools (Dendrinos, Zouganeli & Karavas, 2013). English as a Foreign Language is now taught based on a generic approach to language learning and the use of foreign languages for communication, while until recently languages were treated in the Greek school curriculum as separate, clearly defined subjects promoting different aims and different approaches to language learning (Dendrinos, Zouganeli & Karavas, 2013). However, the hours devoted in the school

[20] "The use or study of the English language by non-native speakers in an English-speaking environment. The term English as an additional language acknowledges that students are already competent speakers of at least one home language." Retrieved, 6 June, 2017, https://www.thoughtco.com/english-as-an-additional-language-eal-1690600

program are far from ideal and that is the reason why parents choose additional language teaching support in private tuition classes, usually evening language schools, which are a popular phenomenon in Greece (Alexiou & Matheoudakis, 2013, Dendrinos, Zouganeli & Karavas, 2013). Besides the limited time, another factor that influences the inadequate teaching of English at schools is the lack of applying new teaching methods so that the lesson can be motivating for the students. Learners prefer methods which include games, internet activities and computer technology in order to learn English, thus the current teaching situation, including the curriculum, course book, materials and teachers' methods is in question since it seems unable to fulfil the children's true learning preferences (Tzotzou, 2014). There are studies (Alexiou & Mattheoudakis, 2013, Kidonia, 2016, Tzotzou, 2014) which point out the need for teachers to be trained in order to follow the current educational needs and changes so as to be able to enrich the traditional classroom work and teaching techniques.

4.1 EFL and Dyslexia in Greece

The above mentioned teachers' inefficiency in teaching the English language is far more obvious when it comes to teaching children with learning difficulties as they also lack knowledge and training on dyslexia (Lemperou, Chostelidou & Griva, 2011, Rontou, 2010, 2012). The root of the problem is that in Greece children with special needs are included in the mainstream school without having made the fundamental changes required for inclusion and without having specialized educating staff in order to satisfy the children's educative needs (Riga, 2012). Unfortunately, there are a big number of Greek language teachers who think that children with learning difficulties should not be a part of mainstream schools because they are considered a problem which they have to solve themselves without having the appropriate infrastructures or the qualifications required (Riga, 2012). The lack of training and knowledge on issues

of special education is stated as a major problem for both Greek and English teachers since the skills required to cope effectively with the demands of the teaching context are inadequate (Lemperou, Chostelidou & Griva, 2011, Riga, 2012, Rontou, 2010, 2012) so they cannot differentiate the lesson in order to satisfy all the students' needs fact that is also explained by the inability of a lot of children with dyslexia in Greece to learn English efficiently.

The "ILD"- 3Dlexia method – Case study site

The 'i love dyslexia' organization, where the current study took place, is the first and only internationally, highly specialized in holistic[21] and innovative EFL learning to students with dyslexia and learning differences. It's is a highly sophisticated combination of diverse pedagogical approaches and authentic EFL material for whole brain activation, designed based on the latest cognitive neuroscientific research. The founder of ILD[22] and 3Dlexia method Aggeliki Pappa, took into consideration the global literature about dyslexia and created an effective method which could remediate the underlying difficulties that keep struggling learners from making progress. Acknowledging the fact that neuroplasticity[23] enables the brain to make new connections among neurons (Doidge, 2007, Krafnick et al., 2011, Keller & Just, 2009, Valeo, 2008) and the different ways that a dyslexic brain functions, the method builds the students' cognitive capacity in areas such as memory, attention, and processing speed, as well as language and reading skills. All abstract information and complicated rules from EFL books are transformed into 'smart' visuals, creative mind maps, funny

[21] "Holistic education nurtures the broad development of the students and focuses on their intellectual, emotional, social, physical, creative or intuitive, aesthetic and spiritual potentials." (Hare, 2010, p. 3)
[22] http://www.ilovedyslexia.gr/el
[23] "The process by which neurons create new connections among themselves.". (Vola, 2008)

mnemonics, augmented reality materials and 3D constructive multi-sensory games to develop reading, writing, grammar, oral, and listening EFL skills in fun, radical, experiential ways, connecting cognitive and metacognitive cultivation with technology and nature (see Appendix I).

Furthermore, the students' emotional state is of great importance. It is well-known that children, adolescents, and adults with dyslexia are particularly vulnerable and present higher levels of stress and anxiety than those of the average population (Carroll & Iles, 2006, Miles, 2006, Nelson & Hardwood, 2011, Piechurska-Kuciel, 2010, Reid, 2011, Riddick, Sterling, Farmer, & Morgan, 1999). They usually have low self-esteem and high levels of anxiety which has been proven to be an inhibitory factor for the learning process as it has an impact on attention span and working memory (Nelson & Hardwood, 2011, Lyneham, 2009, Owens, Stevenson, Hadwin & Norgate, 2012) which are important cognitive abilities.

The students who come to ILD are given the chance to attend one-to-one lessons and a weekly two-hour workshop since we want to ameliorate both the students' academic performance and their self-confidence and esteem. The socio-emotional cultivation during the workshops, transforms students' personality and their peak cognitive performance is shown in a field that challenges them the most, while at the same time they develop holistically, in a balanced way, their social and emotional well-being.

According to the findings regarding the phonological deficit hypothesis the ILD method has been designed based on the explicit instruction and practice (Sparks, Ganschow, Kenneweg, & Miller, 1991) that leads the students to an appreciation that spoken words are made up of smaller units of sounds, because getting started in alphabetic reading depends critically on mapping the letters and spellings of words onto

the speech units (Hulme & Snowling, 2013, Costenaro, 2013, Reid, 2011, Snow, Burns, & Griffin, 1998, Vellutino, 2004, Wimmer & Schurz, 2010). The phonological awareness training is combined with spelling instruction since it has been found that if it is integrated into the beginning of a reading program carefully, it can help students improve both their reading and spelling skills (Johnson, 2013). The third component of the ILD method which is of equal importance is the use of mnemonics (Reid, 2011). As mentioned in chapter 2.2.2, even though students with dyslexia have poor verbal working memory, they usually have a good visuospatial working memory which is the one that helps them store information in the long-term memory. Consequently, the use of mnemonic strategies should be implemented so as to help students enhance their memory by finding a way to relate new information to information already locked in long-term memory.

Research design-Methodology

6.1 Educational Research

People's need to understand and explain the unknown has led to the development of the field of research which is defined as a "studious inquiry or examination; especially: investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws"[24]. That is the reason why, research has become a predominant tool for countless fundamental fields such as psychology, history, medicine and education (Starman, 2013). In particular, education is one of the fields where a considerable number of changes take place in a short time so it is vital

[24] research.(n.d.). *Online Library Learning Center*. Retrieved, 24 May, 2017, http://www.usg.edu/galileo/skills/unit01/infoage01_03.phtml

that immediate action be taken according to the new facts. Therefore, educational research has greatly developed in the past years and not only does it help educators gain a better understanding of problems or issues by accumulating valuable knowledge, but it also assists them in improving practice (Creswell, 2012). Bassey (1999:39) defines educational research as "critical enquiry aimed at informing educational judgments and decisions in order to improve educational action." Practitioners have the possibility to evaluate approaches that they hope to work with individuals in educational settings and this process involves shifting through research to determine which results will be the most useful (Creswell, 2012). The results are based either on the quantitative research method or the qualitative one. Even if there is a debate over the use of these two methods for educational research the latter one seems to be widely accepted by researchers in the past few decades, because they have realized that valuable information can be gained through rich anecdotal study -particularly when experimentation or other quantitative methods are not possible or desired (Nath, 2005). On the other hand the data collected by qualitative methods contribute to descriptions of phenomena and it helps move inquiry towards more meaningful explanations since both the context of events as well as the events themselves are better understood (Sofaer, 1999).

However, the subjectivity of the qualitative findings often causes controversy about the robustness and quality of the study (Bryman, 2012, Johnson & Christensen, 2014, Leung, 2015). This is the reason why another research approach is rapidly expanding in the social and human sciences which is called mixed methods research (Creswell, 2013, Johnson & Christensen, 2014). As its name indicates, this method combines both qualitative and quantitative methods so that an in-depth understanding of the research problem and question can be provided (Creswell, 2012, 2013, Johnson

& Onwuegbuzie, 2004, Johnson, Onwuegbuzie & Turner, 2007). One may wonder when a mixed methods design should be used. According to Creswell (2012):

> "You conduct a mixed methods study when you have both quantitative and qualitative data and both types of data, together, provide a better understanding of your research problem than either type by itself. Mixed methods research is a good design to use if you seek to build on the strengths of both quantitative and qualitative data."

In this context, I decided to use the mixed methods design because both qualitative and quantitative data will be collected.

6.2 Mixed Methods Design

As discussed above, in mixed methods studies, a researcher combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative data collection, analysis) (Ary, Jacobs, Sorensen & Walker, 2014, Johnson, Onwuegbuzie & Turner, 2007). The use of these approaches can occur at different points in the research process (Creswell, 2012, Greene, 2007, Johnson & Onwuegbuzie, 2004) and the method can be either fixed[25] or emergent[26] (Creswell & Clark, 2011, Creswell, Klassen, Clark & Smith, 2011). When it comes to educational research, the most commonly used mixed methods designs are: a) the triangulation or convergent parallel design, b) the explanatory sequential design, c) the exploratory sequential design and d) the embedded design (Creswell & Plano Clark, 2007, Creswell, 2012). Fetters, Curry and Creswell (2013) also distinguish a larger framework that

[25] "The use of quantitative and qualitative methods is predetermined and planned at the start of the research process, and the procedures are implemented as planned." (Creswell & Clark, 2011, p. 54)
[26] "The use of mixed methods arise due to issues that develop during the process of conducting the research." (Creswell & Clark, 2011, p. 54)

incorporates the basic design which may involve (1) a multistage; (2) an intervention; (3) a case study; or (4) a participatory research framework.

For the present study the embedded design was selected, in a case study framework since both qualitative and quantitative data are collected to build an in-depth understanding of the cases (Stake, 1995). This design was chosen based on three important aspects: the timing of the use of collected data (i.e., the order in which the data are collected or used in a study, between data collection and data analysis, during data analysis, or in the interpretation), the weight given to the quantitative or the qualitative approach and the approach to mixing the two datasets (i.e., how the two datasets will be related or connected (Bryman, 2012, Creswell, 2007, 2009, 2012, Creswell et al., 2011, Johnson & Onwuegbuzie, 2004).

Taking into consideration the aforementioned aspects and the needs of the current study, we decided to conduct a qualitative dominant mixed method as more qualitative data will be collected and the quantitative ones will support the findings (Ary et al., 2014, Kanga, Njeru, Wachera & Rutere, 2015, Ponce & Pagan-Maldonado, 2015). The integration of the two types of data will be made at the interpretation and reporting level through the narrative weaving approach which involves writing both qualitative and quantitative findings together because the results are connected to each other thematically (Fetters et al., 2013).

6.2.1 Concurrent Embedded Design

The literature suggests that the embedded design is a mixed methods design in which quantitative and qualitative data are collected simultaneously or sequentially and one data set provides a supportive, secondary role in a study based primarily on the other data type (Creswell, 2007, 2012, 2014, Creswell & Clark, 2009, Creswell et al.,

2011). As Creswell et al. (2011) mention, the embedded design can be suitable for an intervention study, since qualitative data can be used both before and after the intervention so as to explore the individuals' experiences and quantitative data can be used to measure the success of the intervention (Creswell, 2009, 2012, Creswell & Clark, 2007). In this context, the present qualitative dominant study uses the qualitative data to gain a deep understanding of the participants' difficulties because of dyslexia as well as their experiences of the intervention program. The quantitative data, which were simultaneously collected, is used to support the research questions related to the extent that the participants' reading skills improved due to the intervention program. Another reason that this mixed methods model was chosen is because we have the chance to collect the two types of data simultaneously during a single data collection phase. Therefore, the study will have the advantages of both quantitative and qualitative data, fact that increases its validity.

6.2.2 Qualitative Method – Case study

As discussed previously the dominant method of the study is the qualitative one and the reasons have already been stated. What has not been mentioned is the selected qualitative strategy. While one might think that qualitative research study is of one kind, there are actually many varieties of qualitative approaches. According to Creswell (2012), there are five different strategies of inquiry: ethnography, narrative, phenomenological, grounded theory, and case study.

After a thorough examination of the strengths of each strategy, case study was proven to be the most suitable approach for the present study, in which we need to analyze the effects of a reading intervention program in a natural surrounding. As Merriam (1998) mentions, "because of its strengths case study is a particularly appealing design for applied fields such as education. Educational processes, problems,

and programs can be examined to bring about understanding that in turn can affect and perhaps even improve practice. It has proven useful for studying educational innovations, for evaluating programs and for informing policy" (p. 41). The case study has a level of flexibility, as it can be designed to suit the case (Hyett, Kenny and Dickson-Swiftet, 2014) which might be the analysis of a student, a teacher, a class, a teaching plan, a curriculum or an educational community (Coimbra & Martins, 2013). Therefore, in the present study we are given the opportunity to gain in-depth understanding of the research problem (Tellis, 1997, Nath, 2005, Stake, 2005, Hancock & Algozzine, 2006) and discover the extent to which the program has been implemented, by providing immediate feedback so as to discover or confirm the process by which the treatment had the effect it did (Cook & Reichardt, 1979). Apart from the fact that the research problem will be holistically viewed and understood, the case study strategy was also selected in the aim to reflect Yin's (1994) definition since "how" and "why" questions are being posed by focusing on a contemporary phenomenon within some real-life context (classroom) in which the investigator (teacher) has little control over events. Since similar definitions have been given by Merriam (1988) and Stake (1995), having all in common the study of a situation in its "real life" context and the understanding of complexity (Simons, 2009), the present study seems to satisfy the prerequisites for applying the case study research approach.

6.2.2.1 Multiple Case Study

The review of the literature proves that there is not only a single type of case study but the researcher has the opportunity to choose the most suitable one depending on the research question as well as on the specific issue under investigation (Rowley, 2002). One of the variations within the method is that the research has been conducted with the use of more than one case. In order to describe this, Yin (1994) and Merriam (1988)

use the term "multiple case study". Stake (2005) also uses the terms "collective case study" or "multicase study" (2013) which, according to him, are used when the interest is not focused only on one case but the investigation of the phenomenon is studied through a number of cases sharing a common characteristic or condition. In this context the researcher is able to compare the cases, to study their similarities and their differences in order to grasp more detailed information about the research question (Bengtsson, 1999, Merriam, 1988, Stake, 2005, 2013, Wahyuni, 2012, Yin, 1994). The number of the cases to be selected depend on the replication needed. In the current study the cases were selected in a way that similar results will be achieved (literal replication) and if that be the case there will be strong evidence for the initial set of propositions (Rowley, 2002, Yin, 1994). Besides the more compelling and robust results, which result from the number and the variation of cases, (Baxter & Jack, 2008, Bengtsson, 1999, Merriam, 1988, Ridder, 2016, Rowley, 2002, Yin, 1994), multiple case study enables the advance of a field's knowledge since the findings allow better understanding and theorizing about a larger collection of cases (Denzin & Lincoln, 2008, Merriam, 1988, Rose, Spinks, & Canhoto, 2014).

In the present research we aim to study the effectiveness of an innovative reading intervention program applied to students with dyslexia. The need for a multiple case study not only does it derive from all the above mentioned reasons but also from the fact that students with dyslexia – besides having some common characteristics – they present different learning profiles. This happens because the degrees of severity of dyslexia differ, fact that also influences the students' strengths and weaknesses (Crombie, 2014, Kormos & Smith, 2012). According to the International British Association,[27] "the impact that dyslexia has is different for each person and depends on

[27] https://dyslexiaida.org/frequently-asked-questions-2/

the severity of the condition and the effectiveness of instruction". These associated characteristics which vary in degree and from person to person[28] are the reason why a multiple case study has been selected. Each case to be studied is an entity located in its own situation and background so if the findings of each case are identified in the others as well, then there will be literal replication and the results will be more robust (Ridder, 2016).

6.3 Purposeful sampling – An overview

One of the most important steps when designing a case study is that of choosing the most suitable samples in order to have the replication chosen. It is necessary that the researcher take into account the research purpose, questions, propositions and theoretical context, as well as the accessibility, the available resources and time (Rowley, 2002). Opposed to quantitative research, which involves large samples so that accurate predictions can be made mathematically (little information about a lot of people selected randomly) (Davis, Gallardo, & Lachlan, 2010), qualitative research is mainly based on purposeful sampling. As Patton (1990) states:

> "Qualitative inquiry typically focuses in depth on relatively small samples, even single cases (n = 1), selected purposefully. The logic and power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research, thus the term "purposeful sampling" (p. 169)."

