Peoples' Democratic Republic of Algeria

Mohamed Khider University of Biskra
Faculty of Letters and Languages
Department of Foreign Languages
Division of English

MASTER DISSERTATION

Submitted and Defended by:
TEMAGOULT Nabila

The Impact of Integrating *Aidodys* Application as a Pedagogical Aid

on the Reading Fluency of Dyslexic Learners

The case of 4th and 5th grade dyslexic learners

Ben Chaib Saleh Primary School-Arris-

Board of Examiners

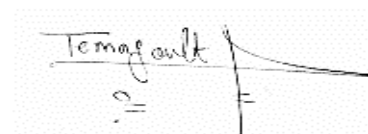|		
Dr.Rabhi Salima	MCA	Chairperson
Dr.Meddour Mustapha	MCB	Supervisor
Mrs. Aichaoui Theldja	MAA	Examiner

Academic Year: 2019-2020

Declaration of Original Work

I, TEMAGOULT Nabila, a graduate student at Mohamed Khider University of Biskra, and author of a Master dissertation entitled: "**The Impact of Integrating *Aidodys* Application as a Pedagogical Aid on the Reading Fluency of Dyslexic Learners-The case of 4th and 5th grade dyslexic learners Ben Chaib Saleh Primary School-Arris-***";*** hereby declare that this research work supervised by Dr. Meddour Mustapha is my own original work, and has never been previously presented, published, or submitted for any academic institution or university for any degree.

Certified,
Miss TEMAGOULT Nabila

Dedication

Oh Allah, almighty Allah, you gave me strength, you gave me faith, you gave me health and granted me the gift to write and finish...
Elhamdulillah..

To an unusual man, to a hero, to my first love, to a perfect father...**daddy**
To a superwoman, to a queen, to my everlasting love, to a unique mother, **mommy**
How can I express my endless gratitude and love through words? Your unconditional support and infinite love made of me what I am today... without you my dear parents, I could never achieve my goals... you are my source of inspiration and eternal pride...thank you

To **my sister**, my beautiful sister, my idol, my princess...You have always been an example to follow, an admirable person, I am so lucky to have you... thank you for being there for me when no one was...

To **my brother**, my handsome little brother, my only and unique brother, you are a divine gift sent to our family... you are the source of my energy and happiness, you have always been there to help and support me...thank you...

To snow-white, my dear sister, the best friend someone can have, **Amani**...

To the coincidence that made me meet the girl with the golden heart, "**Princess Manar**", then the squad of English nerds **Sana, Kaouther, Ikram, Ramia**... I am grateful to have you in my life...

University life could not be more fun without having **Yousra** with me... thank you

To my brother, cousin and best friend, **Ilyes Temagoult**

To my childhood friend, the one who helped and supported me, **Dr. Abdel Mounaim Zemmouri**

To all members of my family without any exception

To the one who changed my life, the one who made me happier... to the man who unconditionally loved me and promised to be always there for me...to my dear **Dr.Tarek AMEJD**

Finally, to **myself**, to me, to **Melissa** and to **Melissa's brain cells**... to the one who had in every step myriads of reasons to give up but did not... I promise you... this is just the beginning of a successful journey...

Acknowledgement

My sincere appreciation and gratitude go to my supervisor, **Dr. Meddour Mustapha** for his guidance, patience and pertinent remarks. I am grateful to have this opportunity doing research under his tutelage.

Dr. Meddour Mustapha was not only a good supervisor, but an excellent motivating teacher who marked my university path. I enjoyed every single session and waited impatiently for the next. I starved for his positive feedback and I felt proud each time he praises me. It needs a special man to be a successful teacher… Dr. Meddour Mustapha is a special man and an amazing teacher.

I would love to thank members of the jury Dr Rabhi Salima and Mrs aichaoui Theldja for reading my work.

Acknowledgments go to Teachers who enlightened me with knowledge during these five years. Mr and Mrs. Chenini were and are so special to me, Miss Ouerniki is one of a kind, Dr. Turki, Dr. Bechar, Dr.Chelli, Dr. Beteka and all teachers of English department at Mohamed Khider University.

I also appreciate the help of Mr. Bousyouda Fares, Mr. Guettala Abderraouf and Mr. Rahmouni Emhamed for providing me with precious information and helping me to do and finish my research in due time.

Abstract

Building a successful learning commences primordially with the process of cracking written symbols and converting them into sets of words, sentences, and texts to forge meaning: It is the basic skill sharpened at schools that guarantees the systematic learning of new skills and experiences. Nevertheless, dyslexia, the inability to decode letters to read, does not only paralyze the normal path of learning, but also condemns dyslexics as being "learners with special needs". Pointing the Algerian classes, these needs are not fairly addressed and dyslexics are dropped out of schools due to their frequent failure. Seemingly, such a problem cannot have any solution. Yet fortunately; the combination of pedagogy and ICT nowadays can make remarkable improvements and turn reading "possible". In this line, the present study proposes *Aidodys* application as a pedagogical aid for Algerian dyslexic learners and aims mainly at their reading amelioration and betterment. At the level of methodology, through opting for a mixed methods approach, we carried out this investigation on a population of a group of young dyslexic learners (N=02) using a pre-experimentation in which the spent time on reading was counted. In order to check the fluency of learners before and after the integration of Aidodys, an observation was conducted on five elements of reading fluency. Finally, the interview with a speech therapist paved the way for collecting informational and thorough data. The analysis and interpretation of results yielded to draw some conclusions; this study validated the effectiveness of Aidodys application for reading fluency improvement, thus confirmed the hypotheses proposed at the beginning of the study.

Keywords: Dyslexia, Aidodys, reading, pedagogical aid, learners with special needs

List of Abbreviation

Dys disorders: dyslexia, dysphasia, dysgraphia

App: application

DLC: Dual Route Cascade model

SVR: Simple View Reading

L.C: Listening Comprehension

R.C: Reading Comprehension

ICT: Information and Communication Technology

AT: Assistive Technology

IQ: initialism of intelligence quotient

List of Appendices

Appendix 01: Preliminary Study

Appendix 02: The Calculation of the pre test Mean, Variance and Standard Deviation. Learner One

Appendix 03: Calculation of the post test Mean, Variance and Standard Deviation Learner Two

Appendix 04: Results of the t-test

Appendix 05: The one-minute Reading Test before Adaptation

Appendix 06: Sentences and Text Adaptations Learner One and Learner Two

Appendix 07: The Interview

Appendix 08: Declaration of the Speech Therapist

List of Tables

List of figures

List of Graphs

Graph 01. curve diagram representing the time spent on reading before Aidodys integration

(learner one)

Graph 02. curve diagram representing the time spent on reading before Aidodys integration

(learner two)

Graph 03. curve diagram representing the time spent on reading after Aidodys integration

(learner one)

Graph 04. curve diagram representing the time spent on reading after Aidodys integration

(learner two)

Table of Content

GENERAL INTRODUCTION

No matter how we look the same, share the same anatomical and biological features, age, race, or even genes; we are naturally diverse. It is undeniable that our brains have identical shapes, parts and functions; however, they process and interpret information differently. For this reason, teachers in one classroom must look at learners as a variety of learning styles with various needs; or at least, treat those with learning difficulties differently to "*leave no learner behind*".

Language learning difficulties appear in the four skills; mainly, literacy skills. Yet real learning obstacles are faced when learners have reading problems. In some cases, teachers may find learners who mix letters, replace some of them by other ones, fail to recognize familiar words or even do not follow their systematic order. They also miss lines and omit or add extra words. These learners are not slow, they are not less intelligent than others or have a low IQ level; but these learners are "dyslexics".

Dyslexia is a language-based learning difficulty that appears in writing, spelling, counting, recognizing, remembering and mainly, in reading. You are never "cured" of dyslexia, but the appropriate educational approach or pedagogical tool can help, to a certain extent, learn the elements of spoken and written language in a way the brain can acquire them. In simple terms; dyslexia is a different brain organization that needs different teaching methods and new tools of instruction and didactic aids.

In this regard, the present study aims first, at reviewing some literature about reading, dyslexia, and the pedagogical software *Aidodys* that is designed to help individuals with learning disabilities, and then we empirically try to find out the obstacles faced by dyslexic learners in Algeria, and investigate the effects of using *Aidodys* application on improving the reading performance of these learners.

1. **Statement of the Problem**

A common myth about dyslexics in the Algerian educational context is that "they are failures" (Algerie Presse Service, 2018). We are losing probable future inventors (Thomas Edison), writers (Agatha Christie), brilliant politicians (Winston Churchill and Andrew Jackson) or even geniuses (Albert Einstein) due to the fact that the needs of dyslexics in the Algerian classrooms are not being significantly addressed.

Admittedly, the Ministry of National Solidarity, Family and the Status of Women sponsored some specialised centres for learners with disabilities such as the one of Draa Zitoun, Arris, but this kind of centres often tend to mix learners with various disabilities in one classroom regardless to the type of their cases: autism, mental disabilities, learning difficulties, etc. This can negatively affect learners and may lead to frustration and interpersonal skills' problems (listening, speaking and questioning).

Moreover, the lack of speech therapists and psychologists existing in the Algerian schools is a proof that dyslexics are not given the necessary attention and care. As a matter of fact, in the region where the experimentation of this research work takes place (Arris-Batna), there are more than 10 primary schools, 7 middles schools and 2 high schools with only one speech therapist.

After having access to archives of Arris Secondary School's medical care assistance, and with the cooperation of a speech therapist, cases of dyslexia were diagnosed, and a classroom observation as a preliminary study was conducted at schools to check up and confirm the existence of such a problem. As expected, dyslexics seem to have no special treatment, no serious attempts to be helped by teachers, not even some pedagogical tools that can serve them as an aid to facilitate reading for them. That is why there are some cases who suffer from severe problems to the extent that they are still struggling in primary schools or 1st year middle school repeating the same year for 3 to 4 times.

In order to cope with such an issue, technology is the most likely reasonable solution. With its multidisciplinary nature, technology could do gigantic steps in the remedial and the solving of some critical problems in different fields. In education and pedagogy, technology could smoothly impose itself in classrooms and prove its efficiency.

Henceforth, dyslexia can also be ameliorated through integrating numerical tools and new software into classrooms such as e-readers, tablets, talking-fingers apps, Aidodys, etc. *Aidodys* an application adapted that helps learners with sight problems and dys disorders in general. Compared to traditional, non-computer-based methods of teaching, *Aidodys* application users witness that it can help improve dyslexics' reading fluency. As such, through this work, its effectiveness in our environment will be tested.

2. Research Questions

This research work aims basically at answering the following questions:

1- How does Aidodys software impact the reading duration of dyslexic learners?

2- Are there any changes in the reading fluency of dyslexic learners after the use of Aidodys?

3- How do speech-therapists perceive and act with dyslexic learners?

3. Research Hypotheses

In order to answer the presumed research questions, we propose the following hypotheses:

H1- If Aidodys software is consistently and properly used, the reading duration of dyslexic learners will decrease.

H2-The reading fluency of dyslexic learners will likely to be improved after the use of Aidodys application.

H3- If speech therapists are effectively trained and given adequate means, they will contribute to the problem solving of dyslexics.

4. Research Aims

The general aim of this study is to observe the impact of integrating a technology-based pedagogical aid to dyslexics in Algeria and ameliorate their reading fluency.

In the light of the general aim stated above, some specific aims can be mentioned as follows:

1- Proposing the application of Aidodys in schools as a pedagogical aid to help dyslexics in the Algerian classroom.
2- Reconsidering the place of this category of learners and facilitating the reading task for them for a better social and academic balanced integration.

5. Significance of the Study

This study is, in the first place, a proposed aid to a marginalized category of learners in Algeria (dyslexics). It can be of a great help to teachers, on the one hand, in terms of saving time and efforts, in addition to facilitating the task of teaching a class that includes some dyslexics. On the other hand, dyslexics will find themselves making less effort with better results. Moreover, it aims at discovering the obstacles faced by speech therapists since they have the ability to provide dyslexics with significant help. In addition to the previously stated aims of helping dyslexic learners in Algeria, the study seeks to develop a theoretical understanding of dyslexia psychologically, and technology integration in the Algerian classroom.

6. Research Methodology

Selecting an approach to a research framework is not a random decision. It should be based on a specific philosophical assumption. Simply put, the philosophical epistemologies (post positivism, constructivism, transformative and pragmatic) in addition to the academic requirements control the choice of the research approach. Since the philosophy of the pragmatic paradigm is rooted from both qualitative and quantitative designs, its assumptions fit best with the constraints and nature of our study.

7. Research Approach

There are three types of research approaches: qualitative, quantitative, and a mixed methods approach. "A mixed methods approach is useful when the quantitative or qualitative approach, each by itself, is inadequate to best understand a research problem and the strengths of both quantitative and qualitative research (and its data) can provide the best understanding." (Creswell,2013, p.20). Differently put, complete understanding of the problem and reliable results is reached through combining both qualitative and quantitative research approaches. So, this study follows a mixed methods approach because it is suitable for the nature of this research work to gather informational and accurate data.

8. Research Design

Research designs are types of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in a research design. They are often called strategies of inquiry (Denzin & Lincoln, 2011) (as cited in Creswell,2013, p.12). Some of the commonly used **qualitative research strategies** are case study, grounded theory, longitudinal, ethnography, among others. Whereas, the **quantitative research strategies** are generally divided into two commonly used ones: **Non experimental research**

design that includes correlational and comparative research strategies and **experimental** that can be divided into true, quasi or pre-experimental.

In this study, a mixed methods research strategy will be used through opting for a **pre-experimental research strategy** (one group pre/ post test study) as a quantitative research design and an **observation** in addition to an **Interview** as qualitative research design. By applying the mixed methods research strategy; we are seeking to obtain a more likely complete image and accurate results, and to guarantee the validity and reliability of the research strategy.

9.   Data Collection Methods and Procedures

Data collection methods are tools or instruments used to collect data. There are qualitative, quantitative and mixed methods data collection tools. For the present research study, which opts for a mixed methods approach, both qualitative and quantitative data collection instruments are combined. Besides, we have opted for three data collection tools (treatment, observation, interview) for the sake of triangulation in order to answer the research question stated above.

Quantitative Data Collection Tools

One group pre-test/ post-test study

The short case study is a part of the pre-experimental research design. A type of pre-experimental design in which a single group of test units is exposed to an experimental treatment and a single measurement is taken afterwards. It only measures the post-test results and does not use a control group. It is used in the present research work to check the impact of the integration of *Aidodys* app on the reading fluency of dyslexics. By using this application, we are going to have an idea about their needs through making learners' profiles that go with their comfort of reading.

Procedures

The procedures of the quantitative data gathering are divided into two main steps:

Step one: pre test

First, a specific test called one-minute reading test is used to assess participants' reading fluency of certain simple words and count the spent time. Then, creating profiles to these learners is to be done according to their reading comfort depending on *Aidodys* software.

Step two: Intervention and post test

Step two includes using *Aidodys* app with the same learners and measuring again the spent time after the treatment.

Qualitative Data Collection Tools

A Semi Structured Observation

There are two used tests in this observation: A sentence reading observation, and a text reading observation. Learners are supposed to read some sentences and one text from their textbooks before *Aidodys* introduction, and then, read the same sentences and text after being adapted in *Aidodys* software. The researcher will observe the reading fluency through the accuracy and prosody of these learners.

A Semi Structured Interview (with a speech therapist)

This step of interviewing the speech therapist will allow us to collect some information about dyslexics in Algeria, what are the solutions used to help them, are there any cooperation or suggestions to help them…

10. Data Analysis Procedures

As far as quantitative gathered data are concerned, a statistical analysis procedure will take place. the time spent during word reading before and after *Aidodys* integration will be counted and then compared.

For the qualitative data, the observation will be represented in tables coded with kays, then results will be analysed after comparing and tracking the progress of the reading fluency of learners. As far as the semi structured interview is concerned, thematic analysis is used.

11. Population and Sample

For this study, the targeted population is primary school dyslexic learners who are currently resuming their studies at Ben Chaib Saleh primary school Arris-Batna. These learners differ in age and level. Most of them are struggling to pass to upper grades because of their reading difficulty. All in all, our sample is structured of few young dyslexic learners who study in one primary school. As has been stated before, we could find these learners through the medical care assistance archives found at Arris high school, with the help and agreement of its speech therapist.

Also, a speech therapist working in the center of learners with disabilities (Draa Zitoun, Arris-Batna) accepted to first, test and confirm the cases, then have an interview and answer our questions in order to achieve a complete view of our problem. (see appendix 08)

CHAPTER ONE
DYSLEXIA AS A
READING DISABILITY

CHAPTER ONE: DYSLEXIA AS A READING DISABILITY

Introduction

1. Reading: An Overview

1.1. What is Reading?

1.1.1. Decoding Process

1.1.2. Recognition

1.1.3. Comprehension

2. The Neuro-anatomical Description of Reading Process

2.1. The Occipital Lobe: the visual cortex

2.2. The Angular Gyrus

2.3. The Temporal Lobes

2.4. The Frontal Lobes

3. The Difference Between Reading Disabilities and Dyslexia

4. Dyslexia

4.1. Definition

4.2. Operational Definition of Dyslexia

5. Description of the Brain Faculties Causing Dyslexia

5.1. Dyslexic Brain Functioning

5.2. Types of Dyslexia

Conclusion

Introduction

At their early age of literacy, young learners are expected to develop a competence in reading and writing upon which they base their future learning and motor skills building. Unfortunately, some learners find themselves unable to read, thus condemned as being "less intelligent" and "lazy" when they are in an environment unaware of their case. For this reason, some serious behavioural problems and anxiety take place. Learners facing this problem are, contrarily to what is assumed, as intelligent and hardworking as others, but suffer from dyslexia. The present chapter reviews the notion of dyslexia and looks at its origins; being it neurological, behavioural or psychological. Additionally; since reading is in the core of this chapter, the literature review seeks to find the processes it follows in the brain, and the existing relationship between reading and dyslexia. The ultimate objective is to have a clear image of "**dyslexia as a reading disability**".

1. Reading: An Overview

In addition to writing, reading is the other cornerstone of literacy. It has a fundamental role in growing the brain and its ability to develop foundational language skills for future learners' success.

1.1. What is Reading?

Myriads of assumptions and definitions of reading exist. Reading is a multi-dimensional complex process that involves different physical and cognitive operations. Long, Wood, Littelton, Passenger, and Sheery, (2011) assume that "[…] reading comprises processes of decoding, word recognition, comprehension and articulation…these skills themselves are dependent upon other language related skills, such as phonological awareness, and cognitive processes." (p.241) In other words, reading is more than a simple process of

uttering written words, but it couples both language comprehension and word recognition with cognitive processes to build meaning.

In this regard, Day (2018) states that reading is a number of interactive processes between the reader and the text, in which readers use their knowledge to create and to construct meaning.' (p.198). Simply put, and according to Day's explanation, a number of processes are at work when people read and comprehend. These processes voiced by scholars in the realm of reading process are decoding, recognition and comprehension.

1.1.1. Decoding Process

Decoding is the ability to crack the code that the word carries behind letters and sounds. Many scholars (Frith 1985;Chall 1997; and Ehri 1998,2005) agree that "decoding" is a fundamental step in the reading process. They believe that decoding goes through three major stages: the pre-alphabetic phase, the alphabetic phase, and the consolidated or orthographic phase.

The pre-alphabetic phase is to learn separate words related to visual cues. According to long et al (2011) "[…] for example, children remember the word 'look' because the two letters 'oo' in the middle can remind them of a pair of eyes […]" (p.243). On the other hand, the alphabetic phase is divided into two stages: The Partial alphabetic stage that is the understanding of the alphabetic principle in their written form; and the full alphabetic stage that refers to learning what sound goes with which letter, and combining them in sequences to memorize common words spellings. (sound-letter correspondence, also known as phonics).