[28] https://www.lucid-research.com/documents/factsheets/FS19_Understandingdyslexia.pdf

Since in the present study we intend to get in depth information about our samples so as to broaden our understanding about the phenomenon under study, we chose the purposeful sampling. Similar sampling is suggested when single-subject research is used especially in the field of special education which emphasizes the individual student as the unit of concern and active intervention (Horner et al., 2005). The specific design typically includes multiple participants (3 to 8) in a single study and each participant serves as his or her own control (Horner et al., 2005). That is the reason why the multiple case study method was selected, as well as the maximum variation sampling. According to Patton (1990), there are 15 different strategies for purposefully selecting information-rich cases but we considered the maximum variation one as the most suitable. We identified 2 out of 27 teenagers and 2 out of 35 adults who have a common characteristic but they also display different dimensions of that characteristic (Creswell, 2012, Davis et al., 2010). Thus the common patterns which will emerge from the variations will be of particular interest and value in capturing the shared aspects or impacts of the program. The findings of a small sample of great diversity will be of high-quality, since the detailed descriptions of each case will be useful for documenting uniqueness (Patton, 1990).

All the 4 individuals chosen, as fewer would limit the study (Stake, 2013), have dyslexia. However, they present a wide range of characteristics. Table 1 below describes the profile of the selected cases.

Table 1.

Cases' personal information

Name	Age	Age diagnosed with dyslexia	Years of Special Education input	Years of learning English

John	15	12	2	5
Paul	20	7	7	7
George	15	10	3	5
Anna	32	16	2	8

Table1. Cases' personal information and time spent learning English

One can notice that they are not all at the same age nor have they been assessed, in the same periods of their academic lives as having dyslexia. Furthermore, the time spent for a special intervention program in their language varies among the cases, as well as the time spent while learning the English language. Finally, their learning profile presents variations since their weaknesses and strengths differ according to each individual's severity of dyslexia. These strengths and weaknesses of their native language will determine their success or failure of learning a foreign language (FL) (Ganschow et al., 1998, Sparks et al., 2006).

Before presenting the samples, it should be mentioned that I took into consideration the ESRC[29] (Economic Social Research Council) and SRA[30] (Social Research Association, 2003) framework for research ethics in order to protect subjects from undue harm as a consequence of their participation in research. Therefore, all the participants and the participants' parents were given a written explanation of the procedures of the research and its purposes. They were also informed that they were free to withdraw from the study at any time. We also got their consent in order to use their official state assessments and all the data which would be collected by me and the other teachers. Finally, they were told that their personal data would remain anonymous and that is the reason why the names used in the study are not the participants' real ones.

[29] http://www.esrc.ac.uk/funding/guidance-for-applicants/research-ethics/our-core-principles/
[30] http://the-sra.org.uk/wp-content/uploads/ethics03.pdf

6.3.1 Presenting the Samples

6.3.1.1 Case 1 – John

John is a 15-year-old high school student who was diagnosed with dyslexia at the age of 12 during his first year of junior high school. During the official assessment, John's Wechsler Individual Scale for Children (WISC) IQ test fell within the average scale compared to children of the same age but he faces difficulties due to dyslexia such as reading, spelling and writing. He was suggested to receive special education input, which lasted 2 years, in order to improve his weaknesses. During the "ILD" assessment, which takes place when the students first arrive in order to check their level, John was asked to write the English alphabet but he omitted the letters Tt, Uu and Xx (see Appendix A). He was also asked to write a short text about himself but he only wrote 4 simple sentences in which there are spelling and grammar mistakes (see Appendix A) even if he has been learning English at school since the age of 10.

6.3.1.2 Case 2 – Paul

Paul is a 20-year-old university student who was diagnosed with dyslexia at the age of 7 during his second year in primary school. Based on his official assessment, we notice that Paul's IQ is above the average compared to the children of the same age, although his reading ability is rather weak. This fact is compliant with researches which testify that children with dyslexia have lower reading levels than would be predicted by their IQ scores, because slow reading is biologically determined thus irrelevant of dyslexic individuals' IQ (Das, Mishra & Kirby, 1994, Elbeheri & Everatt, 2009, Ferrer, Shaywitz, Holahan, Marchione, & Shaywitz, 2010, Siegel, 1992). Moreover, he showed great difficulty in both long and short term memory as well as in phonology fact that influenced his writing and reading skills. Consequently, he was suggested to attend a special intervention program in order to improve phonological awareness. Paul was

assessed five more times till the age of 17. During all these years he went through numerous special education intervention programs which improved his reading comprehension skills as well as his oral ones. During his last assessment, Paul's WISC IQ test falls within the above average scale compared to his peers but he still faces difficulties in writing, reading texts and reading pseudowords even if the Greek language is considered to be a transparent one (Andreou and Baseki, 2012, Kotoulas, 2004, Reid et al., 2008, Seymour et al., 2003) fact that usually facilitates decoding unknown words. Another finding which was pointed out during the assessment and it is worth mentioning is that Paul shows frustration and signs of anxiety when he fails, fact that often happens to people with dyslexia (Dekker, 2015, Carroll & Iles, 2006, Ryan, 2004, Tanner, 2009) and it should be taken into consideration during this study. During the "ILD" assessment, Paul didn't manage to write all the letters of the alphabet in the correct order and he even omitted the letters Rr, Ss, Tt, Uu (see Appendix A) even if he has been learning English for 7 years. The text he chose to write was very short and simple with some spelling mistakes (see Appendix A), fact that proves the low level of the language development.

6.3.1.3 Case 3 - George

George is a 15-year-old high school student who was diagnosed with mild dyslexia and Attention Deficit Hyperactivity Disorder[31] (ADHD) at the age of 10. During his official assessment he showed difficulty in focusing on the activities and in being organized. He was also very impulsive and quite hyperactive. George's WISC IQ test fell within the average scale compared to his peers but he had difficulty in writing and spelling. Another finding that should be mentioned is that he showed signs of emotional

[31] https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd/index.shtml

difficulties, performance anxiety and low self-esteem which is often caused by the existence of dyslexia (Dekker, 2015, Green, 2014, Humphrey & Mullins, 2002, Ridsdale, 2004). After the official assessment, it was suggested that George should be orally assessed at school and that teachers should encourage him so as to boost his self-confidence. During the "ILD" assessment, George was asked to write the English alphabet but he didn't manage to write it in the correct order and he omitted the letters E, Hh, R, u, Vv (see Appendix A). During the assessment, he mentioned that he likes the film "Lion king" so he was asked to write why. He only wrote a sentence which has spelling and grammar mistakes (see Appendix A) even if he has been learning English at school for 5 years and has been attending simultaneously private lessons at home for 3 years.

6.3.1.4 Case 4 - Anna

Anna is 32 years old and works as a nurse and at the same time she is studying to become an ergotherapist.. Although she had severe reading and writing problems in primary school, she hadn't been diagnosed with dyslexia and ADHD until the age of 16 before attending the senior year of secondary school. Studying Anna's official assessment, we notice that even if she is an adult, she has great difficulty in reading. This proves that she has yet to automatize the grapheme – phoneme correspondence even though it is considered relatively easy in the Greek language due to its transparency. Difficulties in writing and spelling are also mentioned. It was suggested that she should attend a special education intervention program for improving her reading skills and that she should be assessed orally at school. During the "ILD" assessment, Anna was asked to write the alphabet and a short text of her preference. She didn't succeed to write the alphabet in the correct order and she omitted the letters Hh, Ii, Rr, Ss, Uu, Vv and Yy (see Appendix A). The text was quite long but there were also

plenty of spelling, grammar and syntax mistakes even if she studied English from the age of 8 until she graduated from school.

6.4 Evaluative Criteria

One of the most significant parts of a research is the assessment of its quality. The criteria on which a researcher has to base his evaluation are reliability, replication, and validity (Bryman, 2012). As reported by Bryman (2012), "reliability is concerned with the question of whether the results of a study are repeatable". He also states that "the idea of reliability is very close to another criterion of research — replication and more especially replicability since sometimes researchers choose to replicate the findings of others". The most important criterion according to Bryman (2012) is that of validity which "is concerned with the integrity of the conclusions that are generated from a piece of research". Similar to this definition is that validity is "the development of sound evidence to demonstrate that the test interpretation (of scores about the concept or construct that the test is assumed to measure) matches its proposed use (AERA, APA, NCME, 1999).

6.4.1 Validity in Quantitative research methods

Since validity evaluates whether the means of measurement are accurate and whether they are actually measuring what they are intended to measure (Winter, 2000), validity has traditionally been attached to quantitative research methods which mainly deal with numbers and anything that is measurable (Bryman,2012, Johnson, 1997). In Shadish, Cook & Campbell (2002), research validity is classified in four major types: a) statistical conclusion validity (the appropriate use of statistics), b) construct validity (the validity of inferences about the constructs (or variables) in the study), c) internal validity, which refers to the validity of inferences drawn about the cause and effect relationship between the independent and dependent variables and d) external validity,

which refers to the validity of the cause-and-effect relationship being generalizable to other persons, settings, treatment variables, and measures.

6.4.2 Validity in Qualitative research methods

Validity does not carry the same connotations in qualitative research as it does in the quantitative one (Creswell, 2014). Qualitative research is often criticized since it is difficult for the researcher to ensure its quality and robustness (Leung, 2015). It has also been characterized as too subjective as findings rely too much on the researcher's views about what is significant and important, therefore, there is a threat of researcher bias which may influence the quality of data interpretation (Bryman, 2012, Johnson & Christensen, 2014). Consequently, it is of major importance for researchers that validity criteria should be established in order for the qualitative research to be plausible, credible, trustworthy and therefore defensible (Johnson, 1997, Whittemore, Chase & Mandle, 2001).

However, the term "validity" is not applied by qualitative researchers, instead they have often generated or adopted what they consider to be more appropriate terms (Golafshanin, 2003). Lincoln and Guba (1985) propose trustworthiness as a criterion of how good a qualitative study is. Each aspect of trustworthiness has parallel with the quantitative research criteria: a) credibility, which parallels internal validity, thus, it refers to the confidence in the 'truth' of the findings, b) transferability, which parallels external validity showing that the findings have applicability in other contexts, c) dependability, which parallels reliability and means the findings are consistent and could be repeated, d) confirmability, which parallels objectivity, so it refers to the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest.

6.4.3 Validity in Mixed methods research

Mixed methods research has developed into the third methodological movement in educational research and has recently risen to prominence (Bryman, 2006, Onwuegbuzie & Collins, 2007, Zohrabi, 2013), consequently discussions about validity issues are still in relative infancy (Log, 2017, Onwuegbuzie & Johnson, 2006). As mentioned above, the term "validity" is not accepted by both the quantitative and qualitative researchers. In this respect, Onwuegbuzie & Johnson (2006) suggest that the possible term that might be acceptable to both of them is "legitimation" because this solution also involves what Tashakkori and Teddlie (2003) refer to as "using a bilingual nomenclature" (p. 12) for both approaches.

Besides the need for finding a suitable term accepted by both quantitative and qualitative investigators, the quality criteria that the researchers have to follow have yet to be clearly established. Even if Tashakkori and Teddlie (2003) have proposed criteria that are based on the notion of inference quality, which is meant to include both the traditional notion of internal validity and the notion of trustworthiness, it only captures portions of the kinds of criteria that have come to be associated with either method (Bryman, 2006). According to Bryman (2006) it is suggested that the considering quality issues should be influenced by the nature and goals of the investigation rather than adopting one approach to assessing the quality of all mixed-methods research. In this concept, he suggests that the following criteria should be used in mixed-methods research:

a) Convergent criteria — use the same criteria for both the quantitative and the qualitative components of the research.

b) Separate criteria — use separate criteria for the quantitative and qualitative components.

c) Bespoke criteria — devise new criteria specifically for mixed-methods research.

Taking into consideration the aforementioned quality criteria and in order to ensure legitimation, which means obtaining findings and/or making inferences that are credible, trustworthy, dependable, transferable, and/or confirmable (Onwuegbuzie & Collins, 2007), I chose the trustworthiness criteria. Since the present study is qualitative dominant and the quantitative research is used to collect background data whose amount are minimal, criteria associated with interpretivist or constructionist ideas, such as trustworthiness, are considered more appropriate than either separate or bespoke criteria (Bryman, 2006).

6.4.4 Validating the accuracy of the findings in Qualitative research

One of the major challenges faced by the researcher, especially in qualitative research, is the process of ensuring that the findings and interpretations are accurate and credible. In order to validate the findings, the researcher should follow specific strategies which strengthen trustworthiness. The primary forms typically used by qualitative researchers are (Creswell, 2012, Guba & Lincoln, 1985, 1994, Merriam, 1988):

a) triangulation - the process of corroborating evidence from different individuals, types of data or methods of data collection,

b) peer / colleague debriefing / examination – the process in which peers or colleagues are asked to examine the data and the plausibility of the findings,

c) prolonged engagement – collecting data over a long period of time to ensure an in-depth understanding of the phenomenon,

d) member checks - the process in which one or more participants are asked to check the accuracy of the themes and of the interpretations.

All the aforementioned strategies contribute to the validation of the findings but the predominant one as Denzin (1970) mentions is triangulation because it gives the researcher the opportunity to increase the validity, strength, and interpretative potential of a study, it decreases the investigator's biases, and it provides multiple perspectives. When interpretations are built upon triangulation, they are certain to be stronger than those of a single method because as Hammersley (2008) mentions by drawing data from sources that have very different potential threats to validity it is possible to reduce the chances of reaching false conclusions.

6.4.4.1 Validating the findings in the present study

In order to validate the findings and ensure the trustworthiness of the present study, I followed the above mentioned strategies. First of all, I employed three types of triangulation, which is also referred as multiple triangulation (Denzin, 1970). The first type is that of data triangulation which involves time, space, and persons (Denzin, 1970, Kimchi, Polivka, & Stevenson, 1991). The data presented in the study include both past (KEDDY[32]-Differential Diagnosis, Diagnosis and Support for Special Educational Needs Centres) and current assessments (ILD, post-pre intervention) which were conducted in different places (KEDDY, ILD) and by different people (KEDDY specialists, Mrs. Pappa, 4 teachers). Data triangulation was also obtained through the use of different data sources: past official assessments, ILD assessment, teachers' field notes the pre- and post-intervention students' assessments scores and post-intervention students' interviews. The next type is the investigator triangulation, which involves the

[32] «Κέντρο Διαφοροδιάγνωσης, Διάγνωσης και Υποστήριξης»

use of more than one observer or interviewer which is also the case for the current study. Finally, I employed the methodological across-method triangulation by using both qualitative and quantitative data collection methods in the study (Denzin, n. d., 1970, Kimchi, et al., 1991).

Besides triangulation, colleague examination was employed, as the data, the findings and interpretations were given to 4 EFL / special education teachers so as to examine them and ensure plausibility. The interpretations of the interviews were also checked by the participants of the study, so member check was also applied. Using three out of the four strategies for ensuring trustworthiness, the findings of the present study can be considered as accurate and credible.

6.5 Data collection

A case study database may include interview transcripts, investigator notes or documentary evidence which allows the investigators to go from data collection through analysis to final conclusions and at the same time enhance the reliability of the study (Baškarada, 2013, Merriam, 2002). In the present study, multiple sources of evidence have been collected in order to ensure validity and triangulation. To begin with, we had access to the cases' official assessments, whose copies are kept in the students' personal file in ILD and are carried by a professional assessor or a psychologist in KEDDY, who are specialists in assessing learning disabilities, and are officially approved and licensed by the Ministry of Education in Greece. The fact that the efficiency of one's native language skills plays such an important role in the FL proficiency development makes it a prerequisite to take into consideration the assessments made in the Greek language. The specific data describe each sample's difficulties in detail so it is easier to speculate potential difficulties in the FL as well.

The second kind of data collected is a non-official assessment which takes place on the students' arrival in "I love dyslexia" EFL School. Since most of them have already attended English courses, they are asked to write down the alphabet and a short text (see Appendix A) so that we are able to understand their level as well as if there is any discrepancy taking into account the years they have been studying the English language. For the present study this assessment is only used as a proof that the traditional methods of teaching English are not so efficient since the students' level does not correspond to the knowledge they should have acquired after so many years of studying the language.