The consolidated or orthographic stage process patterns rather than sound by sound decoding.
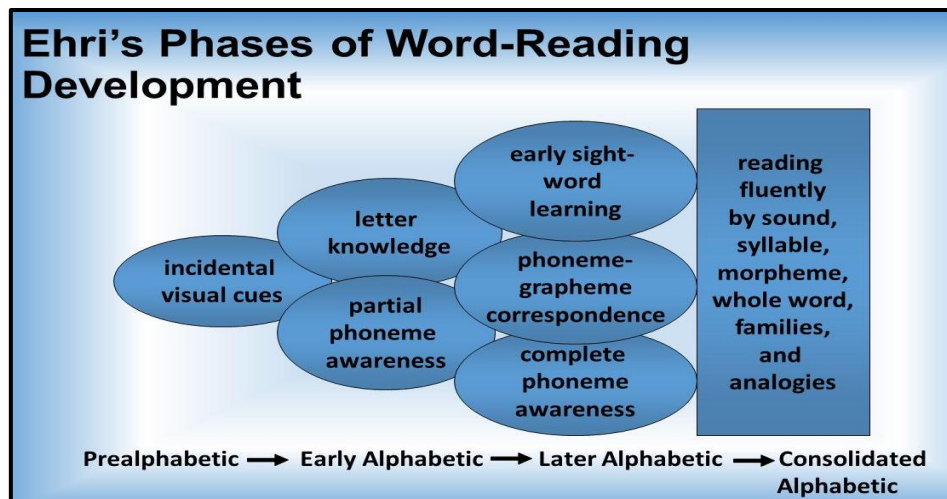
*. Figure 1.*Ehri Phases of Word Reading Development. **Adapted from:** Iowa Core: Building a Strong Foundation of Literacy Skills(blaisehins, June 22 & 23, 2015)
https://slideplayer.com/slide/10563919/

As figure 01 shows, the stages are scaffolded and built one after the other starting from the pre alphabetic stage in which incidental visual cues are detected, then, other phases like letter knowledge, early sight-word learning, and complete phoneme awareness are developed in the alphabetic stage. Reading fluency comes at the end in the consolidated stage

1.1.2. Recognition

The ability to identify and analyse meaning attached to words is known as recognition. Recognition is the crux upon which advanced reading skills depend. A number of computational models of skilled reading are proliferated: McClelland &Rumelhart, (1981); Grainger & Jacobs, (1996); Coltheart, Rastle, Perry, Langdon, & Ziegler, (2001); Plaut, McClellnd, Seidenberg, & Patterson, (1996) (as cited in Chang, 2015). These models are far from being perfect, but Coltheart et al's Dual Route Cascaded Model (DRC) is considered as a reliable one since it combines all the previous mentioned models.
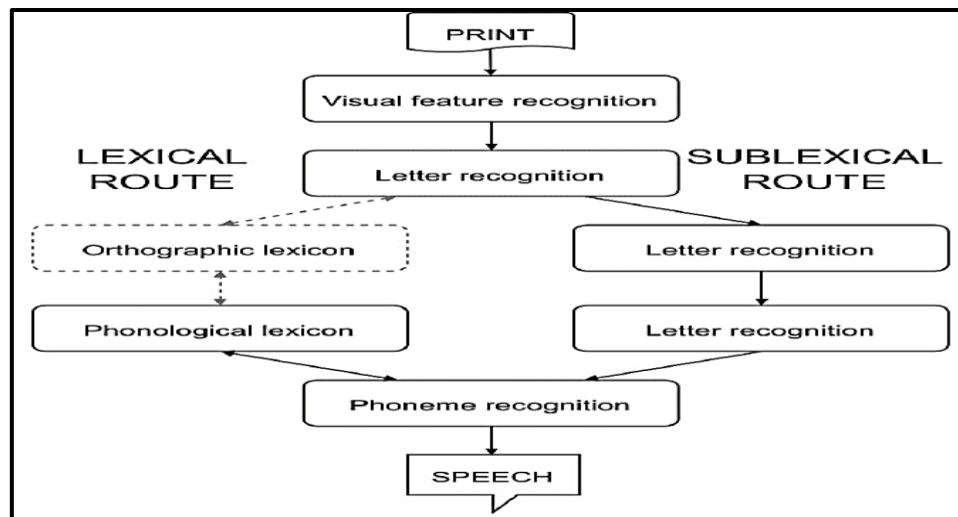
Figure 2. DLC Model of Reading Aloud and Word Recognition. **adapted from**
https://www.researchgate.net/figure/The-DRC-model-of-reading-aloud-and-word-recognition-The-grayed-out-features-of-the_fig1_323951294

According to Long et al (2011), there are two main available routes to read a word. The identified letter sequence is matched against a lexicon of all known words in the first route. Once a match is found, both the phonological representation of the word (i.e. how it is pronounced) and its meaning (semantics) are activated so the correct word is spoken aloud. This is known as the lexical route. Likewise; the second route involves known and unknown words, and letter-by-letter decoding of the printed word based on known rules about which sounds go with which letters, this is known as sub-lexical route. (p.244).

To put it differently, the two routes are simultaneously activated while reading. If the word is familiar, it takes the lexical route where there will be a phonological and semantic matching to all known words, and find the correct one; whereas when the word is not familiar, it takes the other sub-lexical route where a "letter-by-letter decoding" and "which sound goes with which letter" matching process will take place to get eventually to word utterance.

In simple terms, word recognition includes sight recognition of the written word, decoding alphabetic principles along with spelling-sounds correspondence, and phonological awareness including phonemes, syllables, sounds, etc…

1.1.3. Comprehension

Comprehension is what switches "decoding" into "reading". Decoding and pronouncing a set of combined letters are the two angles of the reading triangle, but with the ability to assemble grammatical structures and derive meaning from words and sentences, the reading process becomes complete.

Two prominent models were developed in the literature about comprehension: The Simple View Reading (SVR) and Scarborough's Reading Ropes. The SVR was adopted by the Rose Report and forms a central part of the Primary National Strategy's view of literacy learning (Rose, 2006; DfES, 2006) (as cited in Teaching Times Article,2009); yet, it is not a recent idea since Gough and Tumner introduced it in 1986.

As a formula, The Simple View of Reading (SVR) presents Reading Comprehension (RC) as the product of Listening Comprehension (LC), i.e. Comprehending the meaning of texts being read, and also presents Decoding (D) that is reading each word in texts accurately and fluently.

Scarborough's reading Ropes gives a detailed view about reading:
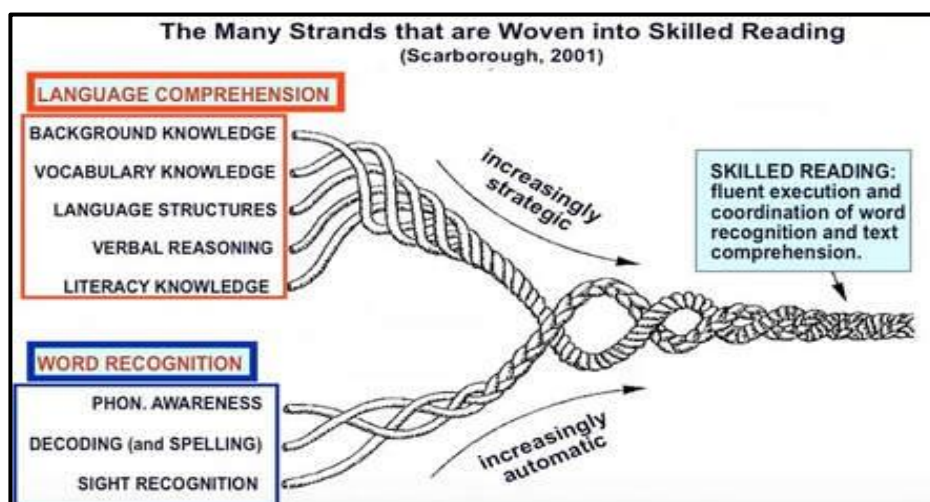
Figure 3. Scarborough Reading Ropes The Many Strands That are Woven into Skilled Reading.***Adapted from***:*https://slideplayer.com/slide/12748467/*

This model compares skilled reading to a rope, which consists of many different strands that are essential for the rope (skilled reading) to come together. The first strand according to Scarborough's model consist of language comprehension that combines other language related skills namely the background, vocabulary, structures of language reasoning and literacy knowledge, and on the other hand, word recognition under which phonological awareness, decoding and sight recognition are classified.

To conclude, reading encompasses in its process different skills such as language comprehension, recognition, decoding, phonological awareness, vocabulary…to becomes accurate, fluent, and increasingly automatic.

2. The Neuro-anatomical Description of Reading Process

Reading is a complex process. It requires the activation and coordination of different areas of the brain's left hemisphere found in the occipital lobe, the angular gyrus, the temporal lobe (Wernicke's area), the front lobe (Broca's area), and finally, the motor cortex. (Snowling, 2006, p.150)
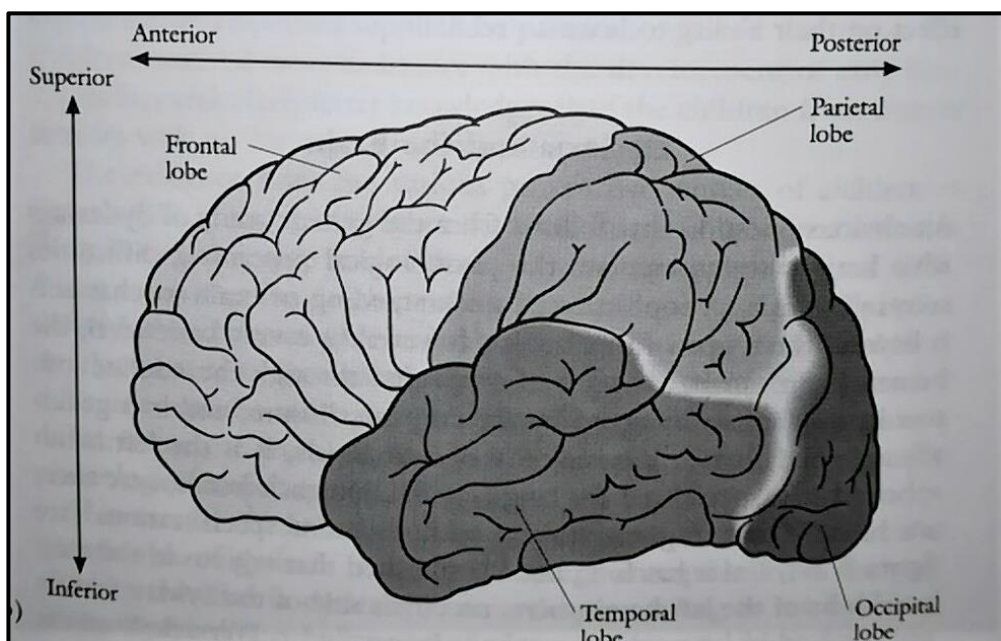
Figure 4. Parts of the Brain **Adapted From**: dyslexia, Margaret,JSnowling, 2006 p. 150.

2.1. The Occipital Lobe: The Visual Cortex

The visual cortex, located in the back of the brain, is involved in the identification of the visual features and shapes (straight, crooked, left, right…) of letters through the retina of the eye via pathways to the visual cortex. The word "cup", for instance, includes different shapes (C-U-P) that will be identified in the visual cortex.

2.2.   The Angular Gyrus

The left angular gyrus region has connections to somaesthetic (anterior parietal lobe), visual (occipital lobe), and auditory (temporal lobe) cortex. Furthermore, the angular gyrus is in direct proximity to primary language cortex (Wernicke's area). Geschwind (1964) argued that the development of the angular gyrus–inferior parietal region of the human brain is instrumental in permitting cross-modal sensory associations (e.g., visual-auditory, visual-tactile) and that these cross-modal associations are a prerequisite for the development of language. (Hier;1987)
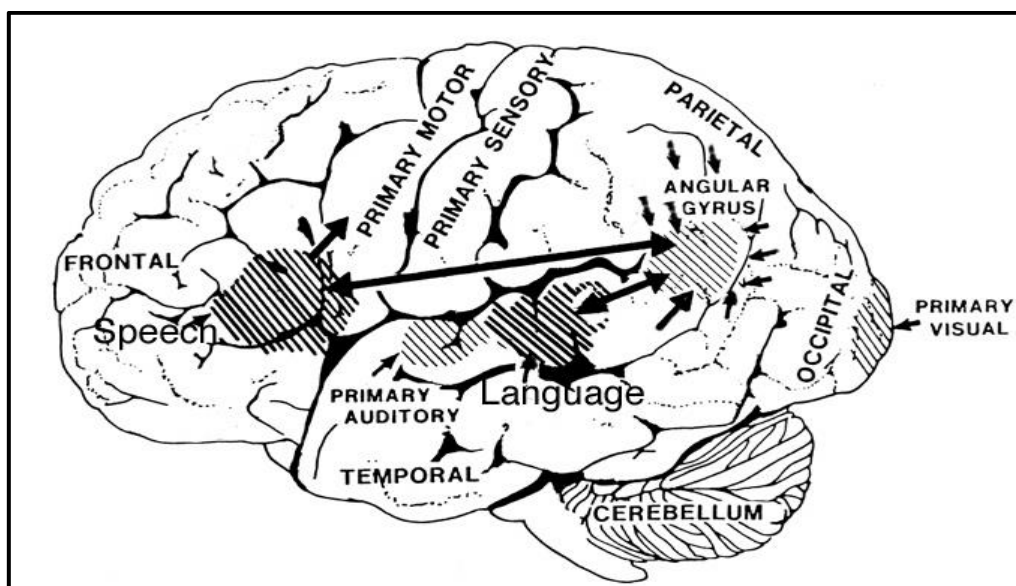
Figure 5. The Angular Gyrus in the Brain. **Adapted From** http://brainmind.com/AngularGyrus.html

2.3. **The Temporal Lobes**

They are located in the lower back of the brain and associated with hearing and interpreting sounds (discriminating speech sounds and phonological awareness). Any misperception of phonemes can change the meaning of words, that is why children who have problems in recognizing speech sounds will face difficulties with phonological awareness and decoding.

Crystal (1987, p.261) assumes "[…] in the upper back part of the temporal lobe, extending upwards into the parietal lobe, a part known as Wernicke's area which plays a major role in comprehension […]" .In other words, this area in the temporal lobe is one essential element of a larger network involved in language comprehension and interpretation of meaning.
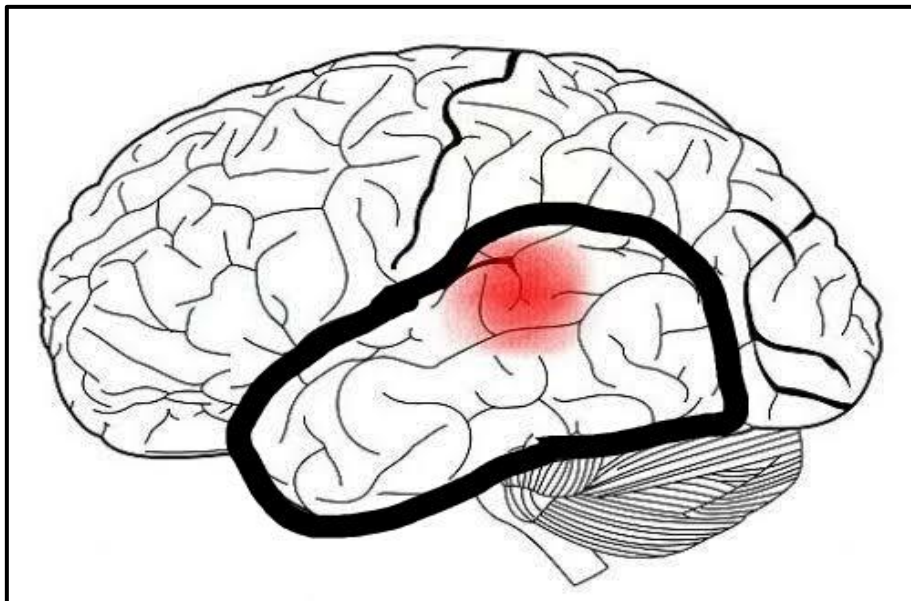
Figure 6. Localization of Wernicke's Area in the Temporal Lobe **Adapted from**:*http://fr.baiug.org/the-area-of-wernicke-and-understanding-of-language-2043*

2.4. The Frontal Lobes

as the name suggests, they are located at the front of the brain. The frontal lobes are associated with higher cognition, voluntary movements, and expressive language. the left half

of the lobes is language related, thus responsible for speech production, reading fluency, grammatical usage and grammar rules.

The lower back part of the frontal lobe is primarily involved in the encoding of speech. This is the Broca's area. The Broca area is connected to other regions of the brain, including the Wernicke area, by a neuronal tract known as the arcuate fasciculus. In addition to serving a role in speech production, the Broca area is also involved in language comprehension, in motor-related activities associated with hand movements, and in sensorimotor learning and integration. (Rogers,2016)
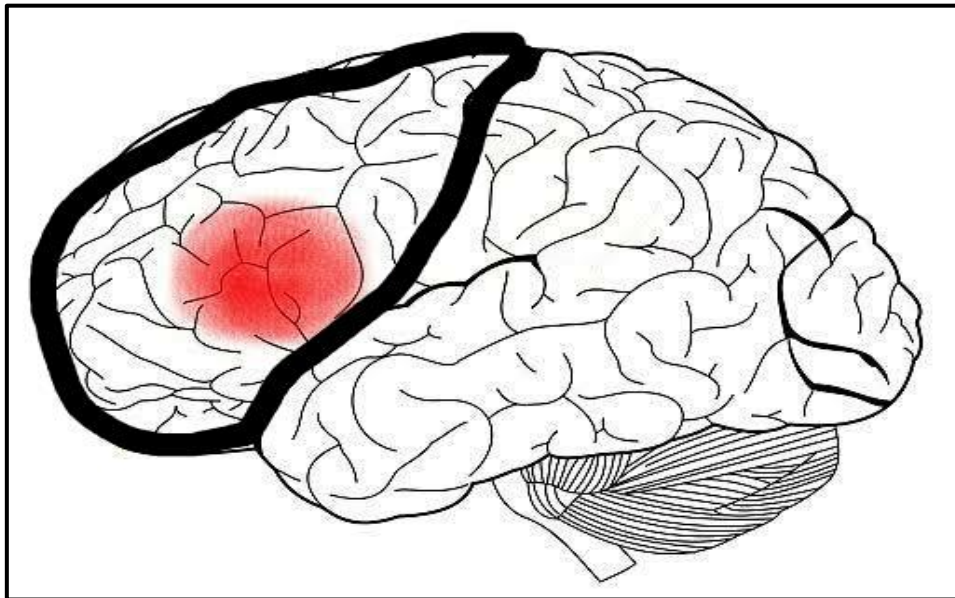
Figure 7. Broca's Area **Adapted from***:http://fr.baiug.org/the-area-of-broca-and-understanding-of-language-2043*

To conclude, reading pathway starts from the eye (retina) to the **visual cortex** to analyse the shapes of the letters, then goes to the angular gyrus. This latter is considered as the word storage of the brain, and any damage occurring in this area will result of severe word finding and confrontive naming difficulty.

In the temporal lobe, meaning is constructed in Wernicke's area (make the association between the word and its meaning through bringing the picture that goes with the

word/sentence) and sounds related to that word are deciphered in auditory cortex in the temporal lobe.

The frontal lobe where Broca's area responsible for speech production exists, the recognition of single letters and letter combination that form the word occur. After these processes, the nerve impulse moves to the **motor cortex** that is a part of the frontal lobe of the brain which controls muscle movement, including voluntary movement, and speech (facial muscles, tongue...).
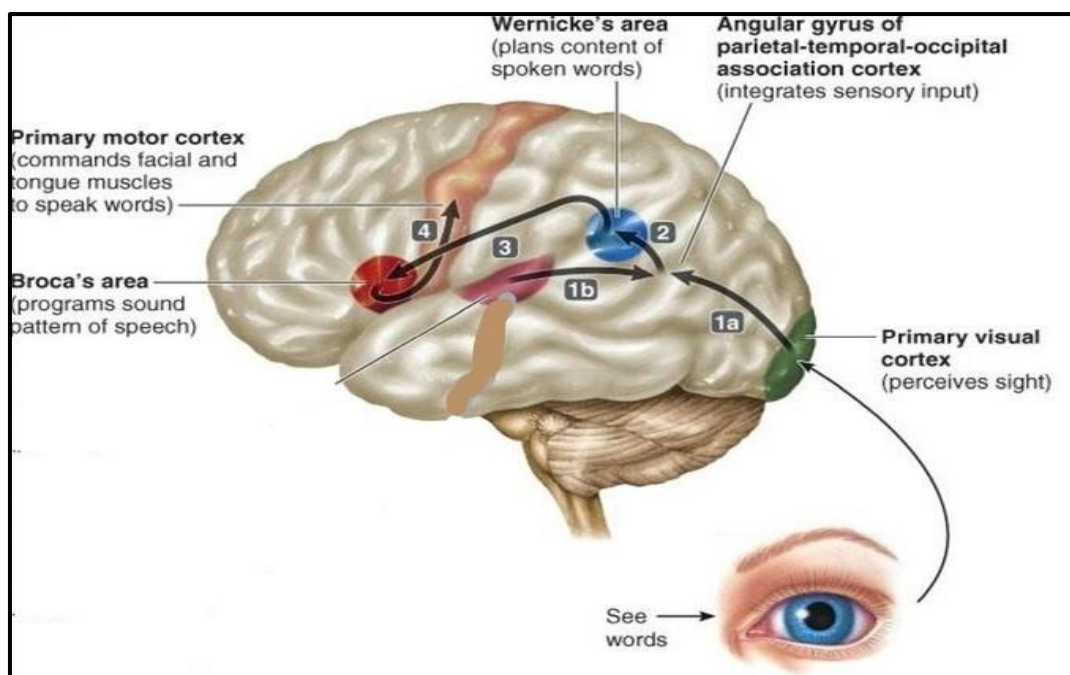
Figure 8. The Anatomical Description of Reading .**Adapted From:**
https://slideplayer.com/slide/13005763/

Figure 8 demonstrates the reading process starting from the eye and the visual cortex that perceives the words through analysing their different shapes and interpret them into meaningful letters. Then comes the role of the angular gyrus of the parietal-temporal-occipital association cortex to integrate sensory input. The content of the spoken words is planned in wrinkle's area then sent to Broca's area to program sound patterns of speech. The ultimate step is to send the nerve impulse to the primary motor cortex that commands facial and tongue muscles to speak words.