In order to create an informal reading assessment, we reviewed some standardized tests such as the DIBELS[33] (Dynamic Indicators of Basic Early Literacy Skills), the Woodcock-Johnson III, Diagnostic Reading Battery[34] and the TOWRE-2[35] (Test Of Word Reading Efficiency). In all three of them the students are given the task of both real word identification and pseudowords so that their understanding of the alphabetic principle and basic phonics can be tested. Besides these tests, we also reviewed the TIWRE[36] (Test of Irregular Word Reading Efficiency), IWT[37] (Irregular Words Test) and the SIPPS[38] (Systematic Instruction in Phoneme Awareness, Phonics and Sight Words) assessments as we wanted to test the level of acquisition of irregular words, which cannot be read through decoding since some or all of the letters do not represent their most commonly used sound and need to be identified by sight or automatically, for example *light, yacht, child, photo, fought,* etc. (Milne, 2005, Vaughn & Linan-Thompson, 2004). In the present study none of the above mentioned standardized tests

[33] https://dibels.uoregon.edu/market/assessment/dibels
[34] http://iapsych.com/wj3ewok/LinkedDocuments/Buros%20DS%20review%20copy.pdf
[35] https://sites.ualberta.ca/~lphillip/documents/Introduction%20to%20the%20Test%20Reviews.pdf
[36] http://www4.parinc.com/Products/Product.aspx?ProductID=TIWRE
[37] http://www.sd5.k12.mt.us/userfiles/-12/My%20Files/Curriculum%20and%20Instruction%20-%20English%20Language%20Arts%20Common%20Core%20Standards/THIRD%20GRADE/Irregular%20Words%20Test.pdf?id=949
[38] https://www.collaborativeclassroom.org/sipps

were used as a whole but some of the parts were the guide for the creation of the researcher's informal assessment since we would like it to be based on words whose sounds are related to the rules taught during the intervention program (see Chapter 6.4). Before starting the phonological awareness intervention program, we ask the students to read 45 pseudowords such as *wub, thome, zight, plute, dall, waith* which include most of the phonemic rules, as mentioned in Chapter 6.4, 20 English words like *cellphone, threw, light, amuse, vote* and 8 sentences comprising irregular words (in bold) for example ***The*** *small brown bears* ***are*** *under* ***the*** *tree* or ***The*** *clown is wearing a* ***white*** *blouse*, so that words can be read in context (see Appendix B). The same test is given to the students after the end of the program so that we can measure if there is any improvement compared to the first assessment.

Another kind of data that we collected are field notes[39] (see Appendix C). It is important to record events and cases' behaviors so that useful conclusions can be drawn. Each and every one of the four researchers kept jotted notes (also called scratch notes) — very brief notes written down on pieces of paper (Bryman, 2012) which were later used for creating each case's academic profile.

Finally, as in most qualitative researches, the cases were interviewed. The interview is a widely used method because it is considered flexible. The interviewer can lead the interview towards the direction needed and perhaps adjust the emphasis on the research as a result of significant issues that emerge in the course of interviews (Bryman, 2012, Merriam, 2002). For the present study the semi-structured interview was chosen as the most suitable one, since the research has clear focus. More than one person is

[39] "Field notes select and emphasize certain features of what one sees and hears, ignoring others. They are the data that preserve the insights and understandings of fieldworkers forthcoming from their close and long-time encounter with that which they seek to understand" (Schwandt, 2015, p. 117)

to carry out the interviews and the multiple-case study research needs some structure in order to ensure cross-case comparability (Bryman, 2012). Semi-structured interviews are organized around a set of predetermined open-ended questions but questions that are not included in the guide may be asked as well, as the interviewer focuses on things said by the interviewees (Bryman, 2012, DiCicco-Bloom & Crabtree, 2006, Edwards & Holland, 2013). Consequently, all the questions will be asked using a similar wording from interviewee to interviewee and the open-endedness of the questions will allow the participants to fully express their viewpoints and experiences contributing valuable, detailed information (Bryman, 2012, Edwards & Holland, 2013, Turner, 2010).

After the end of the intervention program carried out for the present study, we conducted an interview (see Appendix D) with each one of the students. The participants were interviewed face to face, in their classrooms, between mid-September 2016 and late November 2016 because not all of them started the intervention προγραμ at the same time. The interviews lasted from 15 – 25 minutes and with the cases' approval, the four teachers, one for each case, audio recorded them so as to ensure accurate transcription (Merriam, 1998) and kept notes that they consider being of particular importance.

The first questions (1-4) were not only demographic but their aim was to provide information on the participants' background related to dyslexia. The next ones (5-11) focused on the participants' previous experiences and difficulties while learning English and their perceptions on the efficiency of the teaching methods. The aim of the last questions (12-16) was to obtain the cases' opinions about the method used in "ILD" and to what extent and in which way it helped them improve their skills compared to the way they used to be taught the English language.

The transcription process began in early December 2016 after the completion of all the interviews. Before translating the transcripts, I presented them to the participants for a review so as to ensure accuracy. After translating the transcripts and the additional notes, I had them reviewed by the other three interview teachers who are also English teachers and they can give rigorous feedback so as to ensure transcript accuracy.

6.6 "ILD" teaching program / intervention.

Before presenting the program, it should be noted that even if we call it an intervention program for the needs of the current study, everything that is presented is part of the "ILD" teaching method and is applied to all the students attending the lessons in the "ILD" organization. For the present study the program lasted for 3 months for each student and the one-hour lessons were taught individually in one-to-one teacher–student environment. Four specialized EFL teachers, who have a Master's degree at Special Education, took part in the current study which took place in the "ILD" organization. One of the aims of the "ILD" method is to make sure that all students, even those who have already been taught English, can read accurately and in time fluently. All students should acquire good awareness of the sounds of speech, understand the connection between graphemes and phonemes and learn how to analyze words into sounds.

During the first lessons, the letters of the alphabet are taught and the students learn that each letter has a name and a sound, which can be presented as the letter's formal and short name, respectively. Each letter is represented with a picture which helps into the memorization of the letter formation and the letter sound. The initial sound of the word of the picture is the letter sound (short name). The letter (formal) name can be learnt by using the ABC song. For example, for the letter -*a* an apple with a worm is used and a ladder (which is used to grab the apples from the tree) to represent the upper

case letter A, for the letter - *g* a girl with a long pony tail is used and for the upper case letter G the hand of a gorilla eating a banana (see Appendix E). After being taught the letters, the students practice the sounds using the online program www.starfall.com (see Appendix F). Technology is an integral part of the "ILD" method since many studies have shown that children with dyslexia who use computers to learn and practice phonology become more efficient at reading and spelling (Ecalle, Magnan, Bouchafa & Gombert, 2009, Fälth et al., 2013, Gonzalez et al., 2015, Kast, Baschera, Gross, Jäncke & Meyer, 2011, Saine et al., 2011, Torgesen, Wagner, Rashotte, Herron & Lindamood, 2010). Besides computers, the teacher also uses 3D letters to create words that the student has to read based on the sounds he/she learnt. Moreover, activities of identifying and differentiating the sounds, of blending and segmenting syllables and sounds as well as manipulating phonemes are implemented in order for the student to become aware of the grapheme-phoneme correspondences. At the beginning of each lesson, the students revise the letters that have already been taught. When new letters are added, the activities become more and more complicated by making possible combinations of all letters, so that the student can become familiar with the sounds of the letters.

When all the letters are taught, spelling rules are explicitly taught as well so that the students can acquire the sound-spelling mappings needed for reading accurately the inconsistent English words such as night, brown, found, prawn, child, throw etc.. In some of the rules, the terms digraph and diphthong are used so it is necessary that their definition be given. A digraph is two letters that spell one sound, while a diphthong is one vowel sound formed by the combination of two vowel sounds which is quite confusing especially when reading (Farrell, 2010). Thus, during the lessons the students learn the most essential spelling rules which are often encountered while reading, such

as the consonant-vowel-consonant (CVC-e) combination followed by the letter “e” (silent), which changes the vowel from a short vowel sound to a long vowel sound, the consonant digraphs (ch, sh, th), the vowel digraphs (ee, ea, ai, ay, oa), the diphthongs (ou, ow, ew, aw, au, all, ight –special pattern-), the r-controlled vowels (ir, ur, er) whose sound is no longer short but it is a new one, the hard and soft c / g sounds and finally the rule for the pronunciation of the letter -y which has both the long sound of the letter -i and the long sound of the letter -e depending on the syllables of the word.

In order for the students to remember all these rules, mnemonics based on pictures and little stories are used. For example, the sound / ʃ / is represented by the letter -s (snake) (Pict. 1) and the letter -h (horse) (Pict. 2) so when the snake visits the horse which is very noisy the snake says shhh / ʃ /.

Pict. 1. Flashcard representing visually the letter - s

Pict. 2. Flashcard representing visually the letter - h

Another example is that of the soft c sound. The letter -c in the “ILD” alphabet is represented by Celia the cat. When Celia is with her animal friends, the elephant (letter –e), the iguana (letter –i) and the yak (letter –y), they call her Celia (soft sound / s /) while the apple (letter –a), the orange (letter –o) and the umbrella (letter u) which do

not know her name just call her Cat (hard sound / k /). The rules are usually taught during the first half of the lesson. The remaining half hour is devoted to practicing on the computer and to performing reading activities which include decoding more complicated words. Furthermore, they are given both pseudo-words and regular words which they have to analyze into letters, sounds and syllables. For instance, they have to find how many letters, syllables and sounds the word *-chew-* has. In this way they realize that even if the word has 4 letters, there are only two sounds and 1 syllable. This activity is quite effective because the student is also able to improve his spelling skills since he becomes familiar with the fact that some pairs of letters make 1 sound but 2 letters must be written. The teacher also dictates words to the students in order to check their understanding of the sounds. After having taught most of the rules, the teacher also dictates short sentences so that the students can also understand the structure of the language.

When the students start feeling confident with reading, they are given simple, short sentences taken from English course books. Besides the books, they also use the website where they can find short texts. The site is very helpful for them since they can check the correct pronunciation of the words by clicking on them. They feel independent and they have the opportunity to practice at home on their own. While they are reading in context, they can develop fluency and make connections between words and meanings which will facilitate reading comprehension in the future.

Data presentation

7.1 Analysis

In order to analyze the results of the present study, we took into consideration the five different kinds of data that we collected: the official assessment, the "ILD" first

informal assessment, the pre and post intervention reading assessment, the teachers' notes and finally the cases' interviews.

The errors for the analysis of the main reading assessment are classified into two main categories and their subcomponents. As reading comprises two major processes that of the visual decoding of the message presented in a written form, and the one of the orthographic (word form) analyses (Lachmann & Geyer, 2003), we distinguish errors due to visual processing difficulties and phonological deficits.

7.1.1 Visual decoding errors

Orton identified three groups of typical mistakes done by students with reading problems (as cited in Lachmann & Geyer, 2003, p. 55):

- Disabled readers show a significant difficulty in differentiating letters which are horizontally or vertically symmetrical to each other or rotated (p and q; band d; p and d). These errors were called "static reversals".
- Disabled readers tend to confuse palindromic words (*was* and *saw*; *not* and *ton*) and to read partially from right to left resulting in a reverse of paired letters or even syllables within a word. These errors were called "kinetic reversal".
- These students also demonstrate remarkable capability for mirror reading and writing, sometimes better than for reading in normal orientation.

According to the above mentioned groups and by taking into consideration the typical mistakes of students with dyslexia like: omitting or adding phonemes or syllables,

making substitutions of phonemes or whole words[40] (Frank, 2014, Lock, Last & Dunea, 2001), the visual processing error analysis of the present study is divided into: a) inversions (left-right confusion over symmetric letters (b-d, p-q, n-u, g-q) and ordering of letters (snail-nails) (Capellini & Ciasca 2007, Khera, 2015, Nieto, 2004), b) omissions, c) additions, d) substitutions.

7.1.2 Phonological and spelling decoding errors

The second category includes errors stemming from phonological decoding and spelling rules which are explicitly taught during the intervention program. The phonological and orthographic decoding errors are divided into: a) the alphabetic principle (grapheme to phoneme correspondence – CVC words), b) CVC-e (silent e rule), c) CCV syllables which are called onset clusters, d) consonant digraphs (ch, sh, th, qu), e) vowel digraphs (ee, ea, ai, ay, oa), f) diphthongs (ou, ow, ew, aw, au, all, ight –special pattern-), g) r-controlled vowels (ir, ur, er), h) hard and soft c / g sounds.

7.2 Pre-intervention results

7.2.1 John

According to his teacher's notes, John's reading ability is satisfactory but he needs a lot of practice when it comes to spelling. His deficit in spelling is also confirmed by the results of the pre-intervention assessment. Figure 1 below shows

[40] http://www.dyslexia-international.org/eCampus/ONL/EN/Course/S2-3-2.htm

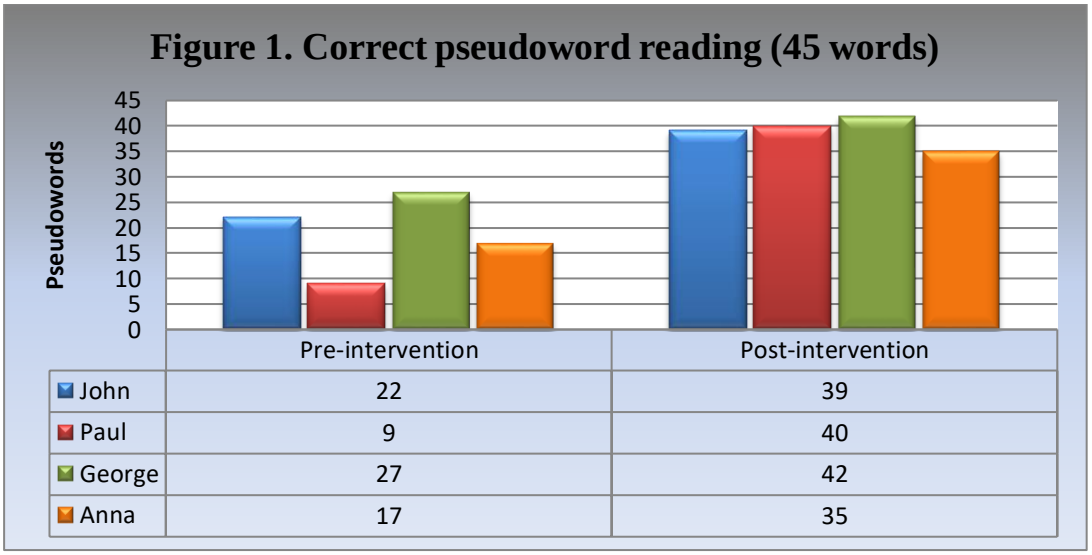


Figure 1. Cases' correct answers while reading the 45 pseudowords pre and post intervention.

That John read correctly 22/45 pseudowords and 9/20 regular words and his errors are mainly due to phonological and orthographic decoding deficit (Tables 3, 4, 5, 6 see Appendix H).

Table 3 - Phonological and spelling decoding errors

Case 1 – John / Diphthong errors

Pseudowords	Correct pronunciation	John's reading
bown (pre/post int.)	/baʊn/	/bəʊn/
trawn (pre-post int.)	/trɔːn/	/traʊn/
jound (pre/post int.)	/jaʊnd/	/jɒnd/
mauto	/mɔːtəʊ/	/maʊtəʊ/
goom	/guːm/	/gʌm/
zight	/zaɪt/	/zɪhθ/
Regular words		
author (pre/post int.)	/ˈɔːθə(r)/	/ʌθə(r)/
prawn (pre/post int.)	/prɔːn/	/praʊn/
blouse (in sentence)	/blaʊz/	/blʊz/

As shown in Table 3 John, apart from the diphthong –ew that was correctly read in the pseudoword *newt*, didn't manage to read any of the words which included a diphthong correctly. However, words that were similar to the pseudowords but they were familiar to him such as *light, loud, shadow, yellow, cloudy, clown*, were pronounced correctly, fact that shows that either he can apply grapheme–phoneme correspondence by analogy (Goswami, 2008) or by using the direct access route without decoding them (Milne, 2005). It is also worth mentioning that the words *brown, yellow, cloudy* and *clown* were read in context which is easier for children to decode than as a single isolated word (Das, 2009). Another type of orthographic mistakes that John made is that of the vowel and consonant digraphs. As one can notice in Table 4 the digraph *–ch* is pronounced incorrectly in pseudowords while John reads correctly the words *children, much* and *teacher* when they are part of a full sentence (see Appendix B). The findings in Table 5 below suggest that John has yet to automatize the silent *–e* rule especially with the long sound of the letter *–u.* None of these words was correctly read even if they were regular and simple ones. Nevertheless, while reading the rest of the words *glite, thome, slape, quate, cellphone, quite, vote, like, ice, white* following this rule, John didn't make any errors.

Table 5 - Phonological and spelling decoding errors
Case 1 – John

Alphabetic principle Pseudowords		
gux	/gʌks/	/gʊks/
yib (pre/post int.)	/jɪb/	/waɪb/
wax (pre/post int.)	/wæks/	/wɒks/

Silent -e		
Pseudowords	Correct Pronunciation	John's reading
plute	/pljuːt/	/plʌt/
Regular words		
amuse (pre/post int.)	/əˈmjuːz/	/əˈmaʊz/
huge (in sentence-pre/post int.)	/hjuːdʒ/	/hʌg/
Pete (in sentence)	/piːt/	/pet/

According to the findings figured in Tables 3 and 5, it can be assumed that John has difficulty in reading the long sound of the vowel digraphs and he hasn't distinguished the soft and hard sound of the letters *-c* and *-g* even when reading regular words in context for example garage /ˈ*gæraːʒ*/ read as /ˈgereg/. Consequently, John's decoding ability is quite weak when it comes to unknown words but his reading improves when he can use the direct access path for words that he has visually memorized (Milne, 2005). What should also be noted is that John also made some visual decoding errors especially inversion of the letters *–b* and *–d*. The eight sentences (see Appendix B) which included 15 irregular words were correctly read (Figure 5, see Appendix G) apart from the words *huge* and *blouse* which need orthographic decoding. The word *blouse* was read */blʊz/* which implies cross-linguistic transfer since the diphthong -ou also exists in the Greek language and it is pronounced /ʊ/. Finally, John's reading is of average speed and he doesn't hesitate while reading fact that makes his reading quite fluent[41].

[41] «Fluent readers can read text with speed, accuracy, and proper expression." (National Reading Panel. Reports of the subgroups, 2000, p. 3-1)

7.2.2 Paul

The data collected for Paul were quite informative because he provided us with all his official assessments which were very detailed. Dyslexia in his native language was severe and although he attended special education intervention programs through the years, he hadn't managed to overcome efficiently some of his difficulties, even though his IQ score is still above average. He also shows great anxiety fact that has also been noted by his teacher and should be taken into consideration while analyzing his reading assessment since he was quite stressed:

> *"Paul shows a lot of anxiety when he has to express himself orally. I think that this happens because he has the fear of making mistakes."* (see Appendix C).

One of the most striking findings about Paul is that he made a big number of visual decoding errors (Table 2) most of which (11) were inversions of letters (Table 8, see Appendix H) fact that may reflect the lack of left- to-right orientation (Reid, 2011) or may also indicate some visual processing or spatial difficulties which lead to confusion and reversal of symmetric letters or close forms of letters (Capellini & Ciasca, 2007, Frank, 2014, Nieto, 2004, Reid, 2011).

Table 7.
Cases' classification of errors

Names	Visual (only) Pre-int	Visual (only) Post-int.	Phonolo-gical Pre-int.	Phonolo-gical Post-int.	Both phonological and visual / Pre-int.	Both phonological and visual / Post-int.	Refusals (not read) Pre-int.	Refusals (not read) Post-int.
John	5	0	25	11	3	0	0	0
Paul	15	1	17	6	10	0	3	1
George	3	0	15	3	4	0	1	0
Anna	3	0	25	12	5	1	2	0

Table 7. Classification of cases' errors while reading pseudowords and regular words.

As shown in Table 7 and in Figures 1 (see above) and 3 (see Appendix G), Paul's phonological deficit is quite severe which is also the case in his native language as previously stated. He was able to read only 9/45 pseudowords and 9/20 irregular words which proves that he has difficulty in decoding the words using the phonological path.

Turning now to the error analysis, it should be noted that apart from decoding simple CVC words and already learnt words (direct access route), Paul didn't manage to read many of the words which needed the use of spelling rules to decode them. A surprising finding is that even though Paul has been learning English for 7 years, he hasn't completely acquired the alphabetic principle since he mispronounces the letter – *u* (Table 10 see Appendix H) which he also omitted during the "ILD" informal assessment (see Appendix A) when he was asked to write the alphabet. As shown in Tables 9 (see Appendix H) and 11 below, Paul's knowledge of vowel diphthong and digraph sounds is quite poor since most of the words are mispronounced, while he made no mistakes when it comes to consonant digraphs. That means that he has automatized specific rules. Another interesting finding is that most of the mispronounced words were those based on the silent -e rule (Table 11).

Table 11 - Phonological and spelling decoding errors
Case 2 – Paul

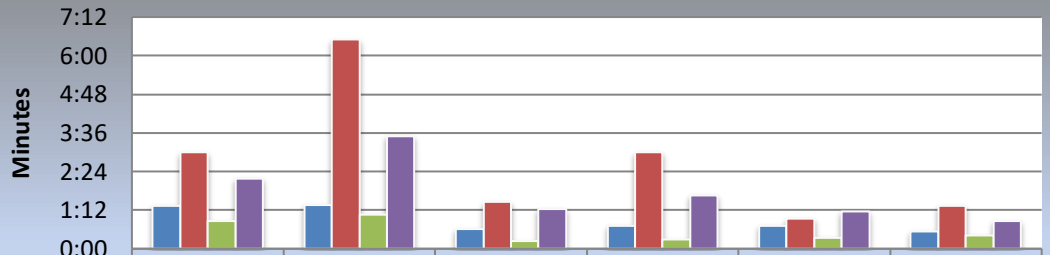
Vowel digraphs		
Pseudowords	Correct Pronunciation	Paul's reading
brean	/briːn/	/brɪed/
shoam	/ʃəʊm/	/ʃɒm/
waith	/weɪθ/	/wɪθ/
Regular words		
peanut	/ˈpiːˌnʌt/	/pɪnʊt/

Silent e		
Pseudowords		
glite	/ɡlaɪt/	/ɡlɪt/
shike	/ʃaɪk/	/ʃɪk/
quate (pre/post int.)	/kweɪt/	/kwʌt/
frane	/freɪn/	/fraɪn/
slape	/sleɪp/	/slʌd/
plute (pre/post int.)	/pljuːt/	/plʌt/
skay	/skeɪ/	/skaɪ/
thome	/θəʊm/	/θɒm/
Regular words		
vote	/vəʊt/	/vɒlte/
amuse	not read	not read
huge (in sentence)	/hjuːdʒ/	/hʊg/
Pete (in sentence)	/piːt/	/pet/

Words are easily read when in context, but Paul didn't manage to decode correctly simple and familiar words such as *huge* and *Pete* even if they were included in a sentence like *This garage is huge*, *These two pets belong to Pete*. Another finding that should be mentioned is that two of Paul's errors are due to language transfer. The letter –x is pronounced /h/ in Greek and the diphthong –ou is pronounced /ʊ/. However, he was able to read correctly the 15 irregular words included in the eight sentences (see Appendix B), even if one cannot rely on the phonological path to read them but automatization is needed.

A result that should also be reported is Paul's reading speed. In Figure 6 below one can notice that compared to the other participants, he needed the most time to complete the assessment.

Figure 6. Pre and Post Intervention Reading time



	45 Pseudowords Pre-Int.	45 Pseudowords Post-Int.	20 Regular words Pre-Int.	20 Regular words Post-Int.	Sentences (42 words) Pre-Int.	Sentences (42 words) Post-Int.
John	1:20	1:21	0:36	0:42	0:42	0:32
Paul	3:00	6:30	1:28	3:00	0:56	1:20
George	0:52	1:04	0:15	0:17	0:21	0:25
Anna	2:10	3:30	1:14	1:40	1:10	0:51

Figure 6. Cases' reading time before and after the intervention program.

Besides his decoding difficulties, this finding confirms the fact that Paul gets really anxious while reading. During the assessment, he hesitated a lot and it took him a lot of time to decode words that he wasn't sure of. His fear of making mistakes as stated in his teacher's notes (see Appendix C) combined with his being stressed prevented him from reading more quickly, hence more fluently.

7.2.3 George

When George was asked what his main difficulties are when it comes to learning the English language he said:

"I basically had difficulty while speaking or writing English and when I had to understand a text."(Appendix D)

His weakness in writing is obvious when we look at the short text he wrote during the "ILD" informal assessment (Appendix A) since there are syntactic and spelling mistakes *"becaues he is very fanny movie"* even if he has studied English for 5 years. However, his reading ability is the best compared to the other participants as he read correctly 60% of the pseudowords and 75% of the regular words (Figure 2, 4, Appendix G). George's errors mainly show lack of automaticity for diphthong and consonant digraph sounds as shown in Tables 13, 14, below which is also stated during his interview:

> *"What I didn't know very well was the digraphs and diphthongs."*(Appendix C)

Table 14 - Phonological and spelling decoding errors

Case 3 – George / Vowel and consonant digraphs errors

Consonant digraphs Pseudowords	Pronunciation	George's reading
chud	/ʧʌd/	/sʌd/
chon	/ʧɒn/	/sɒn/
quate (pre/post int.)	/kweɪt/	/kjuːt/
quemp	/kwemp/	/kemp/
shoam	/ʃəʊm/	/ʃɒm/
Regular words		

quite	/kwaɪt/	/kjuːt/

A finding that should also be mentioned is that although George mispronounced the *–ch* sound in pseudowords, he read correctly the words *children, much* and *teacher* which are part of sentences and familiar to the student who used the direct access route and the help of the context to decode them. George also seems to be unfamiliar with the *–qu* digraph sound as it is mispronounced in both pseudoword and regular word reading. Moreover, he shows a partial deficit for the silent *–e* rule especially with the *–u* sound (Table 15 below) while the words *slape, frane, shike, glite, thome, vote* were correctly pronounced.

Table 15 - Phonological and spelling decoding errors

Case 3 – George

<u>Alphabetic principle</u>		
<u>Pseudowords</u>	<u>Correct Pronunciation</u>	<u>George's reading</u>
yib	/jɪb/	/waɪb/
jound	/jaʊnd/	/zaʊnd/
<u>Regular words</u>		
wax	/wæks/	/wɒks/
<u>Silent –e</u>		
<u>Pseudowords</u>		
plute	/pljuːt/	/plʊt/
<u>Regular words</u>		
amuse	/əˈmjuːz/	/əˈmaʊz/

What should also be noted is that, as George's teacher mentions, he has difficulty in focusing so some of the errors might be a result of his lack of focus:

> *"Because of ADHD it is difficult for George to stay focused for long time periods and he often reacts impatiently, especially when he faces language problems because of his dyslexia"* (see Appendix C)

Another important outcome that shows that George's reading ability is not so deficient is his reading speed which is quite fast (Figure 6), since he read the 45 pseudowords in less than a minute and the 8 sentences (correctly) - in only 21 seconds, which makes George a fluent reader.

7.2.4 Anna

Anna seems to feel uncomfortable when reading because it is very challenging for her as she and her teacher have reported:

> *"I couldn't read correctly but I could speak better especially when I wasn't stressed."*

> *"Anna was very negative about reading; she found it hard to concentrate and gave up very easily"* (see also Appendix D).

Her difficulty is also confirmed by the findings during the pre-intervention assessment. She managed to read correctly only 13/45 (Figure 1, Appendix G) pseudowords while her results were better for regular words as 65% of them were correctly read (Figure 4)

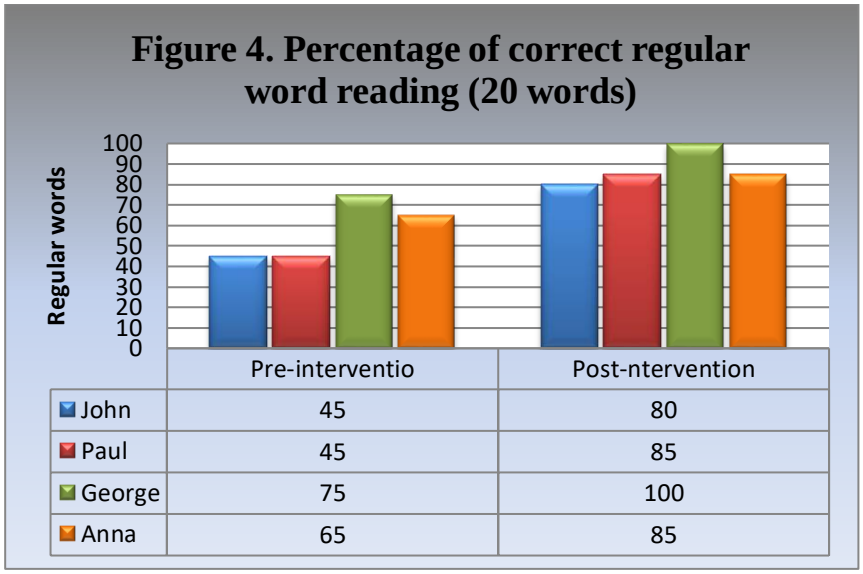


Figure 4. Cases' percentages of reading correctly regular words pre and post intervention.

The findings show that Anna has deficit in most of the phonological and spelling rules especially when it comes to decoding diphthongs, vowel digraphs and the long vowels due to the silent *–e* rule (Tables 17, 18, Appendix H).

Table 17 - Phonological and spelling decoding errors

Case 4 - Anna / Diphthong errors

Pseudowords	Correct pronunciation	Anna's reading
Bown (pre/post)	/baʊn/	/bɒwn/
Trawn (pre/post)	/trɔːn/	/trʌʊwn/
jound	/jaʊnd/	/ jʊd/
mauto (pre/post int.)	/mɔːtəʊ/	/maʊtəʊ/
dall (pre/post int.)	/dɔːl/	/dʌl/
goom	/guːm/	/guɒm/

zight	/zaɪt/	/zigt/
Regular words		
prawn (pre/post int.)	/prɔːn/	/praʊn/
blouse (in sentence)	/blaʊz/	/blʊz/
cloudy (in sentence)	/ˈklaʊdi/	/ˈklʊdi/

Table 18 - Phonological and spelling decoding errors
Case 4 – Anna

Vowel digraphs		
Pseudowords	Correct Pronunciation	Anna's reading
brean	/briːn/	/brɪʌn/
shoam	/ʃəʊm/	/ʃɒm/
waith	/weɪθ/	/weθ/
skay (pre/post int.)	/skeɪ/	/skaɪ/
Consonant digraphs		
Pseudowords		
chon	/ʧɒn/	/kɒn/
Silent e		
Pseudowords		
glite	/glaɪt/	/gɪltɪ/
quate (pre/post int.)	/kweɪt/	/kwaɪt/
frane	/freɪn/	/fraɪn/

slape	/sleɪp/	/slʌp/
plute (pre/post int.)	/pljuːt/	/plʊt/
<u>Regular words</u>		
quite	/kwaɪt/	/kwɪt/
amuse	/əˈmjuːz/	/əˈmʊz/
huge (in sentence)	/hjuːdʒ/	/hʊg/

As shown in the Tables 17, 18 when Anna had to read diphthongs or words including long vowels, she even made mistakes on familiar regular words. For example, the diphthong –ou in the words *blouse* and *cloudy* was pronounced /ʊ/. This error which was also made by two other students supports the effect of cross-linguistic transfer which should be taken into consideration when teaching a foreign language. Nevertheless, words based on the same rules but being a part of a sentence *small, brown, yellow, clown, white, like* (Appendix B) were correctly pronounced fact that proves that she mainly relied on the direct access route and on the context of the sentences which makes decoding easier. Similar findings can be observed for the words *bird, under, cream, children, much, teacher, garage* which were correct while the same sounds in pseudowords were mispronounced (Tables 18, 19).

Anna's reading speed was relatively slow (Figure 6) especially while reading the pseudowords that she read much faster than the regular words and the sentences since she can decode the phoneme-grapheme correspondences by analogy (Goswami, 2008).

7.3 Post-intervention results

7.3.1 John

After the intervention program, John's results greatly improved as he read 86,6% of the pseudowords and 80% of the regular words correctly (Figures 2, 4, see Appendix G). This means that he had 37,7% and 35% improvement respectively compared to the first assessment. Studying the errors which were repeated during the second assessment, John seems to need more time and practice in order to automatize the sounds of diphthongs and the silent *–e* rule which seem to be his main weaknesses (Table 5, see Appendix H). As we can see below in Figure 6, his reading speed was approximately the same in both assessments fact that shows that he did not need additional time in order to apply the rules and decode the words correctly.

After the end of the program and the assessment, John was interviewed so that his opinion about the intervention could be reported. During the interview (Appendix D), John said that visuals, mnemonics and technology helped him learn and memorize the rules more easily.

> *"Using pictures and the interactive board helped a lot. Classification of the rules with mind maps and mnemonics also helped me remember what I learn."*

Because of the fact that spelling rules are taught through pictures and little stories (mnemonics) and they are also revised in every lesson, John is able to remember what he learns. He also mentions that the explicit teaching of the letters' sounds improved his reading even when it comes to unknown words fact also confirmed by the results.

7.3.2 Paul

The most unexpected results were those of Paul's. Despite the fact that his percentages were very low during the first assessment (Figures 2, 4, see Appendix G), he managed to increase the correct answers by 89, 9 % (Figure 2) when reading the pseudowords and by 40% (Figure 4) when reading the regular words. This outcome proves how efficient and beneficial it is for students to learn the phoneme-grapheme correspondences so that they can easily decode even the unknown words. During his interview, Paul said :

> *"The lesson is adjusted to my needs and my pace of learning. I understood the structure of the English language, the letters and their sounds and the spelling rules which help me read."*(Appendix D)

His assessment results present his progress but it should also be mentioned that his reading speed was much slower than the first one since it took him double the time to read all the words (Figure 6). He needed three and a half more minutes to read the pseudowords which means that he tried to remember and apply the rules he learnt as neither automaticity nor fluency has yet been acquired. He was quite stressed and 7 of the 45 pseudowords were first mispronounced but then he self-corrected which shows that he knows the rule but he needs more time to access the required information. We shouldn't forget that the intervention program was in total only 12 hours of lessons thus the students didn't have the time to practice adequately in order to acquire fluency as well.