3.   The Difference Between Reading Disabilities and Dyslexia

Although dyslexia and reading difficulties are used interchangeably, they are different. Thompson (2019) stated that Dyslexia is among the most common learning disabilities. Between 70% and 80 % of people struggling with reading have dyslexia, according to the textbook "Child Psychology."" In other words, "reading disability" is an umbrella term that includes dyslexia. the Simple View Reading approach (SVP) of Gogh and Truner (1986) provided a diagram that gives a simple explanation of the difference between the two (as cited in wooldredge,2018)
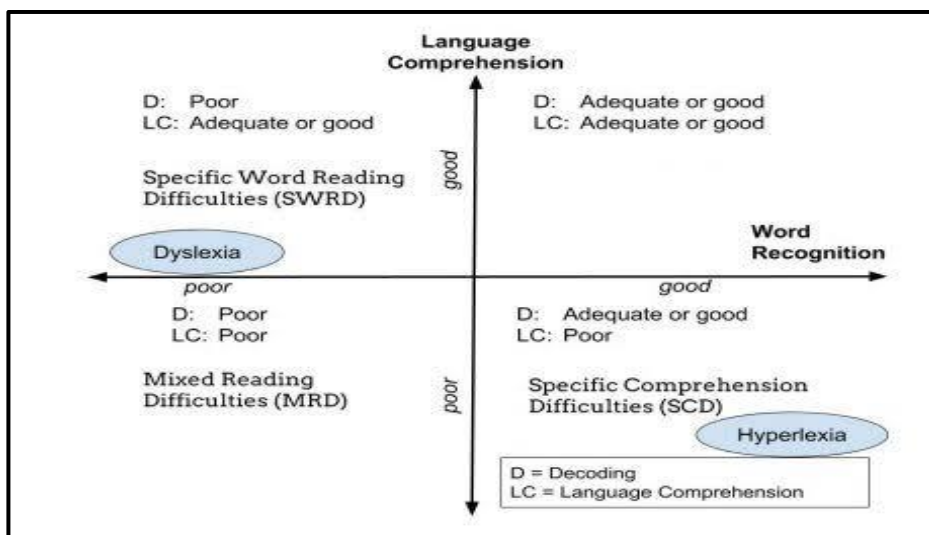
Figure 9. The Simple View Reading (SVR) .**Adapted**
From*:http://ortongillinghamonlinetutor.com/the-simple-view-of-reading-svr-part-1/*

From this model, the distinction between dyslexia and reading difficulties is clear. Dyslexics do not struggle with language comprehension, but according to International Dyslexia Association (2019), they have "difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities."

Dyslexia is a disorder of phonological processing and reading fluency. Students with dyslexia often struggle to identify the sounds for a particular letter or segment a group of

letters. This in turn affects the ability to read words and paragraphs fluently, to spell words, and to use words in writing.

however, reading difficulties, according to the *Encyclopedia of Mental Disorders,* (as cited in Luman Learning, 2019) "involves significant impairment of reading accuracy, speed, or comprehension to the extent that the impairment interferes with academic achievement or activities of daily life."

A learner with a reading disorder may have impaired phonological processing skills, reading comprehension, and/or reading fluency.

4. Dyslexia

The etymology of the term dyslexia shows that dys means "problem with", and lexia "word". The first study of the condition was in 1917 by James Hinshelwood, but the original identification was by W.P Morgan who considered it as a "congenital word blindness". (Long et al, 2011)

4.1. Definition

Dyslexia encompasses a wide range of different interpretations and outlooks. Maisonny (1951) defined dyslexia as "a particular difficulty in identifying, understanding and reproducing written symbols, which has as a consequence of deeply disturbing the learning of reading, spelling, text comprehension and subsequent academic acquisitions" (p.52)

Breznitz (2002), on the other hand, says that "dyslexia is best thought of as a neurological syndrome, which results in specific cognitive deficits with respect to working memory and automatization of learned behaviour… individuals with dyslexia also appear to have difficulties forming association between visual and verbal stimuli." (cited in Long et al,

p.252) Simply put, dyslexia is related to a deficiency in the functioning of the brain that leads to the difficulty of letter-sound correspondence.

In this vein, the National Institute of Child Health and Human Development (NICHD) (2012) defined dyslexia as a specific neurological learning disability that is characterized by difficulties with accurate and / or fluent word recognition, and by poor spelling and decoding abilities. These difficulties result from a deficit in the phonological component of language in relation to other cognitive abilities. consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and the background knowledge.

4.2. Operational Definition of Dyslexia

From the consensus meeting held at the Hyatt Hotel in New York City, on April 9-10, 1994, an operational definition of dyslexia is released.

Dyslexia is one of the several distinct learning disabilities. It is a specific language-based disorder of constitutional origin characterized by difficulties in single word decoding, usually reflecting insufficient phonological processing abilities. These difficulties in single word decoding are often unexpected in relation to age and other cognitive and academic abilities; they are not the result of generalized developmental delay or sensory impairment. Dyslexia is manifest by variable difficulty with different forms of language, often including, in addition to problems reading, a conspicuous problem with acquiring proficiency in writing and spelling. (cited in Dickman, 1995; posted in Dickman consulting alliance, 2015).

simply, dyslexia is a linguistic learning disability performed in the poor ability of decoding and phonological processing, in addition to reading problems, writing, spelling and acquisition proficiency.

5. Description of the Brain Faculties Causing Dyslexia

As has been explained earlier, dyslexia is the inability to connect sounds that make up words with the letters that represent these sounds. Reading is a complex process because there is no area in the brain specifically designed to read, but the whole process requires the rearrangement of different areas to create a sort of "network" to read.

Brennan (2019) upholds that the condition stems from differences in parts of the brain that process language. Imaging scans in people with dyslexia show that areas of the brain that should be active when a person reads don't work properly.

5.1. Dyslexic Brain Functioning

Dyslexic people display an abnormal functioning of the brain. the Learning disability center of Washington University used an MRI spectroscopic images of the normal and the dyslexic brain in order to highlight the misfunctioning occurring in the dyslexic one. They measured the activation of areas of the brain through blood oxygenation: When a part of the brain is active, the level of oxygen-rich blood flow increases in that area, and shows up brighter on the scan. From this signal, researchers infer the location and amount of activity that is associated with a task. From this point, seeing where brain activity does and does not appear helps researchers understand possible causes of this problem. (Harstad, 2017)

The study shows that less performing areas on the dys brains are the ones that are crucial to phonological processing
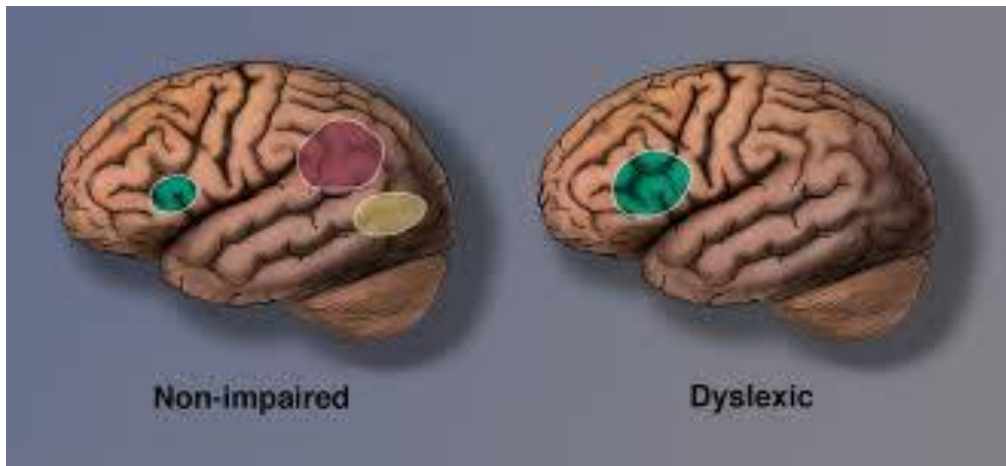
Figure 10. Non-Impaired Vs a Dyslexic Brain. **Adapted From**:*https://www.google.com/search?q=kondisi+otak+anak+disleksia&hl=fr&sxsrf=ACYBGNS6bZpz jLRIzqIWC9SstVtYbgPUVA:1580391941344&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjJ45Piuqvn AhVBrHEKHRTzDnMQ_AUoAXoECAwQAw&biw=1242&bih=568&dpr=1.1#imgrc=WN52Hyt7I6snEM*

The figure above shows the dyslexic brain compared to the non-impaired one. Expectedly, an over-activity in the Broca's area is signalled, and an under activity in other critical regions of the brain used for reading is detected. This misfunctioning affected the relationship between letters and letter groups with the spoken sounds they represent.

5.2. Types of Dyslexia

Several types of dyslexia have been documented, yet two main types are frequently cited. The first type of dyslexia is usually discovered at school. During the first years of learning, teachers can identify some learners who consistently fail at the reading tasks despite adequate intellectual ability, equal learning chances, appropriate instruction, and sufficient educational exposure. This type of dyslexia is innate, inborn, genetic: it is the developmental dyslexia.

On the one hand, Developmental dyslexia includes what is known as phonological dyslexia, that is, according to Crystal (1987), is the "[…] inability to read on the basis of the 'phonic' rules that relate graphemes to phonemes[…]" (p.272) in other words, people with this problem may read familiar words, but not new, technical, and nonsense words.

On the other hand, the reading inability of a literate person after serious brain injuries, strokes or traumas can cause "acquired dyslexia". This latter is divided into two main categories: surface and deep dyslexia. Crystal (1987) explained the former as poor word recognition as a block and mispronunciation that lead to misinterpretation of the meaning, and the latter (deep dyslexia) as the inability to read new unfamiliar words in addition to semantic errors combined with visual errors too. An example of this can be *sympathy* as *orchestra* because of the resemblance of the word *sympathy* to *symphony*.

Conclusion

This chapter reviewed the literature about the reading skill and described its neuroanatomical process in the brain. Reading is a complex process that is not inborn but acquired through involving different physical and cognitive operations. The over and the under activity of certain areas in the brain while reading cause "dyslexia". So, this chapter reviewed mainly dyslexia, and focused also on the difference between reading disabilities and dyslexia. As a conclusion, dyslexics have no comprehension problems but recognition difficulties so, dyslexia is the inability to decode and recognize words. For this reason, some proposed solutions are pointed out in the next chapter.

CHAPTER TWO
PEDAGOGICAL REMEDIES FOR DYSLEXIC LEARNERS

CHAPTER TWO: PEDAGOGICAL REMEDIES FOR DYSLEXIC LEARNERS

Introduction

Reading Instruction Changes Brain Construction…a Way to Improve Dyslexic Reading

1.   Pedagogical Solutions to Help Dyslexics

1.1.   The Orton–Gillingham Method

1.2.   Structured Literacy Instruction

1.3.   Multisensory Approach

1.4.   Differentiated Instruction

1.5.   Inclusive Education

2.   The Integration of Assistive Technology to Help Learners with Dyslexia

2.1.   Hardware ATs/ICT

2.1.1.   E-readers

2.1.2.   iPad

2.1.3.   Laptop Computer

2.2.   Software AT

2.2.1.   Speech recognition software

2.2.2.   Text-to-speech software

3.   Aidodys

3.1.   Definition

3.2.   Origins of Creation

3.3.   How Does a Dyslexic See the Text ?

3.4.   How Does Aidodys Work to Help ?

3.5.   Advantages

Conclusion

Introduction

Scientifically proven, the brain forms 2% of the body's weight but consumes 20% of its energy (in case of a normal person). A dyslexic makes five times more efforts to get eventually to five times less similar results. Considerably; they consume more energy in reading fluency and comprehension, and become exhausted to fulfill other tasks. After recognizing dyslexia as an impediment that paralyzes the learning success, researchers now are trying to find effective solutions through pedagogy. They have been working not only on the reading fluency, but on alternative ways to reduce the degree of exhaustiveness for these young kids. From this assumption, this chapter sheds light on some pedagogical approaches to teach dyslexics, and focuses on *Aidodys* software which is one of the suggested solutions that facilitates the task for both dyslexics and their teachers

Improving Dyslexic Reading

Reading is not a natural process that has a specific area in the brain serving as a "reading center". Rather, it is a network including different parts that change anatomically and functionally while learning to read (Turkeltaub et al., 2003). Considerably, studies highlighted the brain-based differences of dyslexic children who follow effective reading instruction compared to those who fail to make gains (Davis et al., 2011; Odegard, et al., 2008). (cited in Edwards; 2015, paragraph 6).

Simply put, the effective and appropriate reading instruction can stimulate areas of the brain to work appropriately, thus improve the reading fluency of learners with dyslexia. In other words, Individuals with dyslexia can be helped by explicit, cumulative and systematic evidence-based approach

1. **Pedagogical Solutions to Help Dyslexics**

Dyslexia is a learning style rather than a handicap. In this regard, pedagogical procedures and researches took the initiative to continually conduct studies to set effective solutions. Considerably; they proposed different approaches such as inclusive education, the Orton–Gillingham method, the Structured Literacy approach, the multisensory learning, and differentiated instruction.

1.1. **The Orton–Gillingham Method**

The Academy of Orton-Gillingham Practitioners and Educators (2018) defined the approach as:

> a direct, explicit, multisensory, structured, sequential, diagnostic, and individualized way to teach literacy when reading, writing, and spelling does not come easily to individuals, such as those with dyslexia. It is most properly understood and practiced as an approach, not a method, program, or system.

Differently put, this approach is designed to teach the connections between letters and sounds explicitly through the visual, the auditory, and the kinaesthetic pathway to the brain where concepts are taught in a logical well-planned sequence, i.e. each lesson is based on previous grasped lessons (scaffolding) with constant and consistent reviewing. This goes hand in hand with the concept of individualization that fits the needs of every learner aside. For this reason, it has been proved that it is effective if used correctly, so it is included in different software specifically designed for dyslexics.

1.2. Literacy Instruction

Structured Literacy Instruction is, according to the International Dyslexia Association (2018), a teaching approach effective for all students and essential for students with dyslexia. Cowen (2016) argues that this approach combines phonological awareness, morphological recognition, decoding, spelling, and sentence/paragraph comprehension in a systematic cumulative, diagnostic and explicit manner. In other words, it follows a sequential progressive teaching starting from basic concepts to difficult ones. Moreover, it focuses on individualized instruction besides direct teaching of concepts.
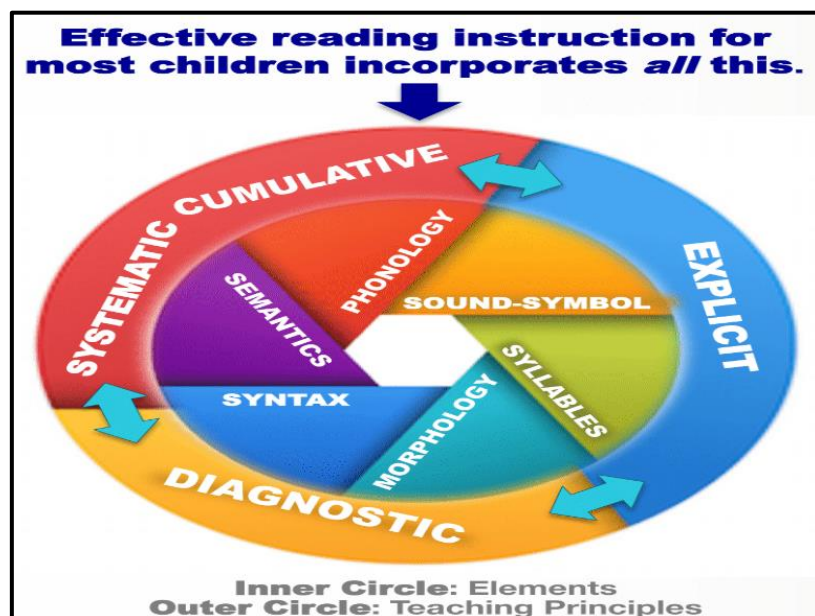
Figure 11. Structured literacy cycle. Reprinted From
https://scholarworks.umt.edu/cgi/viewcontent.cgi?article=2349&context=umcur

1.3. Multisensory Approach

A multisensory approach, "also known as VAKT (visual-auditory-kinesthetic tactile) implies that students learn best when information are presented in different modalities (Murphy, 1997, p. 1) (cited in Brenda 1999, p. 4). Differently put, this approach does not put emphasis only on listening and reading, instead, it tries to use all senses including the gustatory (relating to the sense of taste) and the olfactory (concerning the sense of smell)

ones. For example, instead of making learners listen and write the word '*orange*', it is preferable to show them a real orange, make them taste it, smell it…in order to have a full image about the object in mind

This approach is beneficial for normal learners but more effective for learners with learning difficulties like dyslexia. The use of vocabulary cards is one example that can demonstrate the way this method helps dyslexic learners remember the word in a form of an image rather than sounds and morphemes since, according to the dyslexia foundation of New Zealand, Dyslexic individuals tend to think in pictures rather than words.

Figure 12. Examples of the Multisensory Approach From
https://www.teacherspayteachers.com/Browse/Search:high%20frequency%20word%20flashcards

Another example is to write the words and the ones they refer to the same word using the same color. For instance:

The pupil took the book

He took the book

The pupil took it

He took it

On the other hand, teachers can simulate some action verbs, sounds, and manners to help dyslexics remember the word.

1.4. Differentiated Instruction

Kalbfleisch (1998) introduces differentiated classrooms as "responsive to students varying readiness levels, varying interests, and varying learning profiles" (p. 54). Through the use of differentiation, the strength points of dyslexics are spotted and based upon to design lessons in order to help them make progress in learning. Tomlinson (2014) describes differentiated instruction as factoring students' individual learning styles and levels of readiness first before designing a lesson plan […] Research on the effectiveness of differentiation shows this method benefits a wide range of students, from those with learning disabilities to those who are considered high ability. (cited in Weselby 2018)

Differentiation can be in the content, the process the product or the learning environment. i.e. in a classroom that contains dyslexics, the teacher is supposed to make profiles for learners according to their level, abilities, strengths and weaknesses, and design lessons accordingly varying not only in the content and the process in which it is supposed to be taught, but also in the product (giving authentic feedback to dyslexics depending on the severity of their case) and the environment(making sure that the environment is flexible enough to serve the needs of dyslexics).

1.5. Inclusive Education

UNESCO (2000) believes that Inclusive education is underpinned by a belief in children's rights and in equal educational opportunities and access for all learners (cited in long et al, 2011, p. 266). In other words, inclusive education ensures a common learning environment through putting all learners under the same circumstances and gives them equal

opportunities to learn. In this regard, the Canadian Inclusive Education Center (2017, p. 01) upholds that:

"Inclusive education ensures access to quality education for all students by effectively meeting their diverse needs in a way that is responsive, accepting, respectful and supportive. Students participate in the education program in a common learning environment with support to diminish and remove barriers and obstacles that may lead to exclusion"

From the definitions above, inclusive education is not specifically designed to help dyslexics, but it is meant to help all children with learning difficulties including the ones suffering from dyslexia. (long et al, 2011, p.268)

2. Assistive Technology for Dyslexics

Technology was the powerful tool that has revolutionized the field of education. It has transformed and facilitated the task for both teachers and learners. Teachers, in terms of teaching materials and time management, and learners, specifically learners with disabilities, in terms of needs compatibility through new tactile and digital tools.

As has been mentioned earlier, effective instruction can help students overcome the difficulties faced during the learning process. From this point, current researches have realized that a wide range of options in technology can be an important part of effective instruction and student support. Electronic devices like computers have enabled learners to access a wide range of information in different formats such as audio, video and internet, sharing and documenting photos and images, to represent ideas using presentation applications, and to use analytical tools such as advanced graphics calculator (Churchill and Churchill, 2008 ;Puckett and O'Bannon, 2012) (cited in Tanveer, 2019).

The needs of learners with learning disabilities must be taken into account because they are more likely to perform below average especially in reading and writing. For this reason, technology implementations devoted an important part for their different cases including dyslexics. According to the National Council for Special Education (2018),

> "ICT can be a valuable tool to support pupils with special needs including those with dyslexia. Pupils with learning difficulties can benefit from the visual and auditory nature of ICT. It can be used to develop skills and reinforce learning in a meaningful manner."

Simply put, and considering dyslexic learners, the use of hardware ICT such as laptops, tablets, e-readers are personalized and effective solutions for specific educational needs, allowing learners with disabilities to follow a normal autonomous education.

2.1. Hardware ATs/ICT

Hardware ATs are the physical devices related to computers that are seen, touched and manipulated. Hardware allows to produce and see images on a computer screen, produce sounds, move cursers / pointers around a screen, etc. examples of hardware ATs are laptops, notebooks, personal digital assistant (PDA), palmtops, iPads, and E-readers. These devices were not initially intended to be instructive instruments, but they rapidly moved into schools (Grezlak, 2011; Jackson, 2011; McCrea, 2010). (cited in Elazab Elshazly,2016; p.38)

2.1.1. Laptop Computer

The most common ways in which technology is used to support students with learning difficulties are computer-mediated instruction to improve basic reading as well as access to electronic texts to aid in comprehension (Hecker & Engstrom, 2005). (cited in Bennett et al; 2019).

Laptops are commonly used because they are relatively affordable. Moreover, they can provide a set of different functions combining the audio-visual tactile features.

2.1.2. E-readers

Bélisle (2004) defined e-readers as a digital material developed from the shift of paper to pixel which has produced a new modernized mode of reading qualified as: instantaneous, surface, rhizomic (in network), fragmented and playful unlike the ancestral model which requires concentration, willingness and be attention.

E-readers allow dyslexic readers to better read compared to paper version because of its features such as clear text and fonts, ability to make notes and highlight pieces of text, adapted and modifiable reading speed, adjustable font size and line spacing, presence of illustration, possibility to change space (white between words) with the enlargement of the image, word enlargement (followed with color), automatic reading, and vocal synthesis. So, these features personalize the reading and help readers make adjustments that suit them.

2.1.3. iPad

McClanahan, Williams, Kennedy, & Tate (2012) In analysing research into the use of new technologies with struggling readers, text adjustments are considered to be of the most useful ones. The study investigated the use of the iPad in a number of ways, including reading audio books, using educational websites and utilizing educational games. "…Not only does the iPad provide for increased levels of engagement, it also provides the means for a way in which to assist with increasing awareness of the text and build comprehension" (cited in ElazabElshazly; 2016, p.52).

In other words, the implementation of iPad in classes is beneficial for normal learners, and necessary for dyslexics due to its advantages namely the ease of interaction, the anywhere-everywhere use, e-readership, and suitability for small group teaching (ibid).

2.2. Software AT

Software is a set of instructions, data or programs used to run on a device and execute specific tasks and instructions in hardware. It is divided into application and system software. The former are user downloaded programs that fulfill a need, and the latter refers to operating systems and any program that supports application software. (software testing help)

Miscellaneous educative and assistive technology software specifically designed to help learners struggling with learning difficulties were developed. From this point, some software applications that can help dyslexics exist such as Speech recognition software, text-to-speech software, Lexia, word prediction, OCR, Auto Correct and Auto Text, concept mapping, read for me, and many others.

2.2.1. Speech recognition software

According to software testing help (2019), Voice recognition software is "an application which makes use of speech recognition algorithms to identify the spoken languages and act accordingly. This software analyzes the sound and tries to convert it into text". Example: Google Cloud Speech API, Google Docs Voice Typing, Microsoft Bing Speech API
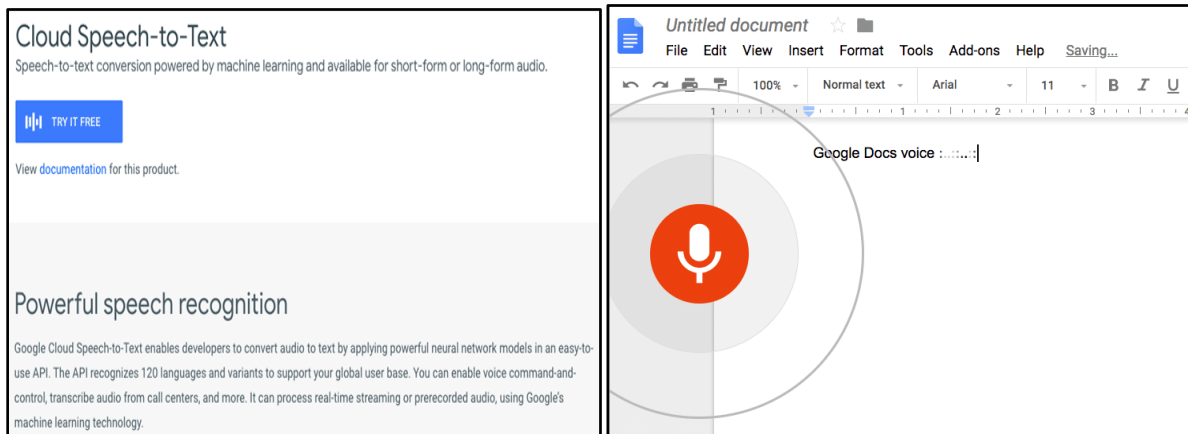
Figure 13. Speech Recognition Software .**Adapted From**
https://www.softwaretestinghelp.com/voice-recognition-software/

A dyslexic learner can use one of these applications to dictate what they are unable to write in order to help them gain time and efforts.

2.2.2. Text-to-speech software

This feature allows users to access a basic screen reader called Narrator, which reads text on the screen aloud while using the computer. Some applications are mac and wordtalk (cited in Bennetts et al; 2019). When Dyslexics are unable to read a text, a sentence, or a word, they can convert it into speech through these applications.

Concept Mapping can assist students in organizing and synthesizing information to make the broader connections necessary for reading comprehension and writing assistance that result in improved performance in content-area instruction. Examples of such software are: bubbl.us, inspiration, and mind-meister. (cited Bunnetts et al; 2019)
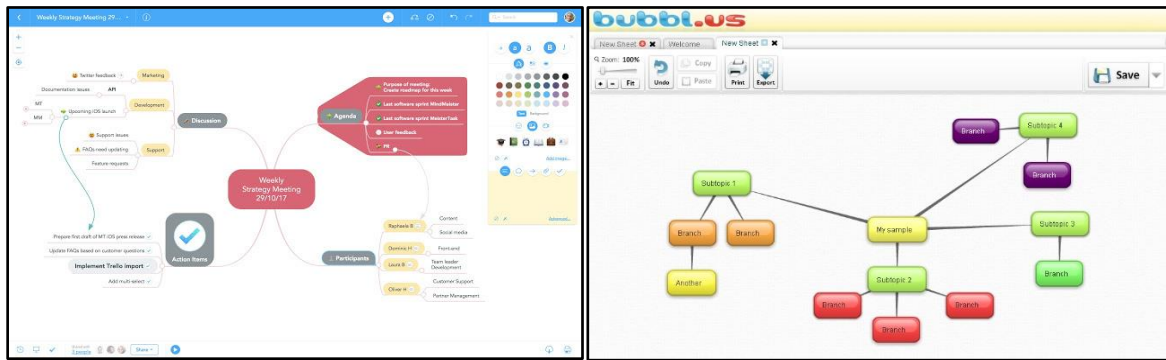
Figure 14. Concept Mapping. **Adapted From**
https://chrome.google.com/webstore/detail/mindmeister/bdehgigffdnkjpaindemkaniebfaepjm?hl=fr

3. Aidodys

"the reading comfort is finally accessible for all"

3.1. Definition

According to Aidodys General Conditions of Use (2016), Aidodys is a social start-up which defends an innovative point of view concerning the access to reading for children, adolescents, and adults' victims of reading and spelling disorders. This company was created for the sake of adapting reading materials to the capacities of the learners: modifications of the layout, simplified and clearer, so encouraging progress.

This application is available online at web navigator (https://www.aidodys.com/). Aidodys promotes inclusive education and differentiation and it provides teachers, health professionals and parents with a tool of personalized adaptation of all sorts of documents to help children with special needs in their daily reading.

3.2. Origins of Creation

APRIL foundation organized a conference on the 30th of June 2015, about dys difficulties and invited the founder of Aidodys to have an insight into it. Corinne Lebocq, a French school aid employee, is meant to help learners with learning difficulties. Julie is one of

her candidates who suffers from dyslexia. With the help of a speech therapist and an optical character recognition software that scans documents and allows modifications in Microsoft Office Word, she could make adaptations of the whole book for Julie. Surprisingly, it could not only facilitate reading for the young learner, but it also increases the degree of comfort to the point where she could read, understand and accomplish the task with her other classmates.

From this, Thibault Lebocq, son of Corinne, come with the idea to translate the work of adaptation done by hand, that took much time, into an application which simplifies the adaptation for teachers, and was of a great help to other learners. Eventually, he became head of Aidodys company.

3.3. How Does a Dyslexic See the Text ?

According to the Academie de Besanson, (p.01) a dyslexic kid reads and sees the words in a different way. One example is the following

Table 1. The Difference between a Normal and a Dyslexic Vision of Texts.

Real text	Same text read and seen by a dys
Monsieur et Madame Renaud vont de Paris à Chamonix. La distance est de 600 km et la voiture consomme 10 litres aux cent kilomètres. Il faut compter 18€ de péage d'autoroute et 8€ de repas pour déjeuner le midi. L'essence coûte 1€ le litre. Ils partent à 8 heures. Quelle est la consommation d'essence ? Quelle est la dépense pour le voyage?	Monsieur etmadamarenovondeupariachameau nit. Ladisten cet deux 600 Km lavoixtureconsso me 10 litrrausanquilaumaître. Ilfocon thé 18€ deux pé âge d'aux taurou tet 8€ derepapourdésjeunéleumidit. Les sens kou tes 1€ lelitreuilpar ta 8 eureh. Kélailaconso mas siondes sans ? Quélailadaipansetotalepourlevoiaje ?

Note: the table is reprinted from *www.academiedebesanson.fr/lecture-dyslexique*

From the two extracts above, difficulties spotted lay in that dyslexics have a problem in letter and word spacing. Moreover, when the last word and the next word begin with the

same letter (distance est), the dys combines them into one word. additionally, he tends to combine the letters to familiar words to him regardless the meaning or the spacing (péage=>pé+age). Moreover, silent letters (heure =>eureh) are a persistent problem.

3.4. How Does Aidodys Work to Help ?

Aidodys provides adaptations to texts depending on learners' needs, preferences and comfort of reading. This latter is done through creating a reading profile, after subscribing. Each learner has his own profile since the difficulties and the degree of the problem differ from one to another. The changes are basically in the fonts, the formatting, the words, the letters and syllables, and the sounds.

Step one: fonts and formatting

After creating the profile, a sample text appears written in a normal style, with propositions to modify the fonts and also with formatting to choose.

Font, letter and word spacing, and line spacing in addition to highlights are included in the phase of fonts and formatting modifications.
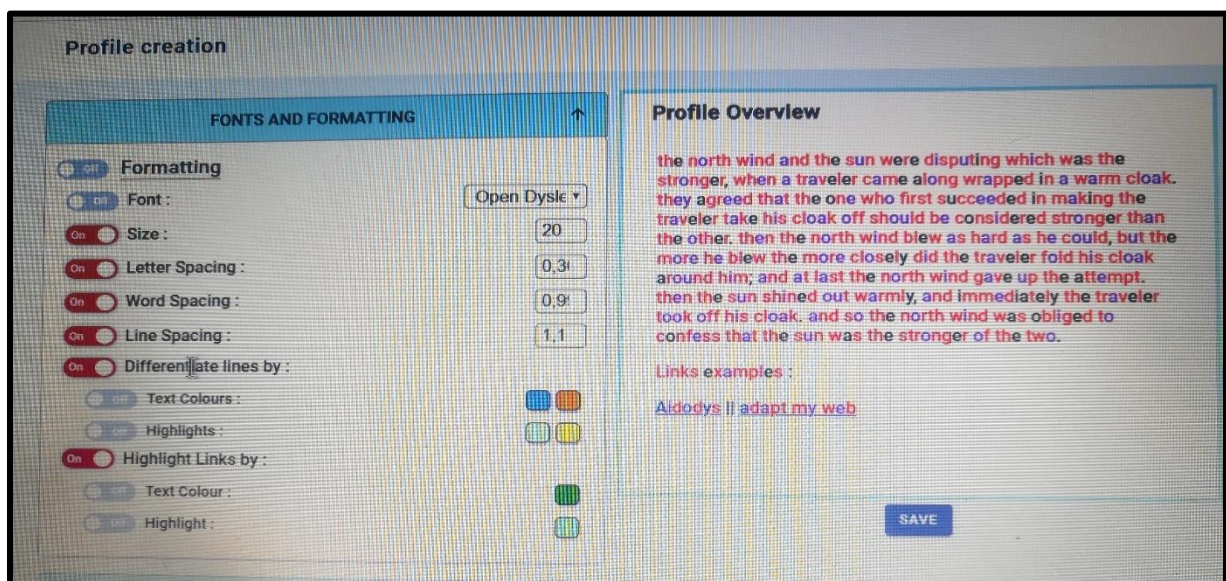
Figure 15. Aidodys Adaptations of texts. Font and Formatting. **Adapted From** Aidodys official website*(https://www.aidodys.com/)*.

After choosing the suitable font for the learner, another option of syllables and words will appear.

Step two: syllables and words

Difficult syllables and words are highlighted depending on the difficulty and the comfort of the learner. The dyslexic chooses the color of the text highlighting, and the difficult words.
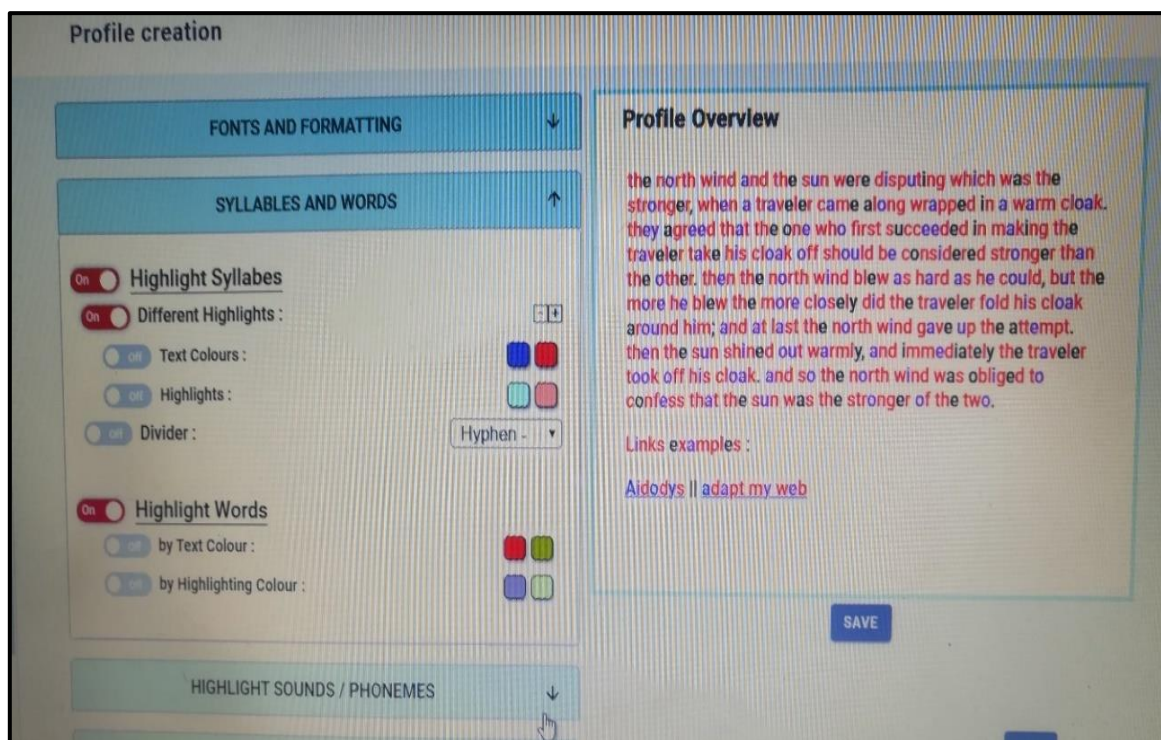
Figure 16. Aidodys Adaptations of texts (Step 02) Syllables and Words. **Adapted From** Aidodys official website *(https://www.aidodys.com/)*.

Other modifications concerning difficult letters including vowels, consonants, capitalization, and punctuation are put in different colors to show the beginning and the ending of sentences. When dyslexic learners personalize the color of difficult words, sounds, syllables, and letters, they will remember them better. Moreover, the space between letters and words give a clearer aspect to the text, thus, better reading.

Step three: highlight letters
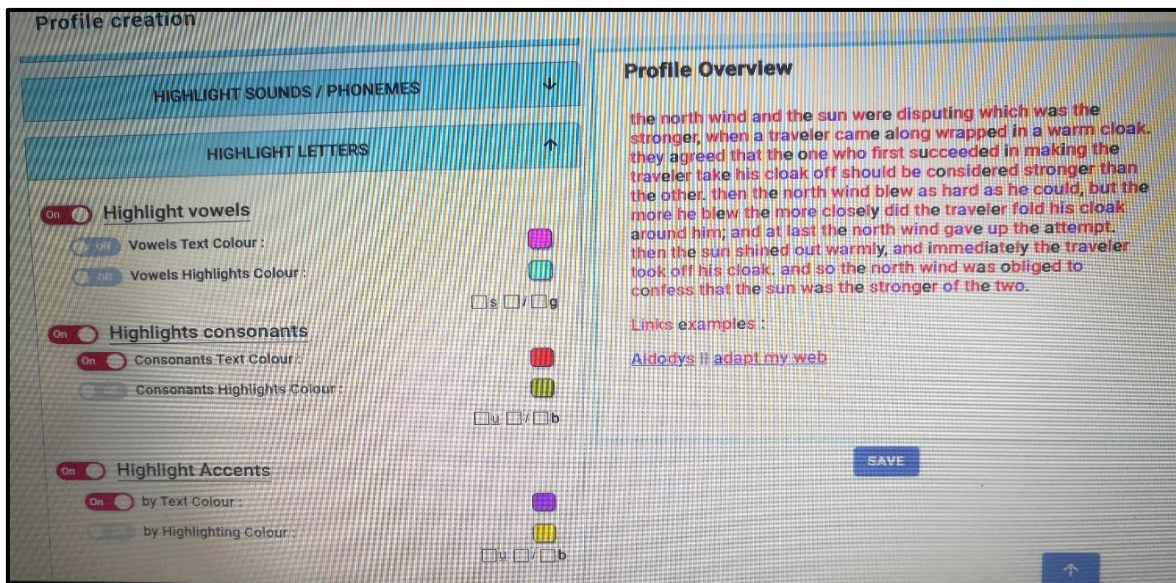
Figure 17. Aidodys Adaptations of Texts. (Step 03) Highlight letters. **Adapted from** Aidodys official website. *(https://www.aidodys.com/).*

The last step is to scan the text meant to be read, and select the profile into which the modifications will appear accordingly.
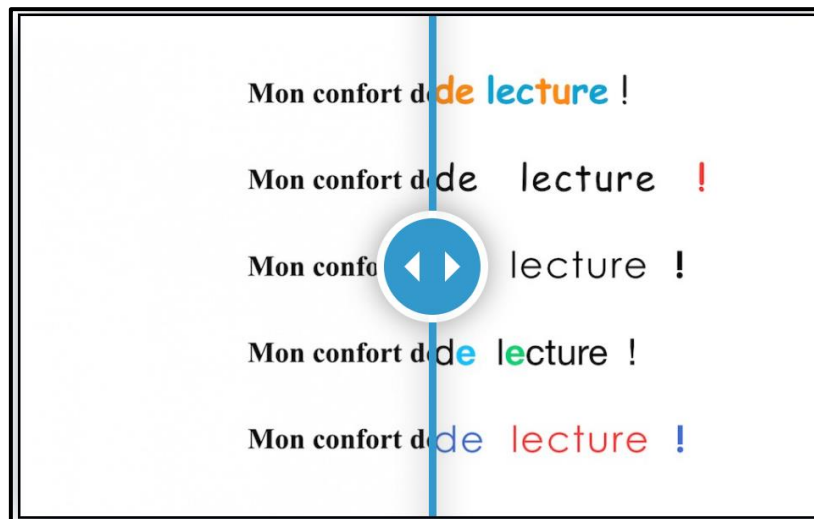
Figure 18. The Difference between normal and adapted texts . **Adapted from** aidodys official website*. (**https://www.aidodys.com/**).*

3.5. Advantages

Aidodys application joins different software functions like camscanners, text to speech, and Microsoft office word in one app. According to the official website Aidodys, it has several advantages namely:

- Audio reading of documents: Aidodys has the feature of reading texts for the ones who are unable to read to allow them both to recognize the word and utter it correctly.

- Adaptation of any type of document: pdf, word, doc, emails

- Printing options: after modifications of texts, the learners can print it to read on the paper version.

- Available for young and old dyslexics: this application is not designated for young learners only, but any dyslexic can use it whether adolescent or adult.