Another striking outcome is that Paul didn't make any visual decoding errors while in the first assessment this was his main weakness. This could be explained by the fact that during the second assessment he tried more to decode the words, therefore he paid

more attention to them and he didn't reverse them. However, it took him much longer to complete the task. When he was interviewed, he reported that:

> *"The examples with pictures helped me understand the structure of the language and now I can express myself orally much better than I used to. I can also understand what the others say without being stressed and I feel more confident."*
>
> *"Mnemonics and pictures are also very helpful because I can remember the rules more easily."*(see Appendix D)

Not only did Paul managed to learn more easily thanks to the different approach but he also achieved to get over his stress by gaining more self-confidence since he is now able to understand the language much better.

7.3.3 George

Although George's percentages of reading correctly the given words were quite high, he succeeded in making a progress as he reached a 93,3% and 100% pseudowords and regular words correct reading respectively. This means that he learnt and applied the rules that he didn't know. That is also confirmed by George himself when he answered to the question if he believes that learning the sounds of the letters and phonology/spelling rules helped him improve his reading skills:

> *"I already knew the letters so this didn't help me a lot. What I didn't know very well was the digraphs and diphthongs and the stories helped me remember them so that I can read better especially words that I don't know."* (Appendix D)

Along with John, George's reading speed had no difference during the second assessment (Figure 6, Appendix G) fact that proves that he is indeed more fluent than the other two participants whose reading time was almost double especially while reading the pseudowords. As already mentioned, pseudowords need decoding through the phonological and orthographic route. His opinion about the method is similar to the other participants' as he thinks that the way of teaching and the use of specific tools helped him overcome his difficulties (Appendix D).

7.3.4 Anna

When Anna was asked after the end of the intervention program if she had succeeded in overcoming some of her difficulties she replied:

> *"I improved my reading skills. I can read more correctly now. Because of the pictures and the stories I can remember the rules and now I know what I am reading."* (Appendix D)

and her teacher also reported that:

> *"…after some time dealing with the letters and their sounds …the progress was monumental, not only could she recognize the letters almost immediately but she could also remember their group sounds and made minor if any lexicalization errors… The progress impressed her as well because we often listened together the recordings I made of her in the beginning and after the intervention and she kept saying -" I can't believe that this is me in the first recording".*(Appendix C)

Consistent with the above mentioned statement, the findings in Figures 2 and 4 (Appendix G) confirm that Anna improved her reading ability by 40%

(pseudowords) and 20% (regular words). The errors, which were repeated during the post-intervention assessment, show that Anna has yet to automatize some of the diphthong sounds (Table 17, Appendix H) as well as the silent *–e* rule. Her reading speed was slower, as it took her an additional minute to read the pseudowords (Figure 6), finding similar to that of Paul's. The most likely explanation of this finding is that both of them have not automatized the phoneme-grapheme correspondence yet, therefore they try to decode the words by retrieving the rules from memory so as to apply them. This process is time-consuming for them so even if more correct answers are given more time is also required in order to read all the words. This is an expected outcome because fluency cannot be acquired in such a short period of time but it needs constant practice and repetition in order to achieve the anticipated results.

Discussion

8.1 Discussion of the findings

The results of the present study show that students with dyslexia can improve their accuracy in reading in English as a foreign language as long as teaching is based on both phonological and orthographic awareness while using mnemonics and technology so as to facilitate the students' memory weaknesses. When comparing all the cases' pre and post intervention reading results there is strong evidence that, even if it was only a 12-hour intervention, the participants' reading skills improved and their errors were significantly reduced. According to the results, it is obvious that the students have not acquired neither phonological nor orthographic awareness, after so many years of studying English since most of the errors were made while reading the pseudowords. Due to phonological and short-term deficiencies, these words cannot be read via the

non-lexical route which involves making use of rules relating segments of orthography to segments of phonology (Coltheart, 2005). However, regular and irregular words were read more correctly since the students could rely on the lexical route which involves accessing a representation in the orthographic lexicon that contains knowledge about the spellings and pronunciations of letter strings that are real words (Coltheart, 2005).

Another proof for the students' difficulty when reading is what they stated during the interview:

> John: "*I had difficulty in spelling"*
>
> Paul: *"I found it very difficult to read, especially unknown words. […] Sometimes I made spelling mistakes especially when I didn't know the words."*
>
> Anna: *"I also couldn't read correctly"*

As we have already mentioned in chapter 7.3, after the intervention the results were far better and the students said that what helped them was learning phonology and spelling rules. This statement answers our first research question and comes to agreement with previous studies (Felton, n.d., Johnson, 2013, Nijakowska, 2010, NRP, 2000, O'Brien, 2011, Otaiba et al., 2009, Oviedo & Gonzalez, 2013, Reid, 2011, Ritter, et al., 2013, Rose, 2009, Winkler, 2016):

> John: *"Phonology has really helped me learn the sounds of the letters and read better. I also learnt to spell because I can remember the rules of digraphs and diphthongs and I know what sounds they make."*
>
> Paul: *"I can read texts now and unknown words as well. […] Before learning phonology I couldn't read and unknown words were very difficult*

for me. Now that I know how letters and different sounds work it is much better"

George: *"What I didn't know very well was the digraphs and diphthongs […] I can read better especially words that I don't know."*

Anna: *"I improved my reading skills. I can read more correctly now. […] The rules helped me because I understood why the words were read in a certain way. I know why the words are read the way they are."*

The participants also stated which the teaching strategies that contributed to their improvement were:

John: *"Using pictures and the interactive board helped a lot. Classification of the rules with mind maps and mnemonics also helped me remember what I learn. […] I think that mnemonics and constant revisions helped me remember what I learnt.""*

Paul: *"Mnemonics and pictures are also very helpful because I can remember the rules more easily. […] The most important is that the stories and pictures help me remember […] Workshops helped me a lot because everybody is like me and I am not afraid to speak"*

George: *"Differentiated instruction really helped me. All the tools we use make the lesson easier and more fun."*

Anna: *"Using my imagination by drawing pictures and telling the rules through stories was also helpful because I didn't have to learn rules by heart. […] By playing, drawing and using technology I remember what the sounds*

are[…]What also helped me is the workshop during which everybody irrespective of level can work together."

As one can notice, mnemonics and the use of technology really facilitates the students' learning process, fact that has also been shown in other studies (Fälth et al., 2013, Gonzalez et al., 2015, Kast et al., 2011, Mastropieri et al., 1994, Condus et al., 1986, Saine et al., 2011, Shaeffer, 2011, Scruggs & Mastropieri, 2000, Schneider & Crombie, 2003, Torgesen et al., 2010) and it is also stated in the teachers' field notes (see Appendix C). Two of the students also mention that the workshop really helped them since they all have the same level so they are not afraid to express themselves and they feel more self-confident.

Important findings that should also be mentioned are those related to the participants' perceptions on their previous experiences while being taught English and while attending lessons in ILD. They all stated that the former teaching methods were not adapted to their needs so the learning process was not easy for them. Furthermore, some of them had experienced injustice or bullying without having any emotional support by their teachers. This caused them anxiety and lack of self-confidence which was an inhibitory factor for learning, fact that is stated by both the participants and their teachers:

Paul's teacher: *"After talking to him I realized that he used to be bullied at school because of his difficulty both in reading and speaking and that is what still makes him so stressed while performing these tasks."*

Paul: *"The teachers didn't adapt the lesson. It was the same traditional lesson for everyone. […] I needed more time so as to learn the new things taught but the teacher didn't care about that."*

George's teacher: *"It's not rare for him, sharing with me school events during which he felt completely helpless and, as a result, he can't help thinking that he's suffering a grave daily injustice. Unfortunately, being part of an educational setting in which George can't feel appreciated for being himself makes him start keeping a distance from his learning*."

George: *"The lesson wasn't adapted to my needs, it was just like all the other lessons. […] It wasn't efficient because there were a lot of rules to learn by heart."*

Anna: *"The teaching method was not efficient at all. It was very stressful for me and I didn't have any interest to keep me motivated. After a while I forgot everything I had learnt."*

When it comes to ILD, their experience is very different and they all state that teachers helped them a lot to gain self-confidence and the lessons were adapted to their needs with a lot of revisions and more time fact that helped them stay calm and learn efficiently:

John: *"The way of teaching is quite different. It makes things easier for me to learn. There is no hurry and we revise a lot."*

Paul: *"The lesson is adjusted to my needs and my pace of learning. […] I can also understand what the others say without being stressed and I feel more confident. […]For me the most important is that teaching was adapted to my needs and my pace of learning."*

George: *"I understand more easily because the lesson is not a traditional one. The teachers are more interested in my needs and they have time for me. […]*

What also helped me is that the teacher was very patient and respected my needs. […] I also like coming here to learn English because it is fun."

Anna: *"In ILD the lesson is student centered. […] The most important fact for me is that the teachers are specialized and they know what they are doing. They are also very patient and respect us."*

It is obvious that the students' negative emotional state can be an inhibitory factor when it comes to learning (Nelson & Hardwood, 2011, Lyneham, 2009, Owens et al., 2012, Szaszkiewicz, 2013) so it is very important to ensure emotional support by respecting their needs.

8.2 Implications for English teaching as a FL to students with dyslexia.

The findings of this study suggest a few pedagogical implications for English teachers whose students might have learning differences. The teaching method under study could be applied by educators not only to beginners but also to more advanced students in order to develop or improve their reading skills.

I would also suggest that mnemonics and technology, which are part of the teaching approach, could be used by teachers of other lessons as well. According to the literature, both techniques are beneficial for students with dyslexia, therefore they should become an integral part of teaching in order to facilitate the students' learning.

A further important implication is that educators should be able to adapt the lesson to the students' needs. Ensuring a safe educational setting and boosting their self-confidence seems to be a prerequisite in order for them to overcome their anxiety irrespective of their age. Consequently, there is strong evidence that educators need

additional professional development so as to be able to accommodate students with learning differences.

8.3 Limitations of the study

Although this research was carefully prepared, there were some unavoidable limitations. First of all, the study's small sample size of four participants, although consistent with positive findings of other studies, delimits the current findings' strength and does not provide a high level of generalizability. Second, the research only lasted for three months. Due to this fact, even if the students' reading accuracy improved by making fewer errors, fluent reading hasn't been acquired. Finally, an important limitation lies in the fact that each case has a different pace of learning. Consequently, those who acquired knowledge faster, had the time to practice more during the intervention, while the others did not. This may have influenced the findings because not all the cases had the same time of exposure to the foreign language.

8.3 Suggestions for further study

It would be interesting, in a follow-up study, to re-test the same students of the study after a certain amount of time, perhaps a year later, to check if there has been any improvement without being taught phonology. Future work should also concentrate on fluency as well. A similar intervention could take place for a longer period of time in order to verify if students besides improving reading accuracy, they will be able to become more fluent by automatizing the rules via constant repetition. I would suggest that, if more time is available for the same intervention, the single-subject research should be used as it is more suitable for studies in the special education field (Horner et al., 2005, Horner & Kratochwill, 2012). An important issue to be taken into consideration in future studies is the need for validation by a larger sample size which

will spend equal time practicing reading during the intervention. Finally, this research has raised some issues in need of further examination regarding the negative effects of the students' emotional state on the learning process. Therefore, I would suggest that a study combining both an emotional and cognitive intervention program should be conducted in order to examine to what extent the students' emotions prevent them from improving.

8.4 Conclusion

The aim of this study was to examine the efficiency of a teaching method which combines most of the strategies which have been proved beneficial for EFL teaching to students with dyslexia. Consistent with previous findings, the present study shows that educators should base their teaching on both phonological and orthographic awareness by using mnemonics and technology in order to facilitate the students' learning process and enhance both their reading and memory skills. The findings prove that students' reading accuracy improves, but in order to acquire fluency more time is needed. The qualitative results of this study prove that the teachers' inability to adapt the lesson and respect the students' needs is an inhibitory factor when it comes to learning. In order for the students to improve and become motivated, the educators should help them become more self-confident without feeling anxiety because of their difficulties. Consequently, professional development and training related to special education should be a prerequisite for all educators.

The current study is a proof that students with dyslexia irrespective of their age have the ability to learn English as a foreign language as long as their strengths and weaknesses along with their emotions and needs are taken into consideration and applied in a single teaching method.

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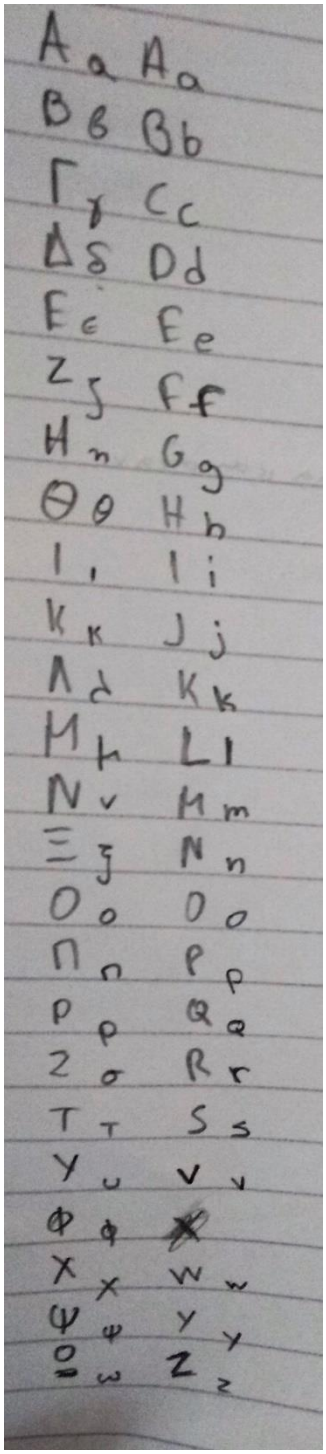
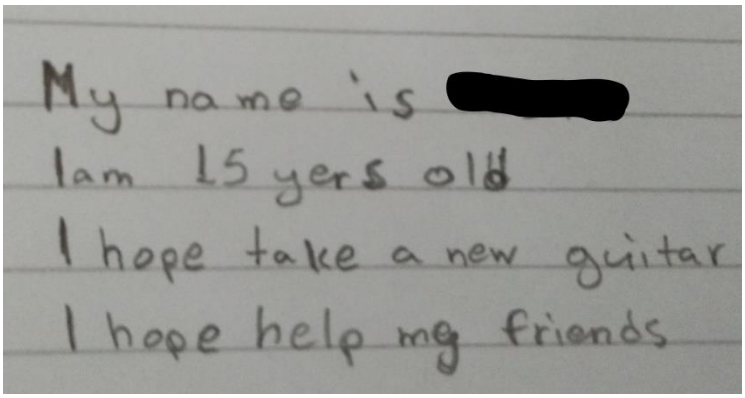
APPENDICES

APPENDIX A - ILD informal assessment

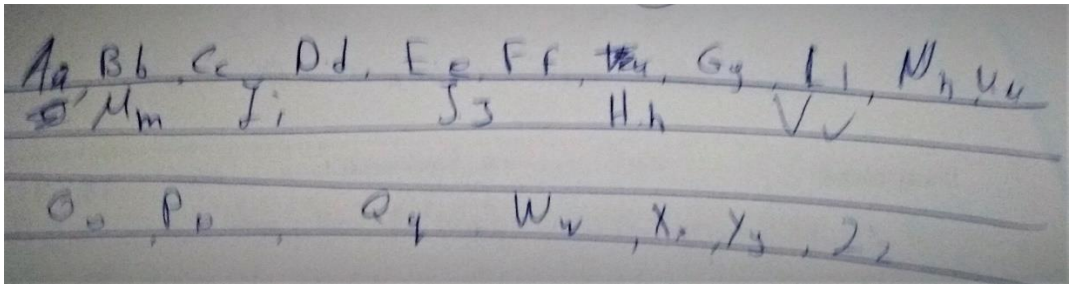
John

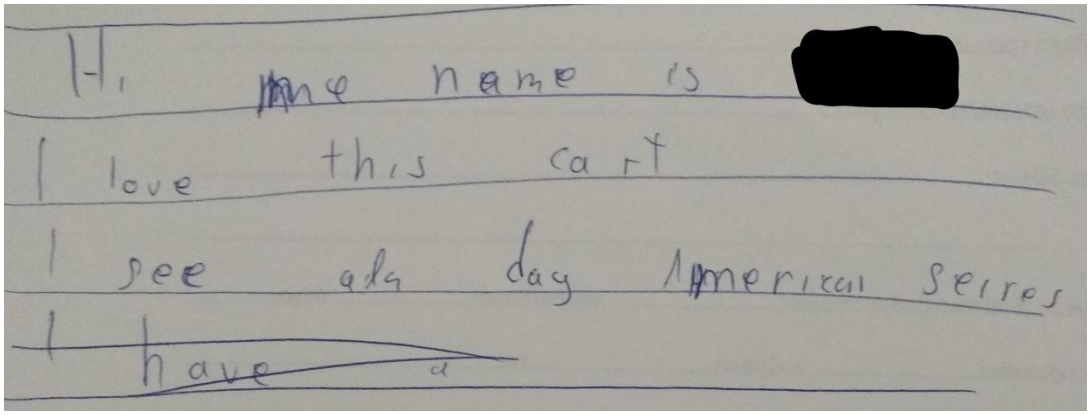




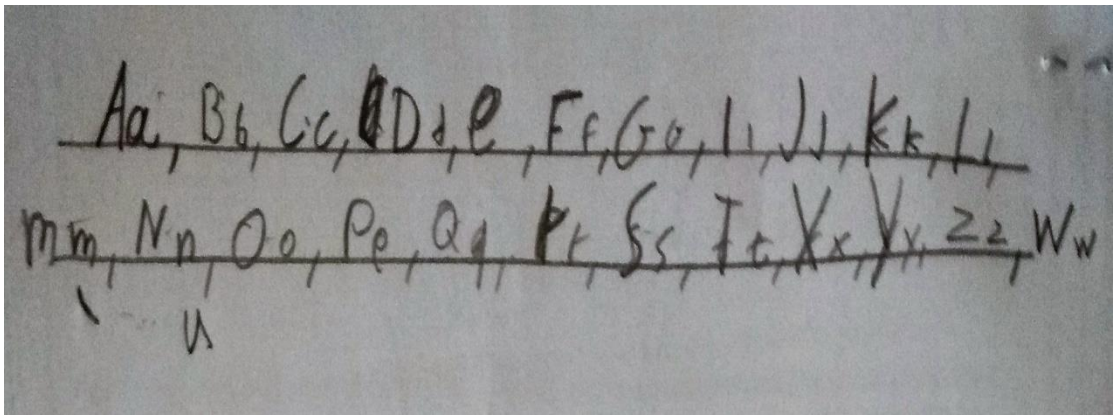
APPENDIX A (continued)