- It can work with other cites: these adaptations work online too. In other words, instead of struggling with information found on the net, the app changes the font and style of the writing of the page on the net according to the profile created on Aidodys to make reading accessible and easy.

- It reduces exhaustiveness and saves time for teachers and learners: dyslexic learners spend all their energy on decoding and comprehending what is written, after this effort, they become unable to fulfill any other task. Aidodys will facilitate the task of reading, so learners can do their tasks easily. As far as teachers are concerned, and because inclusive education is spread, the teacher finds himself adapting texts everyday according to different deficiencies. Aidodys will save time and efforts after creating for each learner the profile that meets his/her needs

Conclusion

Pedagogical remedies for dyslexic learners were the center of interest in this chapter. Main approaches reviewed in the literature like the Orton Gillingham approach, the inclusive education, the differentiated instruction…etc, were deemed as being effective; yet, dethroned by ICT based education since it is more advantageous and beneficial in teaching / learning in general; and for learners with special needs specifically. Aidodys software is an example of how ICT participates in the betterment of reading fluency for dyslexics. For this reason, it was introduced and overviewed in this chapter; then, its advantages were listed and discussed in order to set the ground for its application in our environment. The study and its results will be highlighted in the coming chapter.

CHAPTER THREE
THE FIELD WORK

CHAPTER THREE: THE FIELD WORK

Introduction

1. Research Methodology: The Study Procedures

2. Population, Sample and Setting

2.1. Population

2.2. Sample

2.3. Setting

2.4. Time Frame

3. Data Collection Tools

3.1. Quantitative Data Collection Tools

3.1.1. Pre-experimental Design

3.1.1.1. Definition

3.1.2. The Rational: why is it opted for?

3.1.3. Procedures

3.1.3.1. why Aidodys?

4. Intervention and description of results

4.1. The Pre-test

4.2. Profile creation

4.3. The post-test

5. Analysis of the results

5.1. Type of data

5.2. Statistical Considerations

5.2.1. Descriptive Statistics

Comparison and Analysis

5.2.2. Inferential Statistics

6. Qualitative Data

6.1. Observation

6.1.1. Rational

6.1.2. Procedures

6.1.2.1. Observation of Sentence Reading Before Introducing Aidodys

6.1.2.2. Observation of Sentence Reading After Introducing Aidodys

6.1.3. Comparison and Analysis of the Results

6.1.3.1. Observation of Text Reading Before the Introduction of Aidodys

6.1.3.2. Observation of text reading after introducing Aidodys

Introduction

The results of integrating Aidodys software on dyslexic learners are chiefly highlighted in the present chapter. Subsequently; the field work of this study including the research methods, the research tools, the rationale and the procedures are displayed. This chapter focuses further on data analysis and interpretation of results. In other words, each data collection tool is described, analysed and interpreted in order to examine the study's presumed hypotheses. At the end, some recommendations are provided.

1. Research Methodology: The Study Procedures

Approach selection is built upon specific philosophical assumptions and epistemologies known as the research paradigms. The most known research paradigms are post positivism, constructivism, transformative and pragmatic. Fundamentally, the pragmatic paradigm is rooted from both qualitative and quantitative designs; so, fits best with the constraints and nature of our study.

According to the present study nature and objectives, a combination of qualitative and quantitative approaches is opted to have valid, reliable, and trustworthy results. Moreover, ; the mixed methods approach "is a combination that has a great potential for future research as it can bring out the best of both approaches while neutralizing the shortcomings and biases inherent in each paradigm" (Dornyei 2003, pp. 130-131). Hence, the mixed methods approach enables us to explore the phenomenon studied and have a complete image about it.

Research design provides specific direction for procedures in any research work. It is basically divided into two main sub-categories qualitative and quantitative.
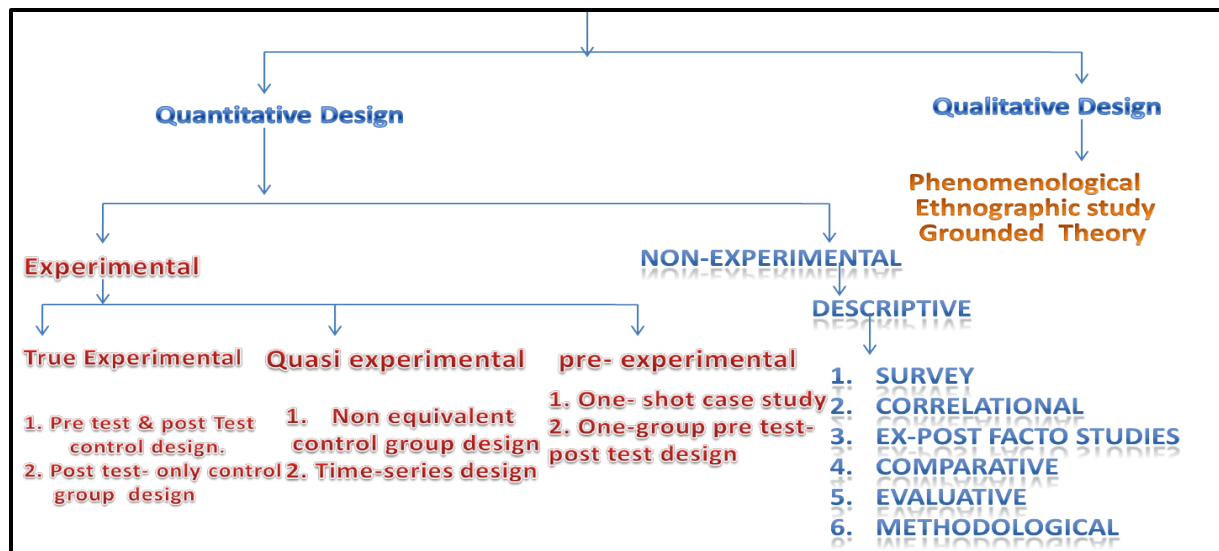
Figure 19. Quantitative and Qualitative Research Design. **Adapted from.**
https://lh3.googleusercontent.com/WcGKYSr067EnJfMDeVdKe-
sTuwWM9mdz7gQztrqxcCFt8Y2ME90SvvuZflGq6wGus3Fk=s113

From the figure above, case studies, phenomenological, ethnographic, and grounded theory studies belong to qualitative research design, whereas the qualitative research design is divided into non-experimental descriptive study that includes surveys, correlational studies, methodological and experimental where true, quasi, and pre experimental designs are the three main categories.

Seeking to obtain a more likely complete image of the conducted study, a mixed methods strategy is opted for. Considerably, a pre-experimental research design forms the quantitative design of the practical part. However, the qualitative non experimental strategies will be more descriptive that includes an interview and a pre-post observation.

2. Population, Sample and Setting

Before carrying out any research work, a specific population and sample must be targeted.

2.1. Population

"A research population is generally a large collection of individuals or objects that is the main focus of a scientific query" (explorable.com, research-population, 2020). The population of this study is meticulously chosen according to the nature of the research. The targeted accessible study population is dyslexic learners; however, this category is only found at primary schools. For this reason, the chosen population are young dyslexics studying at Ben Chaib Salah Primary School-Arris - Batna. These learners were identified by the high-school's speech therapist, and confirmed by the one working at the center of learners with disabilities.

2.2. Sample

Since the main goal of purposive (judgemental, selective, subjective) sampling is to focus on particular characteristics of a population, and a researcher can obtain a representative sample by using his own judgement without any randomization requirements, it fits best the nature and recommendations of our research study. (Kothari,2011)

The sample of the study was formed of N=04 young dyslexic males who study at the same school; however, they differ in age and level.

Table 2.

Details of the Sample

Name	Age	Level	Repeated class
Learner one (I)	14 (born in 2006)	5AP	3 years
Learner two (Il)	11 (born in 2008)	4AP	1 years
Learner three(M)	12 (born in 2009)	3AP	3 years
Learner four (Y)	10 (born in 2010)	3AP	1 year

Due to the COVID-19 blocking of schools, only learners 1 and 2 could complete the post tests in different settings than the ones of the pre-test.

2.3. Setting

The observation, as a preliminary study procedure, was conducted in classrooms at Benchaib Saleh Primary School in Arris, Batna, during one Arabic session and one French session. (October, 2019)

The pre-test and pre-observations took place at the same previous setting in which the subjects (dyslexics) were given the tests in papers and asked to read while we counted the spent time using a chronometer and taking notes in papers.

Due to the COVID-19 pandemic, the post test was done at home with only 2 learners after having the permission of their parents. Whereas the 2 other learners could not resume the work with us.

The interview was held at the office of the speech therapist using the Dictaphone of a smartphone to record.

2.4. Time Frame

The study took place in February and was planned to finish in March. Unfortunately, the schedule unexpectedly changed due to the COVID-19 circumstances, and the post-test was held in different timing and setting.

In this study, we followed all the ethical guidelines of research starting by having a request from the university administration to have the permission of the headmaster of the primary school to work with these learners. The speech therapist signed the declaration of agreement to participate in this study and to answer the questions of the interview (see appendices).

In order to finish the pre/ post-test treatment and observation, we needed five sessions that were divided as follows:

Table 3.

Time Frame of The Study

Session one	**1ˢᵗ meeting**	**20 February, 2020**
Session two	**Speech therapist confirmation of cases**	**1 March 2020**
Session three	**Pre-test (one-minute reading test Observation of reading before integrating Aidodys**	**4 March 2020**
Session four	**Profile creation**	**5 March 2020**
Session five	**Post-test (one-minute reading test) Observation of reading fluency after introducing Aidodys**	**5 June 2020**

3. Data Collection Tools

There are qualitative, quantitative and mixed methods data collection instruments that are basically selected according to the research type and nature. Considerably, since this research work is a combination of qualitative and quantitative designs, both qualitative and quantitative data collection tools are used. From this point, pre-experimental design is the instrument used to collect quantitative data, whereas a pre-post observation and an interview are used to gather qualitative data.

3.1. Quantitative Data Collection Tools

3.1.1. Pre-experimental Design

According to Kothari (2004, p. 41), "Experimental design refers to the framework or structure of an experiment and as such there are several experimental designs: Pre-experimental, quasi experimental and true experimental". In other words, an experimental

design includes three types of experimental methods. One of them is known as pre-experimental method.

3.1.1.1.   Definition

According to (allpsych.com: research methods; pre-experimental design (n.d), the pre experimental method follows basic experimental steps but fail to include a control group. In other words, a single group is often studied but no comparison between an equivalent non-treatment group is made.

There are 3 types of pre experimental method. Before-and-after without control design (also known as One Group Pretest Posttest Study); After-only with control design (called The One-Shot Case Study) and Before-and-after with control design (The Static Group Comparison Study). (Kothari, 2004; p. 41)

One Shot Case Study
$X \quad O_2$

One Group Pretest Posttest Study
$O_1 \quad X \quad O_2$

Static Group Comparison Study
$X \quad O_2$
O_2

Key:
X = Treatment
O_1 = Pretest
O_2 = Posttest
R = Randomization
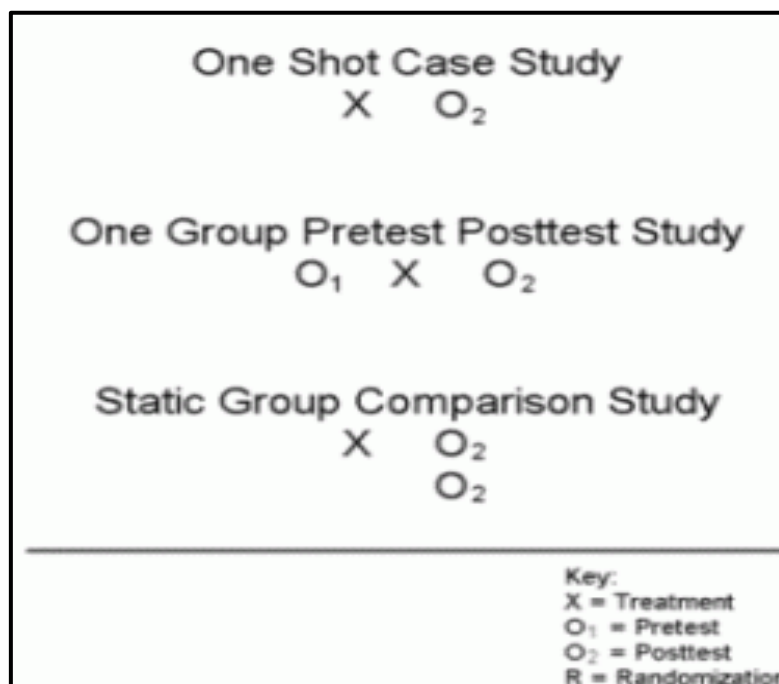
Figure 20. The Pre-Experimental Method . **Adapted from**
https://theintactone.com/2018/02/26/br-u2-topic-2-exploratory-descriptive-experimental-research-design-pre-experimental-design/

In this study, and in order to answer the question "How does *Aidodys* impact the reading duration of dyslexic learners?" a before-and-after without control design (also known as One Group Pre-test Post-test Study) is opted for. Kothari (2004) defined it as single test group or area is selected and the dependent variable is measured before the introduction of the treatment. The treatment is then introduced and the dependent variable is measured again after the treatment has been introduced. The effect of the treatment would be equal to the level of the phenomenon after the treatment minus the level of the phenomenon before the treatment.
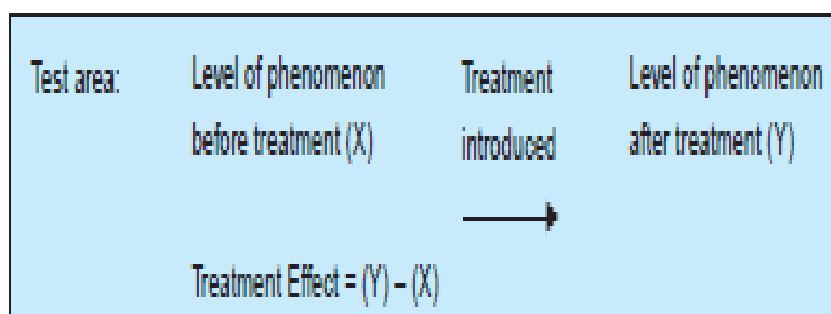
Figure 21. One Group Pre-test Post-test Study. **Adapted from *Kothari.C.R. Research methodology, methods and techniques. P.41***

3.1.2. The Rationale

The current research work deals with a specific category of learners with disabilities. This category is rare and cases are limited. Therefore, we could not have a control group. For this reason, we have had the treatment on the only existing group of dyslexic learners so the one group pre-post-test is used as an alternative.

3.1.3. Procedures

The procedures of the quantitative data gathering are divided into two main steps:

Step one: pre test

A specific test called one-minute reading test is used to assess participants reading of certain simple words and count the spent time.

Creating profiles to these learners according to the reading comfort of each learner, we specific reading profiles through Aidodys software are to be created.

Step two: Intervention and post test

After the phase of profile creation, the previous test will be adapted accordingly and then, given to the same learners to measure again the spent time.

The tests are done in French due to several reasons. First, the sample we are working with are young dyslexic learners who have not learnt English yet, but studied French since their young age. Moreover, this software proposes adaptations to French and English texts only.

3.1.3.1.   why Aidodys?

It is worth mentioning that up till now, ICT could undeniably do gigantic positive revolutions in education. Respectively; Aidodys application was specifically created and designed to help learners suffering from dys problems namely, dyslexia. Since it uses some modern successful teaching approaches like differentiation and inclusive education, this application is used in different countries such as Canada, France, Belgium, and many other countries. Accordingly, many dyslexic learners echoed their satisfaction and witnessed through videos and comments its effectiveness in helping them decode and read .For this reason, we thought about experimenting it in our context and maybe, help Algerian dyslexics defeat and overcome their reading impediment.

Intervention and Description of Results

   3.2. The Pre-test

One-minute Reading Test (The reading test is annexed in the appendices)

Learner one

Table 4.

The One Minute Reading Pre-test. (Learner One)

Reading without Aidodys					
Nb of words	Time	Time spent	Nb of words	Time	Time spent
07	8sec	8sec	56	1min 34sec	15sec
14	17 sec	9sec	63	1min 49sec	15sec
21	29sec	12sec	70	2min 3 sec	14 sec
28	39sec	10sec	77	2min31 sc	28sec
36	54sec	15sec	84	2min45sec	14 sec
42	1min 8sec	14sec	91	3min 21sec	36sec
49	1min 19sec	11sec	98	3min 38sec	17 sec

Description

   During this test, this learner read the first 22 words in 29 sec easily since they are familiar to him. Then he started dropping some words and letters, stopping at certain unfamiliar words such as *"lot" "van" "han"*. Also, he inversed the letters "d" and "b", "p" and "q". As a result, he took a long time to finish 98 words.

   Some words are differently read; for example *"lis"* is read *"il", "dort"* is read *"dod"*.

   In the line 84, he spent 14 seconds because he only read 4 words and stopped, whereas in the line 91, he stopped before each word, and he read most of them in a wrong manner.

The more words contain different letters and are less familiar to him, the more he spends time on them.

The spent time on this test for this learner is 3 minutes 27 seconds to read 98 words. (218 s)
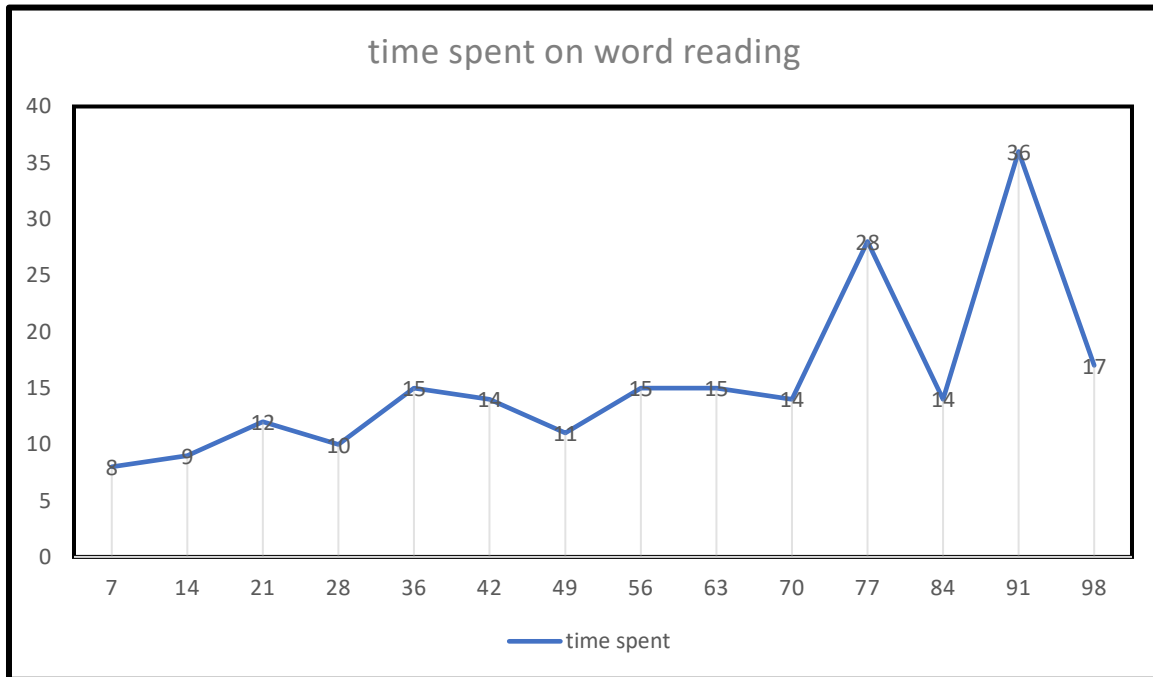
Graph 01. curve diagram representing the time spent on reading before Aidodys integration (learner one)

The curve diagram above shows the changing in the rate of the time spent in reading each category of words. (Learner one)

From the line 7 till 28, the time spent in reading is balanced from 8 seconds to 12. The difference is very slight (2 to 3 seconds of difference).

From line 36 till 70, time spent is between 11 seconds to 15 seconds, which demonstrates the little difficulty in reading certain words.

From line 70 until 98; the difference is remarkable. The learner took maximum 36 seconds to read a line of 7 simple words, then 28 seconds, 17, and 14 (because he dropped many words)

The medium time used to read these words is 14-15 seconds.

Learner two

Table 5.

Results of the One Minute Pre-Test (Learner two)

Reading without Aidodys					
Nb of words	Time	Time spent	Nb of words	Time	Time spent
07	5sec	5sec	56	48sec	7sec
14	13sec	8sec	63	53sec	5sec
21	17sec	4sec	70	1 min	7sec
28	22sec	5sec	77	1 min 6sec	6sec
36	27sec	5sec	84	1min 14sec	8sec
42	35sec	8sec	91	1min 19sec	5sec
49	41sec	6sec	98	1min 26sec	7sec

Description

Reading the words for this learner seemed to be easy to a certain extent. He managed reading 42 words in 35 seconds with some pauses in the second line of the test (14) and the 6th line (42 seconds).

After this, some slight difficulties in pronouncing the words were observed. We remarked that this learner repeats some words while reading. This learner read the whole table in 1 min 26 seconds. (86s)
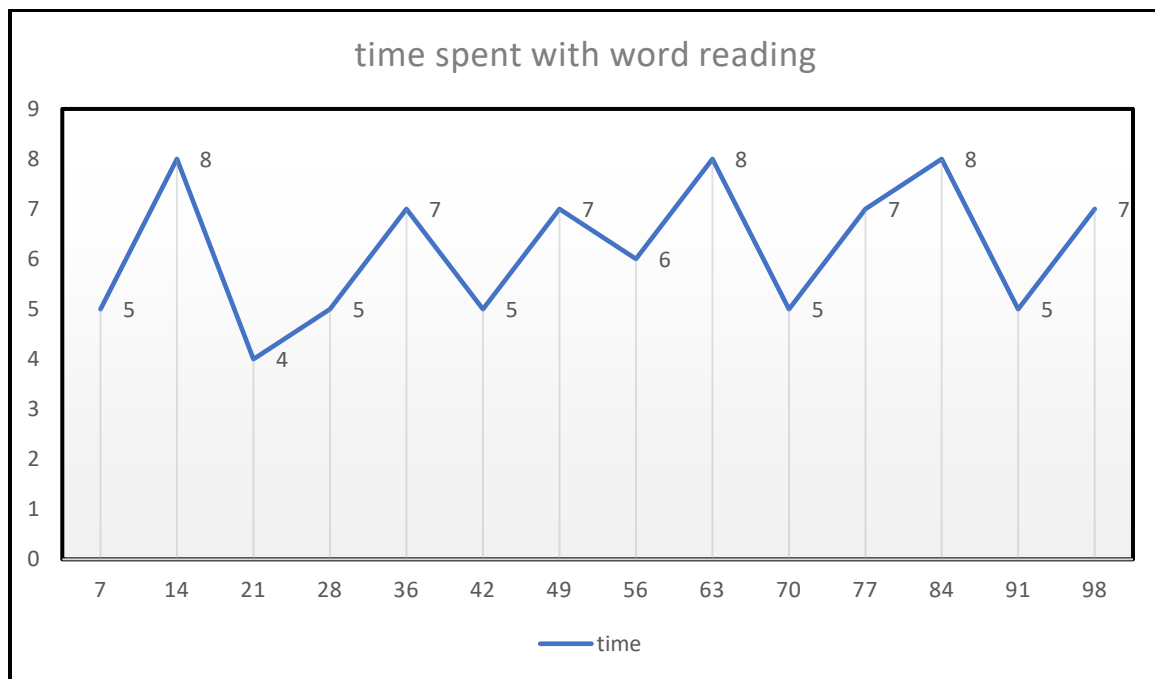
Graph 02. curve diagram representing the time spent on reading before Aidodys integration (learner two)

The curve diagram above shows the changing in the rate of the time spent in reading each category of words. (Learner two)

This diagram is oscillatory from line 7 to line 28 of the test. The time spent to read the words is not stable as it changes from 4 to 8 seconds.

From line 28 to 49, it becomes regular and moves from 5 to 7seconds per line. But from line 56 till the last one (98), it resumes to be unstable and changes from 5 to 8 seconds.

The average time spent to read each line is 5 seconds

3.3. Profile Creation

As has been mentioned in the literature, Aidodys software provides adjustments to texts and creates profiles for dyslexics according to their reading requirements taking into account the shape, the size, and the colors of the font to eventually achieve the comfort of each learner.

From the previous reading in the pre-test, we could manage to take notes about the problems these learners faced. And as noticed, learner one has more difficulties and more severe symptoms than learner two. Obviously, his profile is, to a certain extent, more sophisticated than learner two. At the end, we tried, with their help, to create profiles that can help them.

Profile of Learner 01

We first, changed the font, the size and the space between letters, words, and lines.

Since Aidodys proposes fonts that are specialized and proven to help dyslexics like Lexie Readable, Open Dyslexic, Verdana, Arial, Comic Sans… etc.

We have opted for Luciole font of writing, with the size 20, and 0.3 spacing between letters, 0.9 spacing between words, 1.3 spacing between lines to appear like the following
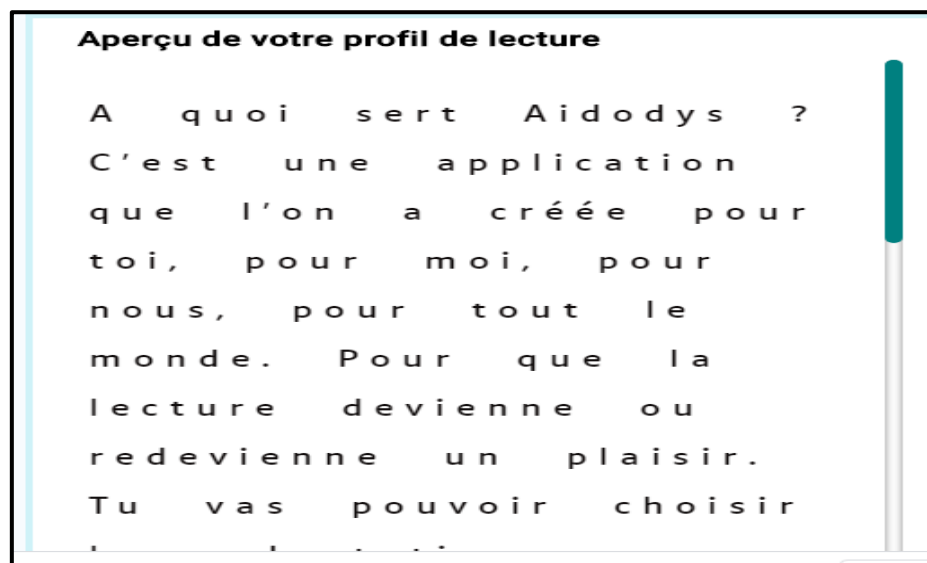
Figure 22. Learner one Profile. Step one Spacing and Font Adjustments. **Adapted from** Aidodys official website/profile-creation/font-and-spacing. *(https://www.aidodys.com/).*

After this, we changed the color of the syllables and highlighted each word of the text separately, so that the learner can differentiate that they are separate words like the following
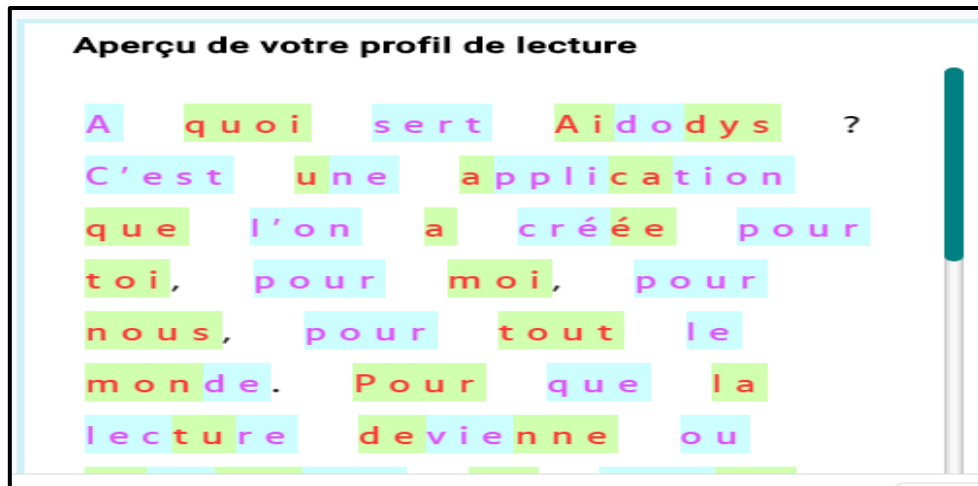
Figure 23. Learner one Profile. Step Two syllables and words adjustments. **Adapted from** Aidodys official site/profile-creation/syllables-and-words. *(https://www.aidodys.com/).*

Then we changed the punctuation, the vowels and consonants, and the letters that the learner mixes.

Figure 24. Learner one Profile. Step Three Punctuation and difficult letters Adjustments. **Adapted from** Aidodys official site/profile-creation/punctuation-and-letters. *(https://www.aidodys.com/).*

Profile of Learner 02

We followed the same steps as in the first profile. We changed the font, the size and the space between letters, words, and lines.

For this learner, and since his case is different from the previous one, we opted for Vandera font of writing, with the size 21, and 0.2 spacing between letters, 0.6 spacing between words, 0.9 spacing between lines to appear like the following
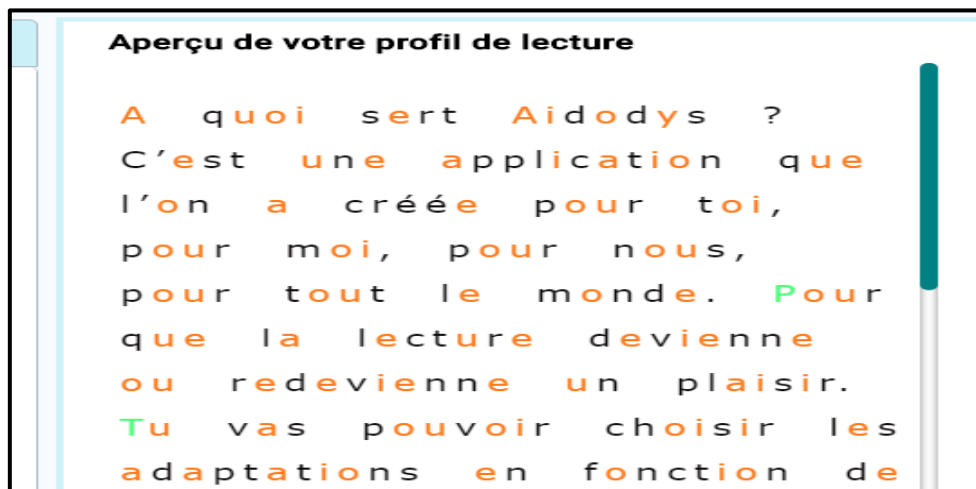
Figure 25. Learner Two Profile. Step One. Spacing and Font Adjustments. **Adapted from** Aidodys official site/profile-creation/font-and-spacing. *(https://www.aidodys.com/).*

After this, we highlighted each word of the text separately, so that the learner can differentiate that they are separate words like the following
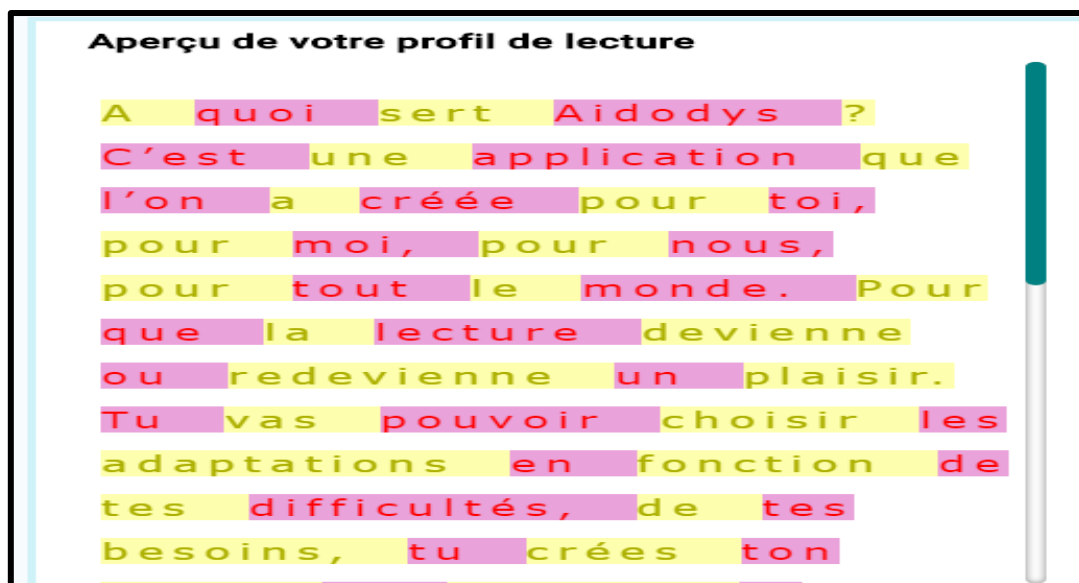
Figure 26. Learner Two Profile. Step Two Words and letters adjustments. **Adapted from** Aidodys official site/profile-creation/font-and-spacing. *(https://www.aidodys.com/).*

Then we changed the punctuation, the vowels and consonants, and the capital letters to announce the beginning of a new sentence.
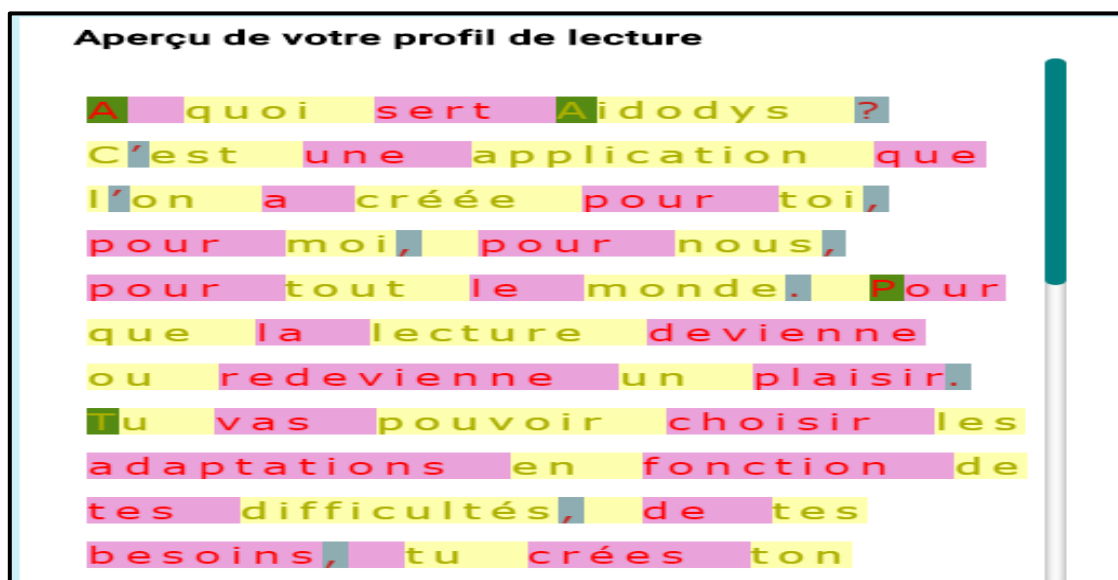
Figure 27. Learner Two Profile. Step Three. Spacing and Font Adjustments. **Adapted from** Aidodys official site/profile-creation/font-and-spacing. *(https://www.aidodys.com/).*

Profiles are manageable and can be changed until the learner finds his total comfort of reading, but due to the lack of time and proficiency, we could only manage to create a profile where the learner can distinguish, syllables, punctuation, and words from each other.

3.4. The Post-Test

The Introduction of Aidodys Software

The One-Minute Reading Test

Table 6.

Results of the One Minute Post-Test (Learner One)

Reading with Aidodys					
Nb of words	Time	Time spent	Nb of words	Time	Time spent
07	6sec	6sec	56	59sec	9sec
14	11sec	5sec	63	1min 7sec	8sec
21	17sec	6sec	70	1min 17sec	10sec
28	24sec	7sec	77	1min 26sec	9sec
36	30sec	6sec	84	1min 33 sec	7sec
42	41sec	11sec	91	1min 43 sec	10sec
49	50sec	9sec	98	1min 50 sec	7sec

Test performance of Learner one

Description

During this post-test, learner one read with an average speed. He dropped some words, and pronounced some in a wrong manner. Pauses were marked, but he could finish the 98 words in 1min 52 seconds.

What is surprising is that he read the letters p, q, d, and b correctly.
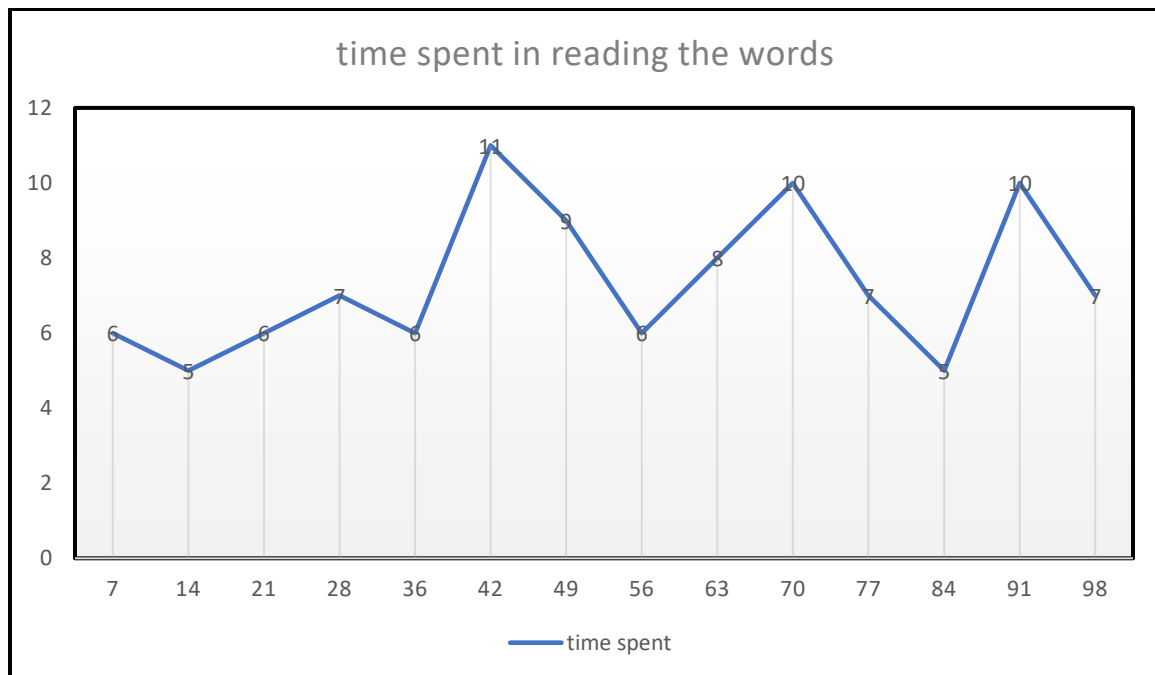
Graph03. curve diagram representing the time spent on reading after Aidodys integration (learner one)

Description

The curve diagram above shows the changing in the time spent in reading each category of words after integrating Aidodys adaptations. (Learner one)

From the line 7 till 36, the time spent in reading is balanced from 5 seconds to 7. The difference is very slight (1 to 2 seconds of difference).

In the line 42, the learner spent 11 seconds in reading 7 words, which made it the longest in the whole reading.

From line 49 to 98, the diagram is oscillatory and changes from 5 to 10 seconds

The average time spent on this reading is 6 seconds.

Test Performance of Learner Two

Table 7.

Results of the One Minute Post-Test (Learner Two)

Reading with Aidodys					
Nb of words	Time	Time spent	Nb of words	Time	Time spent
07	3sec	3sec	56	38 sec	4sec
14	7 sec	4sec	63	45 sec	7 sec
21	11 sec	4sec	70	51 sec	6 sec
28	17 sec	6sec	77	55 sec	4 sec
36	22 sec	5sec	84	58 sec	3 sec
42	30 sec	7sec	91	1min3sec	5 sec
49	34 sec	4sec	98	1min 8sec	5 sec

Description

This learner, during the post-test, read in a highly comfortable manner. He could distinguish vowels and syllables. He found difficulties in reading words that contain only vowels like "au", "ou", and dropped reading them which created a kind of pauses and hesitation.