Paul

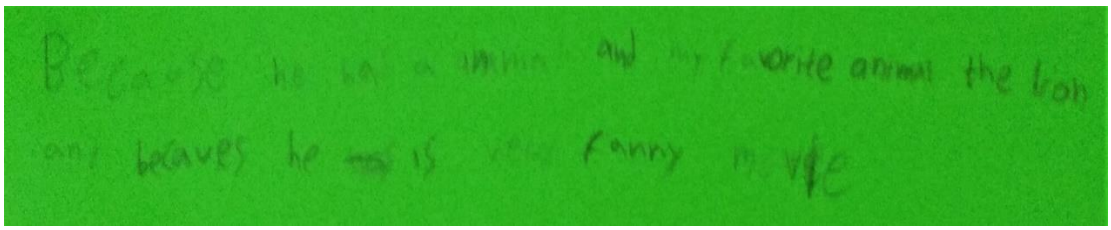




George



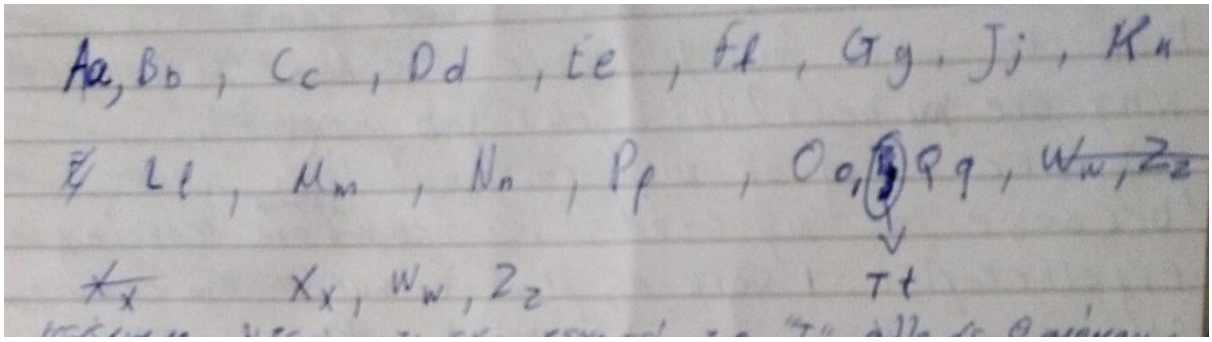
Why do you like the movie Lion King

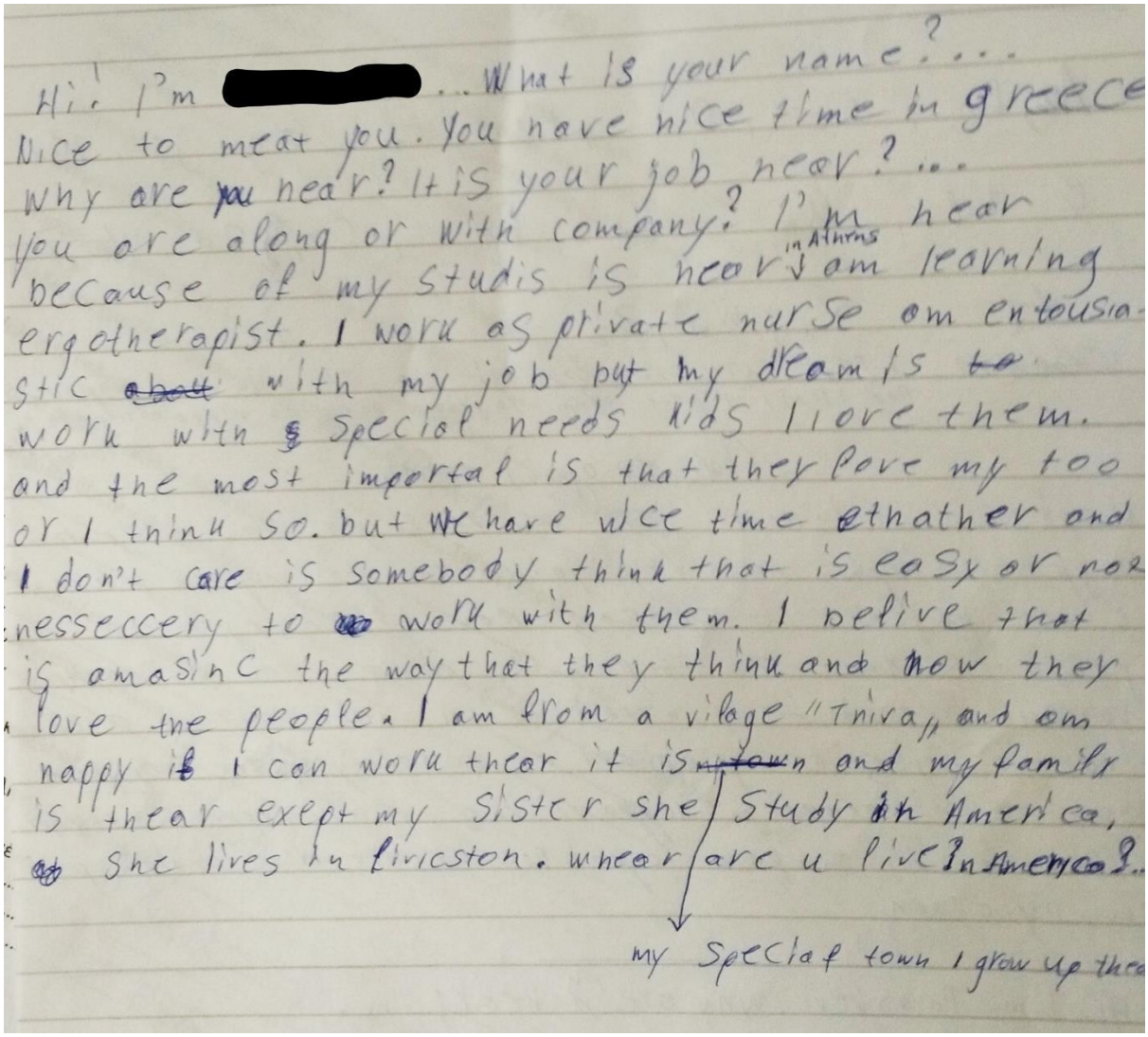


“Because he has a animal and my favorite animal the lion and becaues he is very fanny movie”

APPENDIX A (continued)

Anna





APPENDIX B – Reading assessment

Pseudoword reading informal assessment

wub	cag	pash	shan	tath	glite	bowner	trawn	gux
treel	slom	scad	chud	thome	swock	jound	mauto	yib
zim	theg	wilk	dall	slape	quate	newt	stry	gac
giz	cet	brean	goom	plute	cyx	quemp	surn	shike
waith	wim	zight	chon	frane	shoam	skay	birl	crub

Regular word reading informal assessment

cellphone	threw	coast	author	afraid
gadget	light	thirst	gin	wax
bleed	quite	vote	peanut	amuse
corner	loud	shadow	burst	prawn

Irregular word reading informal assessment

1) **The** small brown bears **are** under the tree.
2) **Some** yellow birds fly in the cloudy sky.
3) **Certain** children like ice-creams **very** much.
4) **Put your** car in **this** huge garage.
5) The clown is wearing a **white** blouse.
6) **These two** pets belong **to** Pete.
7) **Their** teacher's question is difficult.
8) **Today** I feel **great**.

APPENDIX C - Teachers' notes

John's teacher's notes

John is a cooperative teenager during the lesson. He is quite clever fact that helps him easily understand the new grammar rules I teach him. The main problem about John is that he doesn't study at home nor does he do his homework which makes it difficult for me. His reading ability is not so bad but he needs a lot of practice when it comes to spelling. I think that if I work more with John his problems caused by dyslexia will be reduced.

What really helps John is the interactive material and the games we use. He seems to understand the meanings and the rules better and he is also able to remember them more easily. What is also important is the fact that we revise the material taught in every lesson and when this doesn't happen then he has no progress. I think that if he spent more time studying English at home the revision would last less and we would be able to proceed with the material faster.

Paul's teacher's notes

Paul is a very clever student. He is very cooperative and he learns grammar rules very easily since, as he says, technology and mnemonics really help him remember what he is taught. Nevertheless, he finds it quite challenging and difficult to memorize new vocabulary. Besides mnemonics what help him is constant repetition and the use of the words in related context. When it comes to spelling he often forgets letters and makes mistakes based mainly on the irregularity of the words.

APPENDIX C (continued)

If the words are regular which means that the grapheme – phoneme correspondence is applicable to the rules he has already acquired, he spells the words correctly. Another point that is worth mentioning is that Paul shows a lot of anxiety when he has to express

himself orally. I think that this happens because he has the fear of making mistakes. When this happens he gets frustrated and mad at himself even if we have made it clear that only by making mistakes one can learn and that he isn't assessed based on his oral performance. What also causes Paul anxiety is reading, even if he has made great progress since he started the lessons. After talking to him I realized that he used to be bullied at school because of his difficulty both in reading and speaking and that is what still makes him so stressed while performing these tasks. Paul sometimes lacks concentration but most of the times this is related to his emotional state which is influenced by family matters. Generally, he is very sensitive and I think that he needs people to believe in his abilities and praise him. I think that if Paul succeeds in gaining more self-confidence he will be able to overcome his difficulties and be successful at his goals.

George's teacher's notes

George is a rather sensitive boy. He has been facing severe family health issues. He was just 4-5 years old when his mother was diagnosed with mouth cancer and he still remembers his reactions towards her, feeling quite guilty even though he knows he was too young to realize. As regards the relationship between George and his father, it seems that it has always been a difficult one. The fact that George chose to express his feelings to me without being asked for it reveals a really sociable profile and his internal need for communicating, even when he tries to pretend he's not interested in

something. What should also be mentioned is the relationship that George has with his school environment and his teachers. It's not rare for him, sharing with me school events during which he felt completely helpless and, as a result, he can't help thinking

that he's suffering a grave daily injustice. Unfortunately, being part of an educational setting in which George can't feel appreciated for being himself makes him start keeping a distance from his learning. Moreover, he has mentioned that he was bullied by older children in order to give them money. Despite all this difficult background, George feels confident enough about his passion for cooking and has already set his first professional goal; to become a chef.

Because of ADHD it is difficult for George to stay focused for long time periods and he often reacts impatiently, especially when he faces language problems because of his dyslexia. Therefore, during our classes we build up his self-awareness, self-confidence and concentration and work on improving his patience, skill needed for revising previous knowledge without trying to refrain from it.

In conclusion, I find George to be a remarkably clever boy and have noticed that, as long as he receives the appropriate emotional support and guidance, which can allow him feel safe and appreciated enough, he will be able to achieve great goals.

Anna's teacher's notes

Anna is an adult student who struggled during her childhood to learn anything, at the time she had not yet realized she had dyslexia and ADHD since her first diagnosis

came at the age of 16 and came as a shock and a resolution for her because from that moment on she tried to have an intervention from specialists. After the intervention she managed to get into a Technical School to become a nurse, which was a huge feat for her. During her studies she decided to try again to learn English with a more specialized

approach, so she contacted our school and from her academic and emotional improvement I can tell she is progressing just fine.

With Anna we started the phonemic awareness and although in the beginning she was very negative about reading, she found it hard to concentrate and gave up very easily; after some time dealing with the letters and their sounds and with the practice she did at home with the digital applications that I suggested she use, the progress was monumental, not only could she recognize the letters almost immediately (automatization) but also she could remember their group sounds and made minor if any lexicalization errors and mostly used the direct access route. The progress impressed her as well because we often listened together the recordings I made of her in the beginning and after the intervention and she kept saying " I can't believe that this is me in the first recording". She found color coding and digital applications on phonetics very useful, she told me that she enjoyed it so much that she practiced even during her work breaks. I feel very pleased that she progressed from a reluctant reader of the foreign language to an avid student keen to take in everything we are now learning in the classroom.

APPENDIX D – Cases' interviews

Interview

1) How old are you?
2) What is your job?
3) When were you officially diagnosed with dyslexia?
4) Have you ever attended a specialized intervention program for dyslexia? If yes for how long?
5) When did you start learning English?

6) How many years had you been learning English before you came to “ILD”?
7) What was the teaching method like in the previous lessons?
8) Was the teaching method adapted to all the learners?
9) Do you believe that the teaching method was efficient? If not, can you tell us why?
10) Did you face any difficulties while learning English? If that be the case, which were the difficulties and what skills were influenced?
11) What do you think would help you face your difficulties?
12) What differences do you think there are in ILD teaching method compared to your previous experience?
13) Do you believe that some of the difficulties, you have already mentioned, have improved since the time you started attending lessons in ILD? If yes, which ones?
14) What parts of the ILD teaching do you think that helped you improve or overcome your difficulties?
15) Do you believe that learning the sounds of the letters and phonology/spelling rules have helped you improve your reading skills?
16) What do you think helped you remember the letters and the phonology rules?

APPENDIX D (continued)

Cases’ Interviews

Previous experience in learning English.

Questions :

7/8) Was the teaching method adapted to all the learners and what was the teaching method like?

- John: “No, it wasn’t. It was just school teaching”

- Paul: “No, unfortunately the teachers didn’t adapt the lesson. It was the same traditional lesson for everyone.”
- George: “No, not at all. The teaching was just like all the other lessons”
- Anna: “Of course not. It was the traditional way of teaching with a lot of homework and learning rules by heart.”

9) Do you believe that the teaching method was efficient? If not, can you tell us why?

- John: “No, it wasn’t I think I needed more time and maybe some revisions to remember what I learnt.”
- Paul: “No, it wasn’t because I needed more time so as to learn the new things taught but the teacher didn’t care about that.”
- George: ““No, it wasn’t efficient because there were a lot of rules to learn by heart. Sometimes it was also my fault because I didn’t study a lot at home.”
- Anna: “The teaching method was not efficient at all. It was very stressful for me and I didn’t have any interest to keep me motivated. After a while I forgot everything I had learnt.”

APPENDIX D (continued)

Difficulties faced while learning English.

Question:

10) Did you face any difficulties while learning English? If that be the case, which the difficulties were and what skills were influenced.

- John: “Yes, I had difficulty in spelling and grammar because I couldn’t remember the rules.”

- Paul: “I found it very difficult to read, especially unknown words and I wasn’t good at writing or speaking either. Sometimes I made spelling mistakes especially when I didn’t know the words.”
- George: “I basically had difficulty while speaking or writing English and when I had to understand a text.”
- Anna: “I always had problem to understand a text, I had to read it a lot of times. I also couldn’t read correctly but I could speak better especially when I wasn’t stressed. When writing I had a lot of imagination which was usually good since the spelling mistakes weren’t so important.”

Students’ opinions on ILD teaching method.

Questions:

12) What differences do you think there are in ILD teaching method compared to your previous experience?

- John: “The way of teaching is quite different. It makes things easier for me to learn. There is no hurry and we revise a lot.”

- Paul: “The lesson is adjusted to my needs and my pace of learning. I understood the structure of the English language, the letters and their sounds and the spelling rules which help me read.”
- George: “I understand more easily because the lesson is not a traditional one. The teachers are more interested in my needs and they have time for me.”
- Anna: “I cannot even compare the two ways. With the traditional way I couldn’t learn rules by heart and I felt I had a problem so my self-confidence has been very low for years now. In ILD the lesson is student centered and I learn by

playing and by finding out the rules on my own which helps me remember. I use my imagination through stories and pictures so I never forget what I learn."

13) Do you believe that some of the difficulties, you have already mentioned, have improved since the time you started attending lessons in ILD? If yes, which ones?

- John: "Yes, I understand grammar and I remember the spelling rules. I think I am better now and I don't find English so difficult anymore."
- Paul: "I can read texts now and unknown words as well. The examples with pictures helped me understand the structure of the language and now I can express myself orally much better than I used to. I can also understand what the others say without being stressed and I feel more confident. Workshops helped me a lot because everybody is like me and I am not afraid to speak."
- George: "I can understand better when other people speak English and I can speak more easily as well. I also like coming here to learn English because it is fun."

- Anna: "I improved my reading skills. I can read more correctly now. Because of the pictures and the stories I can remember the rules and now I know what I am reading."

14) What parts of the ILD teaching do you think that helped you improve or overcome your difficulties?

- John: "Using pictures and the interactive board helped a lot. Classification of the rules with mind maps and mnemonics also helped me remember what I learn."

- Paul: “The whole process of the lesson helped me, not something specific more than the others. For me the most important is that teaching was adapted to my needs and my pace of learning. Mnemonics and pictures are also very helpful because I can remember the rules more easily.”
- George: “Differentiated instruction really helped me. All the tools we use make the lesson easier and more fun. What also helped me is that the teacher was very patient and respected my needs.”
- Anna: “The most important fact for me is that the teachers are specialized and they know what they are doing. They are also very patient and respect us. What also helped me is the workshop during which everybody irrespective of level can work together. Using my imagination by drawing pictures and telling the rules through stories was also helpful because I didn’t have to learn rules by heart.”

APPENDIX D (continued)

The effect of phonemic awareness on reading.

Questions :

15) Do you believe that learning the sounds of the letters and phonology/spelling rules have helped you improve your reading skills?

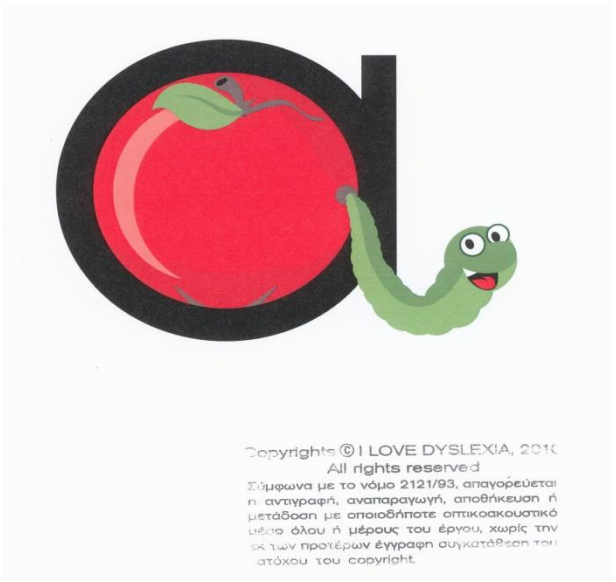
16) What do you think helped you remember the letters and the phonology rules?

- John: “Phonology has really helped me learn the sounds of the letters and read better. I also learnt to spell because I can remember the rules of digraphs and

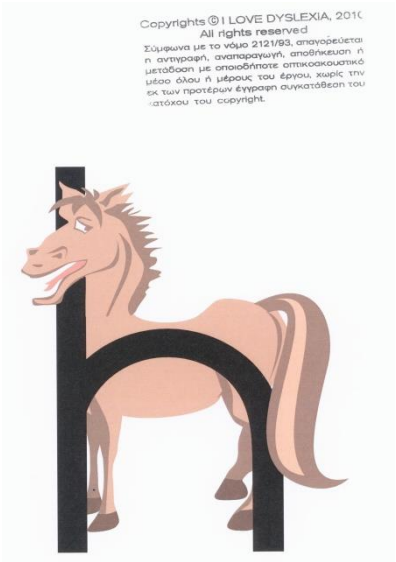
diphthongs and I know what sounds they make. I think that mnemonics and constant revisions helped me remember what I learnt."

- Paul: "Before learning phonology I couldn't read and unknown words were very difficult for me. Now that I know how letters and different sounds work it is much better and the most important is that the stories and pictures help me remember but it takes longer to think and I don't read so fast."
- George: "I already knew the letters so this didn't help me a lot. What I didn't know very well was the digraphs and diphthongs and the stories helped me remember them so that I can read better especially words that I don't know."
- Anna: "The rules helped me because I understood why the words were read in a certain way. By playing, drawing and using technology I remember what the sounds are and I improved my reading. I know why the words are read the way they are. I also feel more relaxed without feeling that I am under assessment"

APPENDIX E - Mnemonics



APPENDIX E (continued)



APPENDIX F – Online Practice Phonology

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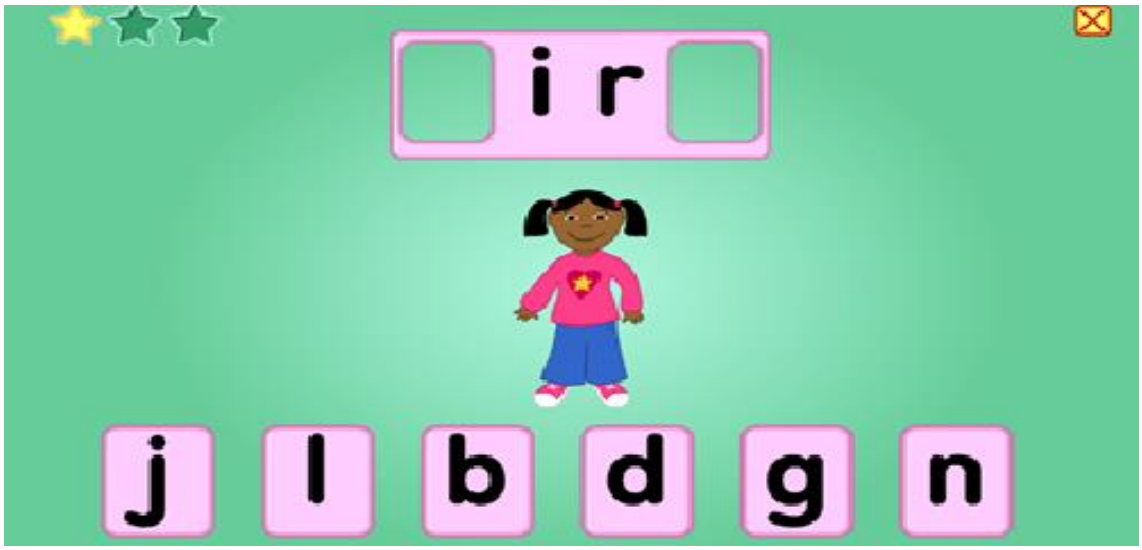

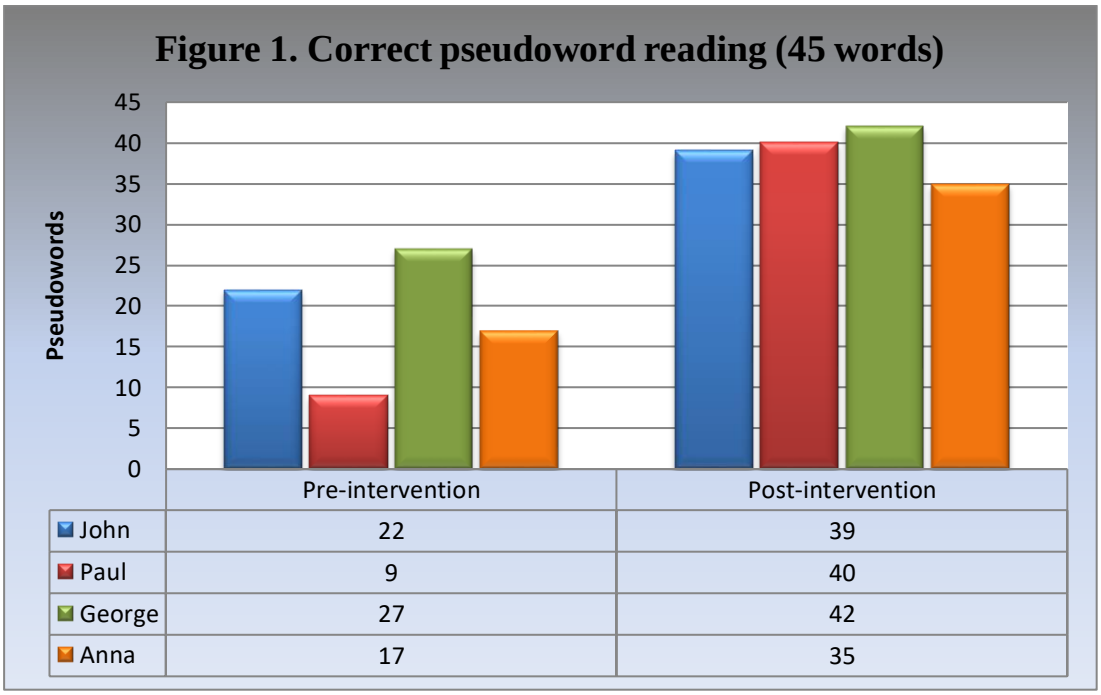

Figure 1. Cases' correct answers while reading the 45 pseudowords pre and post intervention.

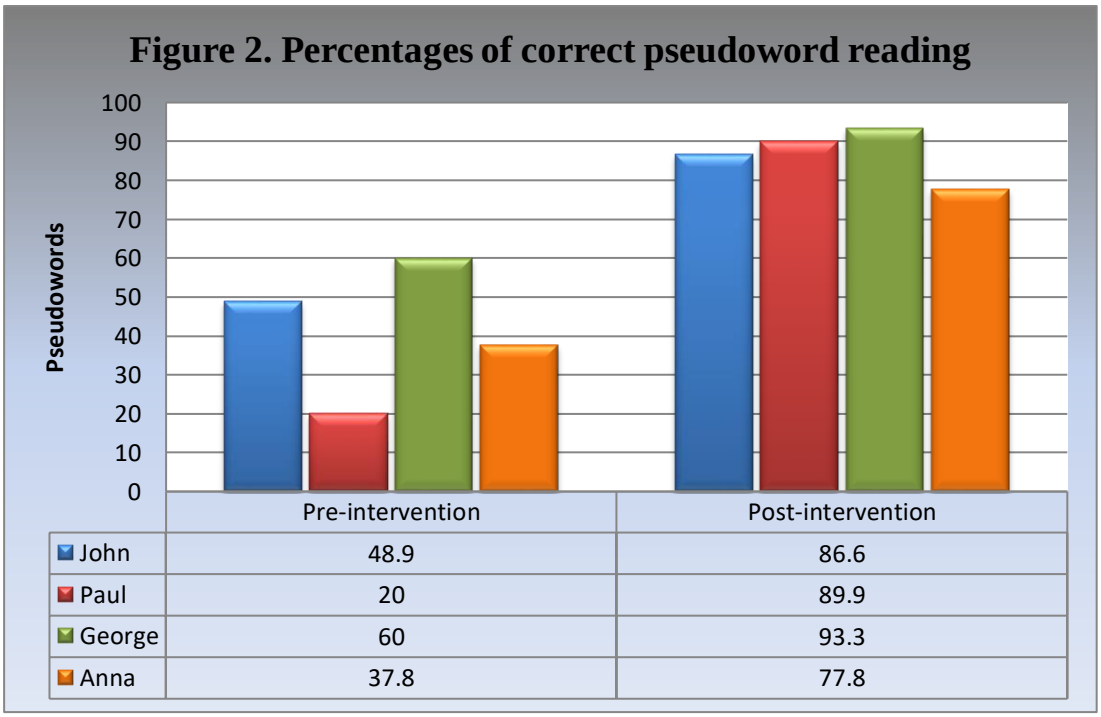

Figure 2. Cases' percentages of reading correctly the pseudowords pre and post intervention.

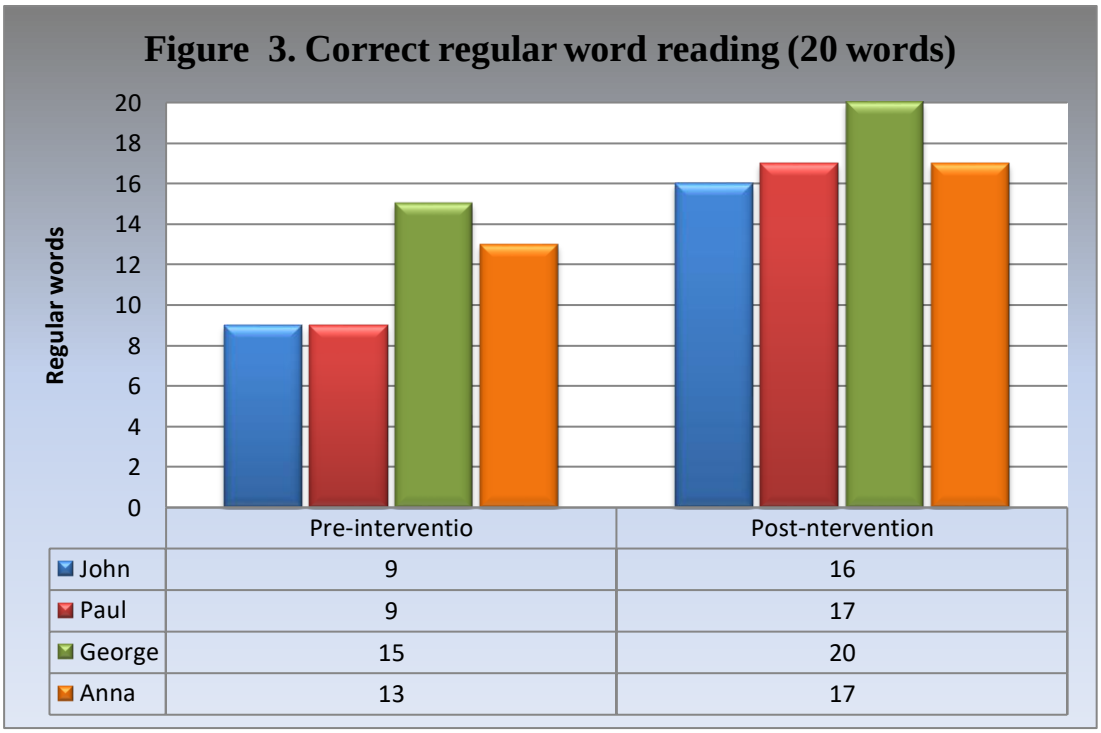

Figure 3. Cases' correct answers while reading regular words pre and post intervention.

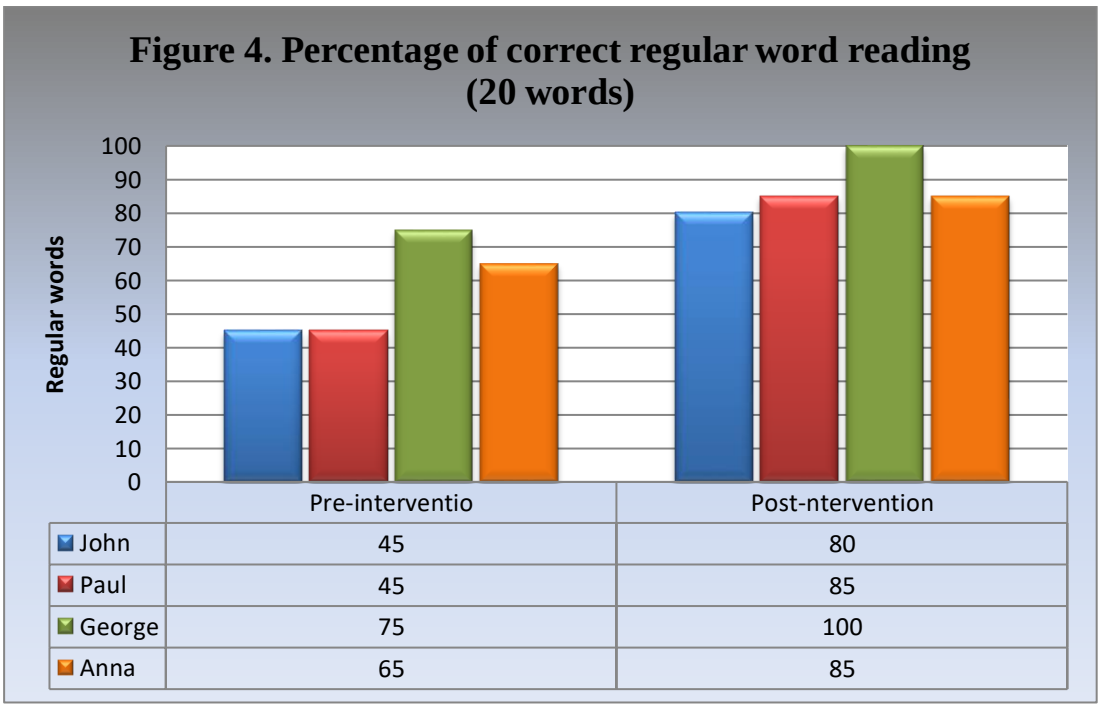

Figure 4. Cases' percentages of reading correctly regular words pre and post intervention.