He spent 1min 8 seconds in this test reading.
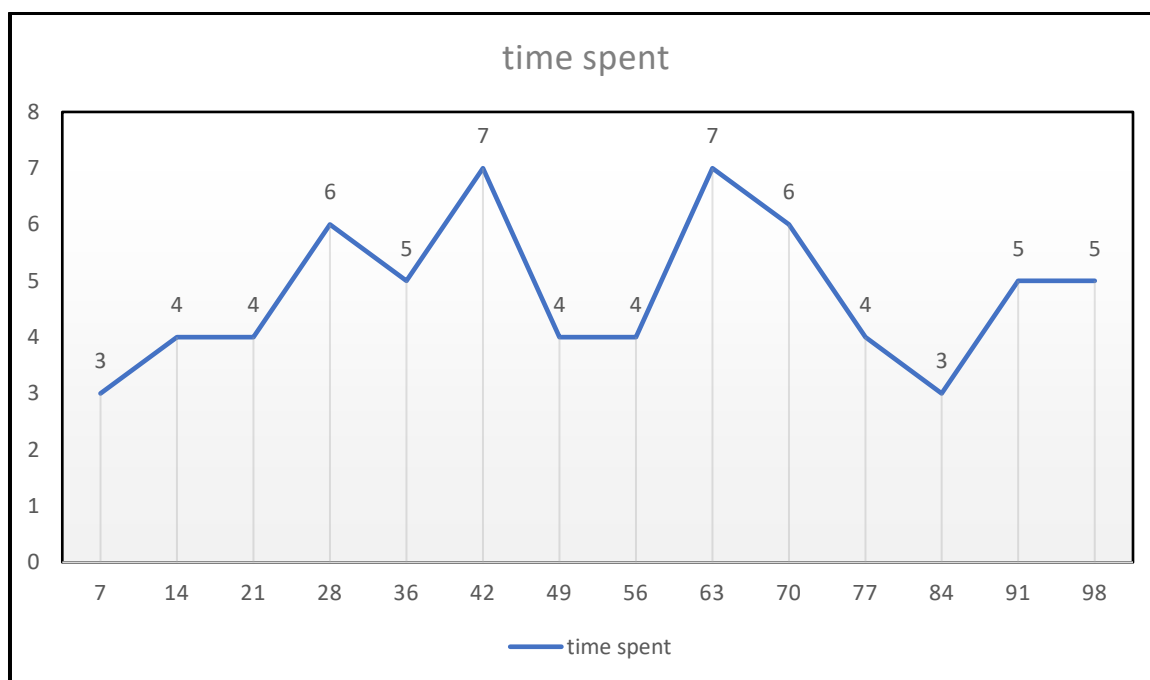
Graph04. curve diagram representing the time spent on reading after Aidodys integration (Learner two)

Description

The curve diagram above shows the changing in the time span in reading each category of words after integrating Aidodys adaptations. (Learner two)

The time spent in reading, from the line 7 till 21, ranges from 3 seconds to 4. The difference is very slight (1 second of difference).

In the lines 28, 42, 63, 70 the learner spent the longest time in the whole reading 6-7 seconds due to pauses marked.

4. Analysis of Results

The One-Minute Reading Test

4.1. Type of Data

Among the most known four types of quantitative data, that are nominal, ordinal, ratio and interval, ratio is the most appropriate one for this test. According to Chelli (2017), ratio

scale embraces classification, order and equal interval metric- but adds a fourth, powerful feature: a true zero. Measures of distance, money in the bank, time, population, marks, on a test and so on are ratio measures as they are capable of having a true zero quantity." (p.42). Moreover, and according to *sage edge publication*, chapter 01, p 21, table 3.1(https://us.sagepub.com/sites/default/files/upm-assets/90578_book_item_90578.pdf) , "time in seconds, to memorize is a continuous variable, quantitative in nature and ratio in scale".

4.2. Statistical Considerations

4.2.1. Descriptive Statistics

Chelli (2017, p. 43) upholds that "Descriptive statistics are used to summarize sets of numerical data in order to conserve time and space." In other words, they present, describe and summarize data in a meaningful way statistically, and set the ground for inferential statistics to confirm/disconfirm the hypothesis.

In order to attain the difference between pre-test and post-test statistically, calculating the Mean, the Variance, and Standard Deviation is a must. The used software is EXCEL 2016

Calculating the Mean

$$\bar{x} = \frac{\sum X}{N}$$

X$_{pretest}$=304   ; X= 10.85   /   X $_{posttest}$ = 177 ; X= 6.32
28   28

Calculating the Variance and the Standard Deviation

The variance for each number: subtracts the Mean and square the result (the squared difference). Then work out the average of those squared differences

Variance $_{pretest}$ =   1339.42/28= 49.76   /   Variance $_{posttest}$ = 171.76/28=6.14

The square root of the variance is the standard deviation

S^2 **pretest** $= \sqrt{49.76}$ / S^2 **posttest** $= \sqrt{6.14}$

S^2 **pretest** $= 7.05$ /S^2 **posttest** $= 2.47$

Table 8.

Sumary of Results

	Nb of words	Pre test	Post test	Difference
	7	8	6	2
	14	9	5	4
	21	12	6	6
	28	10	7	3
	36	15	6	9
Learner 01	42	14	11	3
	49	11	9	2
	56	15	9	6
	63	15	8	7
	70	14	10	4
	77	28	9	19
	84	14	7	7
	91	36	10	26
	98	17	7	10
	7	5	3	2
	14	8	4	4
	21	4	4	0
	28	5	6	1
	36	5	5	0
	42	8	7	1
	49	6	4	2
	56	7	4	3
Learner 02	63	5	7	2
	70	7	6	1
	77	6	4	2
	84	8	3	5
	91	5	5	0
	98	7	5	2
	Mean	10.85	6.32	
	Standard deviation	7.05	2.47	

Comparison and Analysis

The table above represents the results of the pre/post one-minute reading test with the counted mean and standard deviation using Microsoft EXCEL 2016.

As the table suggests, the main observation that can be drawn is that there is a difference in the spent time in reading before and after introducing Aidodys software. The spent time has remarkably decreased after the use of Aidodys. As a matter of fact; the mean of the pre-test is 10.85 in contrast to the one of the post-test is 6.32. In line with these results, the standard deviations of the pre-tests are higher than the post tests. This shows that the speed and the fluency of the dyslexic learners after the use of the software has changed and clearly increased.

4.2.2. Inferential Statistics

Since our data is ratio and the sample is a one sample measured twice (before and after introduction of Aidodys), we have used a dependent (paired) sample t test to confirm the hypothesis proposed at the beginning: "If Aidodys software is used, the reading duration of dyslexic learners will decrease"

$$H0=\mu0=0$$

$$Ha=\mu0\neq0$$

The null hypothesis H0 suggests that the difference between the results of the pre-post tests is 0, whereas the alternative hypothesis Ha presumes that the difference between the results does not equal to 0.

Calculating the means of the pre/post-test in the previous table would allow us to apply and calculate the t-test, degree of freedom and the statistical significance to know whether this difference is statistically significant, thus; confirm or refute the null hypothesis.

Formula of the Paired t-test

We can either calculate the t value manually through using this formula

$$t = \frac{\dfrac{\Sigma d}{N}}{\sqrt{\dfrac{\Sigma d^2 - \dfrac{(\Sigma d)^2}{N}}{N(N-1)}}}$$

d = difference between matched scores
N = number of *pairs* of scores

Or use the EXCEL2016 software in order to facilitate the task. We opted for the later choice and obtained the value of: **t= 13.12** (see appendices).

In order to measure statistically the significance of our study, we have to calculate the *p* value which is set for the present case as 0.05. In other words; the results might be due to 5% pure chance Considerably, the calculated T value is greater than the critical value (Fisher and Yates table), so the null hypothesis was rejected in favour of the alternative. (see appendix 02)

5. Qualitative Data

The non-numerical type of data is named the qualitative data. Kothari (2004) states "Qualitative approach to research is concerned with subjective assessment of attitudes, opinions and behaviors. Research in such a situation is a function of researcher's insights and impressions." (p.05). differently put, qualitative data allows the researchers form different type of parameters through which larger data sets can be observed and thus give a complete idea of the phenomenon studied.

5.1. Observation

This method, according to Kothari (2004) implies the collection of information only through the investigator's observation. As such, this method is not suitable in inquiries where large samples are concerned. For this reason, it is suitable in the research study.

5.1.1. Rational

This semi structured observation is used in order to check the fluency of the learners. According to Balisger–(n.d,), Reading fluency is composed of 3 main components: speed, accuracy, and prosody. By speed, we mean that learners visually scan 3+ words ahead when reading aloud with a high volume, and maintain smooth line to line visual tracking, while accuracy is a highly automatic word recognition and ability to sound out unfamiliar words. Prosody is the pitch, stress, hesitation, pauses, timing, articulation, etc. Among these, we have chosen 5 components to test the reading fluency of the two dyslexic learners.

5.1.2. Procedures

There are two used tests in this observation: A sentence reading observation, and a text reading observation.

The pre-treatment observation was held at the same time with the one-minute reading test.

5.1.2.1.   Observation of Sentence Reading Before Introducing Aidodys

Test one

Sentence Reading Test

This test is about sentence reading and observing their intonation, hesitation, speed, articulation, pauses, and volume. It is noteworthy that this test was based on the one of Grenoble university-France-, yet some modifications in sentences were added.

Sentences

1- Elle a lu un livre.

2- Il ne dit que la vérité.

3- Ils ont de l'énergie.

4- Sofie a cassé son ordinateur.

5- Il parle de sa tata.

Scale: (--) very low (-) low (+) high (++) very high

Performance of Learner One

Table 9.

Performance of Learner One - Sentence Reading Pre Test

Learner 01	
Intonation	--
Hesitation	++
Volume	-
Articulation	-
Pauses	++
Speed	--

Description

From the performance of Learner 1, the following descriptive remarks were made:

- This learner read some sentences but he resumes reading them again.

  o In the first sentence, "lu un" was read "lun".

- In the second sentence, the word "que" was read "pe"

- The 4th sentence was not read appropriately. The "s" sound was repeated many times.

  The expression "Sofie a" was read "Sofia"

- In the last sentence, there was a stop at the word "tata". The learner did not read it.

- He read the sentences with a very high level of hesitation and pauses. The intonation, the articulation and the volume were low.

Performance of Learner 02

Table 10.

Performance of Learner Two- Sentence Reading Pre Test

Learner 02	
Intonation	-
Hesitation	+
Volume	-
Articulation	+
Pauses	++
Speed	--

This learner showed a high level of articulating the words of the sentences while reading. They were acceptably articulated.

In contrast, the high level of hesitation and pauses led to a remarkable decrease in the level of intonation and volume. In other words; the hesitation level affected the volume and the intonation.

What is noticeable in this learner's reading is that he drops every word containing one or two letters. (like articles, possessive adjectives sa, son…). Moreover, the repetition of the word with reversing letters is observed too.

5.1.2.2.   Observation of Sentence Reading After Introducing Aidodys

Sentence Reading Test

Table 11.

Performance of Learner One. Sentence Reading Post Test

Learner 01	
Intonation	-
Hesitation	+
Volume	-
Articulation	+
Pauses	+
Speed	+

Learner 01

From the second sentence reading, that is the post-test reading, this young dyslexic learner showed a low intonation with a low volume, a high level of hesitation resulted of a high level of pauses, but what is remarkably different is that he could differentiate between vowels and consonants. Also, he could separate each word alone correctly after he was reading them as one unit. So, a high level of articulation and an increased speed were marked.

Table 12.

Performance of Learner Two. Sentence Reading Post Test

Learner 02	
Intonation	++
Hesitation	-
Volume	++
Articulation	+
Pauses	+
Speed	+

Performance of Learner 02

Learner two, in sentence reading after integrating Aidodys, showed a remarkable difference in the intonation, the volume, the speed and the articulation. He could read all the existing words in the sentences even the ones he dropped in the first reading, still pauses were present with hesitation especially when he found words containing same vowels.

The other problem remarked in both learners is that they pronounce even silent letters like t in lit, and s in ils. This problem is due to, maybe, lack of knowledge and competence in French

5.1.3. Comparison and Analysis of the Results

From the above-mentioned results, learner one has serious problems in fluency that is the key to comprehension. He clearly suffers from severe dyslexia that prevents him from reading accurately and fluently, thus understands appropriately. Hesitation and pauses were frequent, the speed was very low, and the articulation was not clear since he mixed up words and letters.

After Aidodys introduction, we have observed a remarkable amelioration in reading. It is right that pauses and hesitations still occurred, but the speed, the articulation and the volume were improved.

Learner two showed some difficulties in reading too. They were not as severe as the learner one, but still, he is not as fluent as normal readers of his age. The speed was very low due to the pauses; the articulation was to a certain extent incorrect.

The adaptations of Aidodys were significantly beneficial and helpful. The post observation showed the difference. Learner two read better and more comfortably.

5.1.3.1.   Observation of Text Reading Before the Introduction of Aidodys

The last test contained a text from their French textbook and to observe their intonation, hesitation, articulation, speed, pauses, and volume.

Learners' reading performance Before Introducing Aidodys

Test Two: Text Reading

Learners in this test are supposed to read a text from their textbooks, and at the same time, the researcher will observe their fluency through their articulation, speed, intonation…

Performance of Learner One

The text is extracted from the French textbook of the learner. i.e. a text from the 5th grade textbook.

The text is from sequence 01, project 3, page 79. Entitled « la pollution des océans » (see appendices)

Scale: (--) very low (-) low (+) high (++) very high

Table 13.

Performance of Learner One. Text Reading Pre Test

Learner 01	
Intonation	-
Hesitation	++
Volume	-
Articulation	--
Pauses	++
Speed	--

Description of learner one' text reading performance

The reading of this text was extremely hard. The young learner put much effort in decoding the words that most of them were not correctly spelled. He found difficulties in pronouncing words, in separating words from each other, even when he pronounces the word correctly; he repeated it 3 to 4 times.

Although the text was a small one, (he was asked to read a small part of it), he took considerable time to finish it. The reading was incomprehensible, incoherent, words were read as blocs, and punctuation was not respected.

Performance of Learner Two

The text is from sequence 01, page 76. Entitled « l'histoire de la petite goutte d'eau »'see appendices

Table 14.

Performance of Learner Two. Text Reading Pre test

Learner 02	
Intonation	-
Hesitation	++
Volume	-
Articulation	-
Pauses	+
Speed	-

Description of Learner Two Text Reading Performance

The reading of the text was incomprehensible. No respect of the punctuation marks, this learner read some words as blocs. In other words, he was unable to separate each word from the other. Example: "dleut" instead of "bleue et", "dansl" instead of dans le ciel".

He read some words instead of other words that are common to him like "femme" instead of "flamme"; "Salima" instead of "s'alluma". Moreover, the repetition of words was frequent

Eventually, he managed to finish the whole text reading but he took a long time.

5.1.3.2.   Observation of Text Reading After Introducing Aidodys

Text Reading

Table 15.

Performance of learner One. Text Reading Post Test

Learner 01	
Intonation	**-**
Hesitation	**+**
Volume	**-**
Articulation	**+**
Pauses	**+**
Speed	**+**

Performance of Learner 01

The difference is seen in both distinguishing words from each other and punctuation noticing. However, the volume and the intonation were low; pauses and hesitation were high because the learner needed to decode the words. But eventually, he could read and understand to a certain extent (taking into account the language is foreign and the learner did not receive special instruction and attention in class). Still, the difference is remarkable.

Since he could read the passage, and partly understand it, the efforts of the learner are not only put on the decoding process, but also on the comprehension.

Table 16.

Performance of Learner Two. Text Reading Post Test

Learner 02	
Intonation	+
Hesitation	+
Volume	+
Articulation	++
Pauses	+
Speed	+

Performance of Learner 02

After introducing Aidodys adaptations on the text, the learner was able to read and distinguish letters, words, and punctuation marks. Whenever he sees a punctuation mark, he stops and mentions that this is the colour of a punctuation mark. The articulation was improved, the volume, the speed and the intonation were higher compared to the first reading; however, hesitation and pauses were still present but less frequent than the first reading.

5.1.4. Comparison and Analysis

It is worth mentioning that both learners are dyslexics and have common, yet different problems and difficulties in reading.

Before the introduction of Aidodys, we observed that the reading fluency was very low, the learners put much efforts to read and decode, difficulties persisted, and one of the learners gave up without finishing reading (learner one).

After introducing Aidodys, a noticeable improvement was observed. Both learners could distinguish and separate words from each other, read in a better way, and most importantly, they themselves could feel the change through making some remarks while reading.

6. Interview: description and analysis

According to Easwaramoorthy & Zarinpoush (2006), an interview is a qualitative research technique used when there is a need to collect in-depth information on people's opinions, thoughts, experiences, and feelings. The interview was used as a qualitative tool in order to provide the study with more details and necessary information about learners with dyslexia to answer the question and confirm the last hypothesis of this research.

We have opted for a face-to-face semi structured interview where we have asked some questions to the interviewee and recorded the answers to be scripted and analysed.

6.1. The interviewee

The interview was held with a speech therapist working at a specialized center for learners with special needs (08 years of experience) It took place in 11.03.2020 at the interviewee's office, in Tamazight language, then translated to English to be compatible with our research requirements.

6.2. Content of the interview

The prepared questions of the interview are in the appendices (appendix 07), but since it is a semi structured interview, some other questions emerged while interviewing the therapist.

6.3. Scripting the Interview

After the greetings, and the introduction of my topic, the first question was:

Q 01: How frequently do you find cases of dyslexics in classes? Differently said, when you go to schools, or when you treat cases with special needs, are dyslexics frequently or rarely found?

The speech therapist: According to my 8 years' experience, we can say that I find, in average,3 to 4 dyslexics per year. Comparing to other cases like autists, they are few.

Q 02: How do you think they are treated?

The speech therapist: It basically depends on the teacher. If he is understanding and considerate, he can be cooperative with us to help the learner. But most often, teachers do not provide any help and this makes the process difficult, if not impossible. Parents have their part of responsibility too. When they are unaware of the case of their kid or when they ignore the difficulty of dealing with this case and want to see immediate results after the speech therapist sessions.

Q03: What are the processes followed to detect these learners? Are there any tests?

The speech therapist: Yes, there are some steps to follow. First, the learner must be studying for, at least, 2 years; and he faces no other physical or mental troubles. As far as the tests are concerned, we can ask the learner about the place, time (up, above, under, before, after), also text reading; a text that any learner of his age can read. If this learner can't read it, then he can be considered as dyslexic, of course taking into account all the symptoms of a dyslexic reading.

Q 04: How many sessions of treatment are needed to help dyslexics (per month)?

The speech therapist: The treatment cannot be effective in just one or two months. Dyslexics need to have at least 2 sessions per week with the speech therapist and the psychotherapist;

and during the other days, parents and teachers must follow the instructions of the speech therapist namely giving him attention and care in the class, facilitating for him the instructions of the tasks…and most of all, avoiding ignoring his case.

Q 05: Are there any suggest solutions? Do they have any impact?

The speech therapist: In Algeria, there are no special aids for such cases. We only have some specific tasks that the speech therapist follows to help them. An example of the tasks is putting a bottle on the desk, then ask him where is the bottle. When he learns how things are placed in the space, he will generalize that, for example, to write above the line, to put points at their right places and other related tasks.

Q6- Are all cases the same or it differs from one case to another?

Speech therapist: Well, it differs from one case to another. Dyslexia can be severe as it can be mild but not negligible.

Q 07: In your opinion, do you think Aidodys can help?

Speech therapist: This application can help dyslexics, maybe, read and learn foreign languages, but in our environment, taking into account all the problems existing in our classes, I doubt it can help him become autonomous.

Q08: If this app had Arabic adaptations, do you think it can help our learners to better read?

The speech therapist: Definitely. It can help them read and maybe become autonomous, under the condition that our classes will be provided with the necessary gadgets.

6.4. Analysis

After transcribing the notes and reviewing the data, the common themes and key issues interrelated to the questions were highlighted (coded). Next, the data was carefully analyzed following a thematic analysis.

6.4.1. Rational for The Thematic Analysis

Thematic analysis emphasizes organization and rich description of the data set. In our interview, we gathered data on some specific points that became themes after coding. So, thematic analysis allows extracting more information from our interview.

6.5. Results

The interview was decorticated into four main themes, and each theme into two main focal points:

Table 17.

Themes of the Interview

Treatment	Process	Frequency	Solutions
*By teachers	*Of detection	*Of existence	*Used solutions
*By parents	*Of helping	*Of helping	*Effectiveness of Aidodys

- **Treatment:** according to the speech therapist, both teachers and parents ignore the sensitivity of the dyslexic case, and they are not cooperative to help them. Teachers do not give necessary attention to the learners, and parents do not make sufficient efforts to help their kids. Even when they are presented to a speech therapist, they expect immediate results and when it is not the case, they stop the sessions.

- **Process of detection:** the process of detection is not easy. It takes time and has some specific tests to be done in order to decide whether the learner is dyslexic or not.

- **Process of helping:** the same goes true for the process of helping. It takes much time to see improvements, especially when they have no materials that can help and facilitate the task for both the speech therapist and the learner.

- **Frequency of existence:** dyslexic learners are less frequent than other cases of learning difficulties such as autism. Yet, they still exist and are a part of the classroom.

- **Frequency of sessions to help:** helping through the old methods needs time and collaboration.

- **The used solutions with dyslexics:** they usually follow old solutions that are slow and may cause boredom to the learner. (from the example he gave, we can deduce that they only use what they have as materials, and there is a total absence of ICT in the treatment process)

- **Aidodys:** the speech therapist believes that Aidodys can work; but it will provide better help if there will be an Arabic version in addition to the existing one to help the learners learn foreign languages easily.