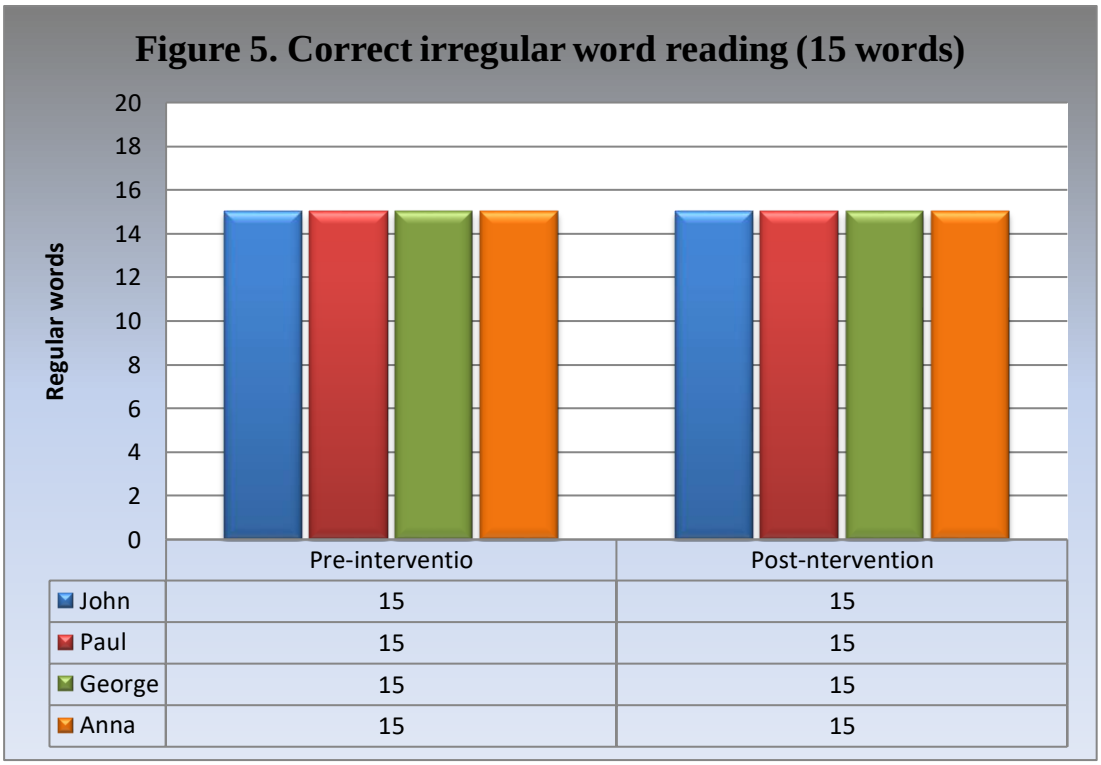

Figure 5. Cases' correct answers while reading irregular words in context.

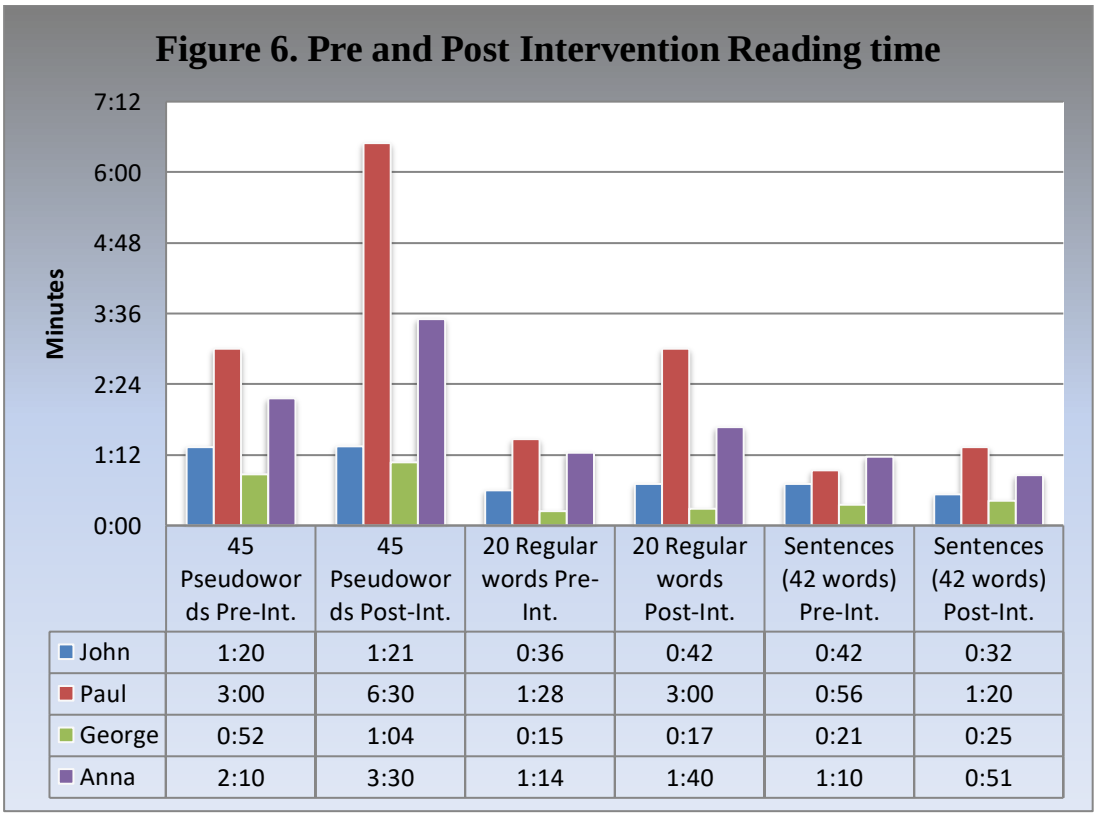

Figure 6. Cases' reading time before and after the intervention program.

APPENDIX H – Cases' errors analysis

John

Table 2 - Visual processing errors
Case 1 – John

	Pseudowords	Regular words	Sentences
	Words changed	Words changed	Words changed
Inversions	brean -drean dall – ball scad - scab		bear - dear
Substitutions	crub - club	threw - throw	under - order
Omissions	bleed – bled waith - with		

Table 3 - Phonological and spelling decoding errors

Case 1 – John / Diphthong errors

Pseudowords	Correct pronunciation	John's reading
bown (pre/post int.)	/baʊn/	/bəʊn/
trawn (pre-post int.)	/trɔːn/	/traʊn/
jound (pre/post int.)	/jaʊnd/	/jɒnd/
mauto	/mɔːtəʊ/	/maʊtəʊ/
goom	/guːm/	/gʌm/
zight	/zaɪt/	/zɪhθ/
Regular words		
author (pre/post int.)	/ˈɔːθə(r)/	/ʌθə(r)/
prawn (pre/post int.)	/prɔːn/	/praʊn/
blouse (in sentence)	/blaʊz/	/blʊz/

Table 4 - Phonological and spelling decoding errors Case 1 – John / Vowel and consonant digraphs errors		
Pseudowords	Correct Pronunciation	John's reading
chud	/tʃʌd/	/shæd/
chon	/tʃɒn/	/sɒn/
waith	/weɪθ/	/wɪθ/
shoam	/ʃəʊm/	/ʃɒæm/
Regular words		
afraid	/əˈfreɪd/	/əˈfraɪd/
coast	/kəʊst/	/kɒæst/
peanut (pre/post int.)	/ˈpiːˌnʌt/	/peænt/

Table 5 - Phonological and spelling decoding errors Case 1 – John		
Alphabetic principle		
Pseudowords		
gux	/gʌks/	/gʊks/
yib (pre/post int.)	/jɪb/	/waɪb/
wax (pre/post int.)	/wæks/	/wɒks/
Silent -e		
Pseudowords	Correct Pronunciation	John's reading
plute	/pljuːt/	/plʌt/
Regular words		
amuse (pre/post int.)	/əˈmjuːz/	/əˈmaʊz/
huge (in sentence-pre/post int.)	/hjuːdʒ/	/hʌg/
Pete (in sentence)	/piːt/	/pet/

Table 6 - Phonological and spelling decoding errors
Case 1 – John

R-controlled vowels		
Pseudowords	Correct Pronunciation	John's reading
surn	/sɜː(r)n/	/sʌrn/
birl (pre/post int.)	/bɜː(r)l/	/bɪrl/
Soft c/g sounds		
Pseudowords		
giz	/dʒɪz/	/gɪz/
Regular words		
gin	/dʒɪn/	/gɪn/
garage (in sentence)	/ˈgærɑːʒ/	/ˈgereg/

APPENDIX H (continued)

Paul

Table 8 – Visual processing errors
Case 2 – Paul

	Pseudowords	Regular words	Sentences
Inversions	Words changed	Words changed	Words changed
b-d	4/6	0/5	2/5
d-b	0/4	0/5	1/4
p-d	1/4	1/3	0/2
p-b	2/4	0/3	0/2
	wilk – wikl surn – srun birl – bril		

	gux – guh (sound h for greek letter x)		
Substitutions			
	wub – wed (pre/post int.) chud – chod cag – gag shan – sman slom – smom gux – guh skay – sky mauto – maud	shadow – smod (pre/post int.)	this – the white – little to – the
Omissions			
	mauto – maud swock – wock treel – teel that – tat	shadow – smod	
Additions			
	thome – throme trawn – trawned brean – dreand	vote – volte	
Refusal (not read)			
	zight	amuse threw	

APPENDIX H (continued)

Table 9 - Phonological and spelling decoding errors

Case 2 - Paul / Diphthong errors

Pseudowords	Correct pronunciation	Paul's reading
bown	/baʊn/	/dɒwn/
trawn	/trɔːn/	/trʌwed/
jound	/jaʊnd/	/ jɒd/
dall	/dɔːl/	/dʌl/

zight	not read	not read
Regular words		
author	/ˈɔːθə(r)/	/ʌθə(r)/
loud	/laʊd/	/lɒʌd/
blouse (in sentence)	/blaʊz/	/blʊz/
cloudy (in sentence)	/ˈklaʊdi/	/ˈklʊdi/

Table 10 - Phonological and spelling decoding errors

Case 2 - Paul

Soft c/g sounds	Correct pronunciation	Paul's reading
Pseudowords		
gux	/gʌks/	/dʒʌh/
giz (pre/post int.)	/dʒɪz/	/gɪz/
cet	/set/	/ket/
Alphabetic principle		
Pseudowords/regular words		
crub	/krʌb/	/krʊb/
surn	/sɜː(r)n/	/srʊn/
peanut	/ˈpiːˌnʌt/	/pɪnʊt/
huge (in sentence)	/hjuːdʒ/	/hʊg/

Table 11 - Phonological and spelling decoding errors
Case 2 – Paul

Vowel digraphs		

Pseudowords	Correct Pronunciation	Paul's reading
brean	/briːn/	/brɪed/
shoam	/ʃəʊm/	/ʃɒm/
waith	/weɪθ/	/wɪθ/
Regular words		
peanut	/ˈpiːˌnʌt/	/pɪnʊt/
Silent e		
Pseudowords		
glite	/glaɪt/	/glɪt/
shike	/ʃaɪk/	/ʃɪk/
quate (pre/post int.)	/kweɪt/	/kwʌt/
frane	/freɪn/	/fraɪn/
slape	/sleɪp/	/slʌd/
plute (pre/post int.)	/pljuːt/	/plʌt/
skay	/skeɪ/	/skaɪ/
thome	/θəʊm/	/θɒm/
Regular words		
vote	/vəʊt/	/vɒlte/
amuse	not read	not read
huge (in sentence)	/hjuːdʒ/	/hʊg/
Pete (in sentence)	/piːt/	/pet/

George

Table 12 - Visual processing errors
Case 3 – George

	Pseudowords Words changed	Regular words Words changed	Sentences Words changed
Inversions	brean -drean		
Substitutions			
	yib – wib	skay – sky (pre/post int.)	
	shike - snike		
Omissions			
	quate - cute waith - wait	quite - cute	cloudy - cloud

Table 13 - Phonological and spelling decoding errors

Case 3 - George / Diphthong errors

Pseudowords	Correct pronunciation	George's's reading
bown	/baʊn/	/bɒwn/
trawn	/trɔːn/	/trɒʊn/
mauto	/mɔːtəʊ/	/maʊtəʊ/
Regular words		
author	/ˈɔːθə(r)/	/ʌθə(r)/
loud	/laʊd/	/lɒʊd/
prawn	/prɔːn/	/praʊn/

Table 14 - Phonological and spelling decoding errors

Case 3 – George / Vowel and consonant digraphs errors

Consonant digraphs		
Pseudowords	Pronunciation	George's reading
chud	/tʃʌd/	/sʌd/
chon	/tʃɒn/	/sɒn/
quate (pre/post int.)	/kweɪt/	/kjuːt/
quemp	/kwemp/	/kemp/
shoam	/ʃəʊm/	/ʃɒm/
Regular words		
quite	/kwaɪt/	/kjuːt/

Table 15 - Phonological and spelling decoding errors

Case 3 – George

Alphabetic principle		
Pseudowords	Correct Pronunciation	George's reading
yib	/jɪb/	/waɪb/
jound	/jaʊnd/	/zaʊnd/
Regular words		
wax	/wæks/	/wɒks/
Silent –e		
Pseudowords		
plute	/pljuːt/	/plʊt/
Regular words		
amuse	/əˈmjuːz/	/əˈmaʊz/

Anna

Table 16 - Visual processing errors
Case 4 - Anna

	Pseudowords	Regular words	Sentences
	Words changed	Words changed	Words changed
Inversions	glite – gilti quemp - guemp birl - birl		
Substitutions	gux – guh (sound h for greek letter x)	threw – throw (pre/post int.) gin - win	
Omissions	waith - wait	bleed - bled	cloudy – cloud
Refusal (not read)	chud cyx		

Table 17 - Phonological and spelling decoding errors

Case 4 - Anna / Diphthong errors

Pseudowords	Correct pronunciation	Anna's reading
Bown (pre/post)	/baʊn/	/bɒwn/
Trawn (pre/post)	/trɔːn/	/trʌʊwn/
jound	/jaʊnd/	/ jʊd/
mauto (pre/post int.)	/mɔːtəʊ/	/maʊtəʊ/
dall (pre/post int.)	/dɔːl/	/dʌl/
goom	/ɡuːm/	/guɒm/
zight	/zaɪt/	/zigt/
Regular words		
prawn (pre/post int.)	/prɔːn/	/praʊn/
blouse (in sentence)	/blaʊz/	/blʊz/
cloudy (in sentence)	/ˈklaʊdi/	/ˈklʊdi/

Table 18 - Phonological and spelling decoding errors
Case 4 – Anna

Vowel digraphs		
Pseudowords	Correct Pronunciation	Anna's reading
brean	/briːn/	/brɪʌn/
shoam	/ʃəʊm/	/ʃɒm/
waith	/weɪθ/	/weθ/
skay (pre/post int.)	/skeɪ/	/skaɪ/
Consonant digraphs		
Pseudowords		
chon	/tʃɒn/	/kɒn/
Silent e		
Pseudowords		
glite	/glaɪt/	/gɪltɪ/
quate (pre/post int.)	/kweɪt/	/kwaɪt/
frane	/freɪn/	/fraɪn/
slape	/sleɪp/	/slʌp/
plute (pre/post int.)	/pljuːt/	/plʊt/
Regular words		
quite	/kwaɪt/	/kwɪt/
amuse	/əˈmjuːz/	/əˈmʊz/
huge (in sentence)	/hjuːdʒ/	/hʊg/

APPENDIX H (continued)

Table 19 - Phonological and spelling decoding errors

Case 4 - Anna

Alphabetic principle

Pseudowords	Correct pronunciation	Anna's reading
wub (pre/post)	/wʌb/	/wʊb/
gux	/gʌks/	/gʊh/
crub	/krʌb/	/krʊb/

Soft c/g sounds

Pseudowords		
giz (pre/post int.)	/dʒɪz/	/gɪz/
gin (pre/post int.)	/dʒɪn/	/gɪn/
cet	/set/	/ket/

Regular words

gadget	/ˈgædʒɪt/	/gæget/

R-controlled vowels

Pseudowords		
Surn (pre/post int.)	/sɜː(r)n/	/sʊrn/
birl	/bɜː(r)l//	/bɪrl/

APPENDIX I "ILD" features