7. Summary of procedures and discussion of results

This research pointed an intricate problem present in Algerian classes that is unfortunately not addressed properly. The major aim of this study, as has been previously stated, is to provide an aid to a marginalized category of learners through the integration of ICT in pedagogy. Reconsidering the place of dyslexics and facilitating the reading task for them for a better social and academic integration is the other priority of this study. Since we targeted learners with disabilities, specifically dyslexics to provide an aid for them, the title of our research is: "the impact of introducing Aidodys application as a pedagogical aid on the reading fluency of dyslexic learners".

In this sense, the first research question of this study is How does Aidodys software impact the reading duration of dyslexic learners?

Through the pre experimental study, we have collected valuable data in giving dyslexic learners a list of simple words varying from two to 5 letters words and counted the spent time on reading them as a pre test. The learners spent a long time on reading.

 After this, the researcher created profiles according to their preferences and comfort, then adapted the same list of words and gave it again to the learners in order to determine the spent time after the adaptation as a post test. As expected, a decrease in time was marked, so an amelioration is highlighted.

After the pre experiment, the second research question was "Are there any changes in the reading fluency of dyslexic learners after the use of Aidodys?"

In order to answer this question, learners were first, given some sentences and a text to be read, and the volume, the articulation, the speed… were observed. This step is done to check their fluency before Aidodys adaptations. Expectedly, learners could difficultly read the passages and gave up eventually. These sentences/texts were adapted through the previously created profiles and then, the researcher asked the learners to read again in order to observe the changes after introducing Aidodys. Results were outstandingly positive since the learners could better read, and improve their fluency.

The last data collection tool is the interview. This latter was conducted for the sake of first, answering the last research question that is "How do speech-therapists perceive and act with dyslexic learners?", and second, collecting further information about dyslexics, about how they are diagnosed, treated, and helped. At the end, some questions to explore their attitudes regarding the software were asked.

At the end, through using these three data collection tools, we have thoroughly discussed the matter of reading fluency of learners suffering from dyslexia. We could collect

some rich and valuable data and analyzed it in order to answer the research questions and confirm the presumed hypotheses suggested at the beginning of our study.

8. Synthesis of Findings

The recapitulated conclusions and findings drawn from this study are as follows. First, from the pre experimental study, reading texts adapted through Aidodys could remarkably decrease the time spent in reading by dyslexics.

Observing the impact of Aidodys on the reading fluency of dyslexics was another important step to determine its effectiveness. From this point, we opted for a semi structured observation of sentence and text reading before and after the introduction of Aidodys. We concluded that the reading fluency of dyslexic learners improved after the use of Aidodys application, so the second hypothesis was confirmed.

The interview is used as a last data collection tool in order to have thorough information about the detection process, the ways of helping them, and their attitude towards Aidodys. From the analysis, we have reached the conclusion that, according to the speech therapist, Aidodys can unconditionally help dyslexic learners compensate for challenges they might experience. So, the last question of our research is answered, and its hypothesis is confirmed.

Conclusion

This chapter was devoted for discussing the fieldwork of our research study. Subsequently, the chosen quantitative data collection tools (the pre-experimentation) and the qualitative ones (the observation, the interview) were highlighted. Moreover, hints on the rational of the chosen methodology were provided to justify the methodological approach selection. Finally, the procedures and the results were discussed to draw conclusions and

confirm hypotheses. To conclude, the questions asked at the beginning of our research were thus answered and hypotheses were confirmed.

Recommendations
For Teachers

- Dyslexic learners are not less important or less intelligent than their peers, maybe with some extra effort and more attention and care, teachers can help them in many ways.

- Working in collaboration with speech therapists will give teachers a better idea about how to deal with these learners, and at the same time, you will be a valuable source of information about their progress.

- The use of ICT is indispensable in classes that include dyslexic learners as they offer some advantages like enabling them to ameliorate their fluency and comprehension, with less efforts and energy thus, motivate them to read and learn

For Parents

- Help your dyslexic kid regain self-confidence through encouraging him to read, motivating him, do the tasks suggested by the speech therapist, choose interesting books and activities that attracts the kid etc… because emotional assistance is the half way to the solution

- Listen to scripted audio books and have your child read along with them. This will familiarize words to him.

- Manage the use of ICT at home and help your kid find his comfort of reading: Apps that can turn reading, spelling and phonological awareness into a game will help.

- Do not expect magical solutions right from the beginning of speech therapists' interventions or applications adaptations. Dyslexia requires patience and non-stop encouragement.

For Ministry of Education

- Since learners with impairments are part of our classes, they have equal chances as other learners, they should not be ignored: cases like dyslexia can be helped through Simple solutions like ICT.

- Developing applications similar to Aidodys or the use of Aidodys is a must in our classes since it has proved its efficacy.

- ICT manipulation and mastering must be a principal part of teachers' trainings. It is useful not only with learners with impairments; but with teaching/learning tasks in general.

For Aidodys Company/Corporation

- Reading is finally accessible for all. It would be perfect if the application can be used with other languages like Arabic.

Limitations

The first faced impediment to our research is the COVID-19 pandemic that obliged us to work with a reduced sample in different and difficult conditions and setting. This latter was a complicated problem that led us to change many steps in our research. Not only did COVID 19 impede the process of research, but it affected the researcher's progress. It is noteworthy that the Arabic version of Aidodys could be of a great help. Moreover, the lack of sources namely books in the field of dyslexia and ICT in helping learners with impairments   was the other limitation that we have faced during this research.

General Conclusion

Ensuring equal chances to all learners including those with learning impairments, specifically dyslexics, is the main purpose of our dissertation. From a preliminary observation and previous studies, we noticed that children having dyslexia are truly suffering from reading problems that leads to more complex behavioural and social difficulties. Henceforth; integrating ICT is suggested as a solution to help Algerian dyslexics improve their reading and comprehension, thus improve their school performance and results and eventually save them from being dropped out of schools. Accordingly, a specifically designed application to facilitate reading for dyslexics named Aidodys is proposed, introduced and tested to check its impact on improving dyslexics' reading accuracy and fluency.

In order to attain the impact of Aidodys on dyslexics, both quantitative and qualitative data collection tools are used. First, a pre-experimental design is opted for to collect quantitative data, and then; an observation and an interview are used for qualitative data. The former collected numerical data through counting the spent time in reading separate simple words, and the latter were used to collect descriptive data about the fluency of the learners and the way they are treated.

The obtained results confirmed that dyslexia is a real impede affecting dyslexics' learning process. However, findings of the study showed an optimistic vision and confirmed the value of Aidodys implementation that has not only interestingly marked amelioration in reading fluency and reading comprehension, but also proved to be appropriate and might be used or based upon to develop a similar application designed to Algerian dyslexics. To conclude, new trends in teaching using ICT are ever developing and illimited. further research to investigate the issue in-depth or occupy similar subject might be conducted in order to help learners in need and "leave no learner behind"

References

- A.Edwards. (july, 2015). Dyslexia and the Brain: IDA Fact Sheet. *International Dyslexia Association: O-G Tutoring in Columbus OH:*, nb; 614.
https://dyslexia.wordpress.com/2015/07/08/dyslexia-and-the-brain-ida-fact-sheet-2/

- *Academy of Orton-Gillingham Practitioners and Educators*. (2018). Retrieved from What is the Orton-Gillingham Approach?:https://www.ortonacademy.org/resources/what-is-the-orton-gillingham-approach/
https://www.ortonacademy.org/resources/what-is-the-orton-gillingham-approach/

- Algerie Presse service. (2018). oran: 900 enfants dyslexiques en echec scolaire annuellment. (2018, juillet 08). *algerie presse services*.
http://www.aps.dz/regions/76049-oran-900-enfants-dyslexiques-en-echec-scolaire-annuellement

- https://www.bbc.com/news/education-30216408

- Bennett, D.J. B. (2019). Technology Integration for Students with Dyslexia. *Texas Education*.
https://www.region10.org/programs/dyslexia-statewide/techplan/

- Brenda.M. (1999). Multisensory Approaches and Learning Styles Theory in the elementary school. *Summary of Reference Papers*.
https://files.eric.ed.gov/fulltext/ED432388.pdf

- Chang, K. (2015). *Evolution of the Dual Route Cascaded Model.* University of Waterloo, Canada.

- Chelli.S. (2016-2017). Lectures of Methodology for M2 Students.

- Creswell, J. (2013). *research design Qualitative, Quantitative, and Mixed Methods Approaches. .* technological horizon in education.
https://us.sagepub.com/sites/default/files/upmbinaries/55588_Chapter_1_Sample_Creswell_Research_Design_4e.pdf

- Cowen, C.D.. (summer, 2016). International Dyslexia Association. *what is structured literacy?*
https://dyslexiaida.org/what-is-structured-literacy/

- Crystal.D. (1987). *The Cambridge Encyclopedia of Language .* Newyork: Cambridge.

- Dan Brennan, MD.(2019) "What Is Dyslexia." WebMD, WebMD, 2019, www.webmd.com/dan-brennan./https://www.webmd.com/children/understanding-dyslexia-basics

- Day, R. R. (s.d.). Issues in Applying SLA Theories toward Reflective and Effective Teaching_Reflective and effective reading. *KONINKLIJKE BRILL NV LEIDEN*, 2018 .

- Dornyei.Z. (2003). *Questionnaires in Second Language.* London: LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS.

- *dyslexia foundation NewZealand*. (s.d.). Récupéré sur recognizing dyslexia: http://www.dyslexiafoundation.org.nz/info.html

- Elazab Elshazly, Elazab Mohamed (2016).A case study of an intervention program for students with dyslexia in a primary school in the UAE. United Arab Emirates University.Theses. 355.

https://scholarworks.uaeu.ac.ae/all_theses/355

- Emerson Dickman, J. (April 13, 2015). Dyslexia: An Operational Definition. *dickmanalliance*.

- https://explorable.com/research-population

- *inclusive education canada*. (2017). Récupéré sur What Is Inclusive Education?: https://inclusiveeducation.ca/about/what-is-ie/

- Kothari.C.R. (2004). *research methodology, methods and approaches.* NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS.

- Long.M C.Wood K.Littleton T.Passenger K.Sheery. (2011). *the Psychology of Education.* routledge edition.

- Maissoney ,B,S.(1951) "What Is Dyslexia?" What Is Dyslexia, Understood, 17 april, 2020,

www.understood.org/en/learning-thinking-differences/child-learning-disabilities/dyslexia/what-is-dyslexia.

- McCrea, B. (2010, january 27). *Measuring the iPad's Potential for Education.* Récupéré sur Educators and analysts weigh in on how the iPad could infiltrate the hallways of K-12 schools nationwide.

https://thejournal.com/articles/2010/01/27/measuring-the-ipads-potential-for-education.aspx

- *national council for special education*. (s.d.). Récupéré sur Dyslexia and Information and Communication Technology: https://www.sess.ie/dyslexia-ICT

- NICHAD (2012), "About Learning Disabilities." Eunice Kennedy Shriver National Institute of Child Health and Human Development, U.S. Department of Health and Human Services,

 www.nichd.nih.gov/health/topics/learning/conditioninfo.

- Rastle, K. (2007). Visual word recognition. The Oxford Handbook of Psycholinguistics, 70-88. doi:10.1093/oxfordhb/9780198568971.013.0005

- Roggers.A.(2016) "Broca Area." Encyclopædia Britannica, Encyclopædia Britannica, Inc., www.britannica.com/editor/Kara-Rogers/6713.

- Rose articles & DfES. (2006). Powering Professional Learning Communities. Retrieved from https://www.teachingtimes.com/2009-pblications

- schafhausser. (2013). Assistive Tech Goes Mainstream: As Schools Shift to Mobile Device Usage and New Forms of Technology-Inspired Pedagogy-Like the Flipped Classroom-Special Ed Is Adopting Mainstream Approaches for Its Assistive Technologies. *technological horizon in education*.

https://www.questia.com/library/journal/1G1-335973313/assistive-tech-goes-mainstream-as-schools-shift-to

- Snowling.M.J. (2000). *Dyslexia.* blackwell publishing.

- Spencer,R & Smullin,T.(2015, september 01). *technology in the classroom.*
http://succinctdad3861.over-blog.com/2015/09/future-reading-using-technology-in-the-classroom.html

- SUNY,Lumen,(2019) "Abnormal Psychology." courses.

www.lumenlearning.com/abnormalpsychology/chapter/reading-disorder-315/.

- Tanveer,U. (2019). How does Technology-Enhanced Learning (TEL) assist students with learning disabilities? Case Study from undergraduate and postgraduate courses in FBL. *Supply Chain, FBL, UoN*. https://www.northampton.ac.uk/ilt/assisting-students-with-learning-disabilities/

- Thompson, Robert Haven, and S. Tanimoto. "HAWK/KW: an Online System for Studying Dyslexic Childrens Reading, Writing, and Programming."

 Https://Homes.cs.washington.edu/~Robthomp/Thesis.pdf, University of Washington, 2019.

- Weselby.C. (21 august 2018). What is Differentiated Instruction? Examples of How to Differentiate Instruction in the Classroom. *concordia university portland*. https://education.cu-portland.edu/blog/classroom-resources/examples-of-differentiated-instruction/welsby

APPENDICES

Preliminary Study

Observation Checklist Conducted in Classrooms where Dyslexics Study

Objective:

Observe to check whether dyslexics in the Algerian classroom in general, and at this school specifically, are given the best conditions to ensure their learning.

Name of the school: Ben Chaib Saleh

Level:4th-5th grade

Observation	Yes	No	Notes
1-Are there dyslexics in this classroom?			
2-Are there any signs that differentiate them?			
3-Are they treated in a special way by the teacher?			
4-Do they show any troubles in their comportment?			
4-reading participation?			
5-According to the teacher's treatment, does he seem to be aware of their case?			
6-Are there any pedagogical tools destinated to them?			

Conducted by: Temagoult Nabila

Appendix 02: The calculation of the pre test mean, variance and standard deviation.
Learner one

	A	B	C	D	E	F
1	8	-2,85714286	8,16326531			
2	9	-1,85714286	3,44897959			
3	12	1,142857143	1,30612245			
4	10	-0,85714286	0,73469388			
5	15	4,142857143	17,1632653			
6	14	3,142857143	9,87755102			
7	11	0,142857143	0,02040816			
8	15	4,142857143	17,1632653		mean pretes	10,8571429
9	15	4,142857143	17,1632653			
10	14	3,142857143	9,87755102			
11	28	17,14285714	293,877551			
12	14	3,142857143	9,87755102			
13	36	25,14285714	632,163265			
14	17	6,142857143	37,7346939			
15	5	-5,85714286	34,3061224			
16	8	-2,85714286	8,16326531	Variance	49,7653061	
17	4	-6,85714286	47,0204082	S.deviation	7,05445293	
18	5	-5,85714286	34,3061224			
19	5	-5,85714286	34,3061224			
20	8	-2,85714286	8,16326531			
21	6	-4,85714286	23,5918367			
22	7	-3,85714286	14,877551			
23	5	-5,85714286	34,3061224			
24	7	-3,85714286	14,877551			
25	6	-4,85714286	23,5918367			

Appendix 03: Calculation of the post test Mean, Variance and Standard Deviation Learner Two

G	H	I	J	K	L	M	N	O	P
	6	-0,32142857	0,10331633						
	5	-1,32142857	1,74617347						
	6	-0,32142857	0,10331633						
	7	0,678571429	0,46045918						
	6	-0,32142857	0,10331633		Mean. Post,1	6,32142857			
	11	4,678571429	21,8890306						
	9	2,678571429	7,1747449						
	9	2,678571429	7,1747449						
	8	1,678571429	2,81760204						
	10	3,678571429	13,5318878						
	9	2,678571429	7,1747449						
	7	0,678571429	0,46045918						
	10	3,678571429	13,5318878						
	7	0,678571429	0,46045918						
	3	-3,32142857	11,0318878						
	4	-2,32142857	5,38903061						
	4	-2,32142857	5,38903061						
	6	-0,32142857	0,10331633			171,964286			
	5	-1,32142857	1,74617347		variance	6,14158163			
	7	0,678571429	0,46045918		S,deviation	2,47822147			
	4	-2,32142857	5,38903061						
	4	-2,32142857	5,38903061						
	7	0,678571429	0,46045918						

Appendix 04: Results of the t-test

	B	C	D	E	F	G	H	I	J
5	-5,85714286	34,3061224					4	-2,32142857	5,389030
7	-3,85714286	14,877551					4	-2,32142857	5,389030
6	-4,85714286	23,5918367					7	0,678571429	0,460459
8	-2,85714286	8,16326531					6	6,321428571	39,96045
5	-5,85714286	34,3061224					4	-2,32142857	5,389030
7	-3,85714286	14,877551					3	-3,32142857	11,03188
							5	-1,32142857	1,746173
							5	-1,32142857	1,746173
				T.test	13,1313776				

Appendix 05: The one-minute Reading Test before/after Adaptation

One minute Common-word Reading test

Si	Me	On	Au	bas	Sa	Ta	07
An	Il	or	be	tes	Ni	Le	14
Om	In	Va	Du	ma	Et	Non	21
oui	Mi	Son	Pu	thé	Pas	Car	28
but	Bon	Ton	arc	can	Dort	Lit	36
Ou	Lui	Vol	est	tôt	Long	Mes	42
chat	Pot	Bois	met	top	Jus	Ses	49
nom	Mot	Jeu	Lot	gaz	Dix	Van	56
bas	Riz	Cube	bel	lis	Pin	Han	63
Rat	Pec	Nuit	big	robe	Six	Gaz	70
gel	Led	Fin	leur	nez	Sel	Mur	77
Ici	Sac	Bol	eau	code	ruine	point	84
nord	Chien	Homme	mais	tète	Etre	Prêt	91
corde	Tard	Fille	rouge	qui	Bête	Belle	98

The one-minute reading test after adaptation learner one

si	me	on	au	bas	sa	Ta	07
an	il	or	be	tes	ni	Le	14
om	in	Va	du	ma	et	Non	21
oui	mi	son	pu	thé	pas	Car	28
but	bon	ton	arc	can	dort	Lit	36
ou	lui	vol	est	tôt	long	Mes	42
chat	pot	bois	met	top	jus	Ses	49
nom	mot	jeu	Lot	gaz	dix	Van	56
bas	riz	cube	bel	lis	pin	Han	63
rat	pec	nuit	big	robe	six	Gaz	70
gel	led	fin	leur	nez	sel	Mur	77
ici	sac	bol	eau	code	ruine	point	84
nord	chien	homme	mais	tête	être	Prêt	91
corde	tard	fille	rouge	qui	bête	Belle	98

The one-minute reading test after adaptation learner two

si	me	on	au	bas	sa	Ta	07
an	il	or	be	tes	ni	Le	14
om	in	Va	du	ma	et	Non	21
oui	mi	son	pu	thé	pas	Car	28
but	bon	ton	arc	can	dort	Lit	36
ou	lui	vol	est	tôt	long	Mes	42
chat	pot	bois	met	top	jus	Ses	49
nom	mot	jeu	Lot	gaz	dix	Van	56
bas	riz	cube	bel	lis	pin	Han	63
rat	pec	nuit	big	robe	six	Gaz	70
gel	led	fin	leur	nez	sel	Mur	77
ici	sac	bol	eau	code	ruine	point	84
nord	chien	homme	mais	tête	être	Prêt	91
cord	tard	fille	rouge	qui	bête	Belle	98

Appendix 06: Sentences and Text Adaptations Learner One and Learner Two:

Learner one

1. Elle a lu un livre.

2. Il dit la vérité.

3. Ils ont de l'énergie.

4. Vous avez un ordinateur.

5. Il parle de sa tata.

6. Tu vas à la plage.

Learner two

1. Elle a lu un livre.

2. Il dit la vérité.

3. Ils ont de l'énergie.

4. Vous avez un ordinateur.

5. Il parle de sa tata.

6. Tu vas à la plage.

Appendix 06

Learner one: Texts before adaptation

la pollution des océans

Les océans couvrent une très grande partie de la surface de la Terre. Ils abritent beaucoup d'espèces de poissons et de mammifères. Ils nous apportent aussi de la nourriture et des ressources précieuses comme le pétrole. Pourtant, les hommes polluent les océans avec des eaux usées, du pétrole et des déchets d'usines.

• Les déchets d'usine

Dans les usines, on se débarrasse parfois des déchets en les mettant dans des fûts qui sont ensuite jetés à la mer. Mais lorsque ces fûts sont percés, les déchets peuvent se répandre dans l'eau. Ils tuent alors des milliers de poissons et de mammifères, comme les dauphins.

• Les marées noires

Quand du pétrole se répand dans la mer, cela cause une marée noire qui pollue les côtes. Les oiseaux et les animaux vivants sur les côtes sont aussi touchés. Le pétrole englue leur fourrure ou leurs plumes, ce qui les empêche de nager ou de voler, et peut les empoisonner lorsqu'ils essaient de se nettoyer.

D'après T. Hare et C. Leplae-Couwez, Les habitats en voie de disparition, Coll. Le monde qui nous entoure, Ed. Gamma.

Text after adaptation

La pollution des océans

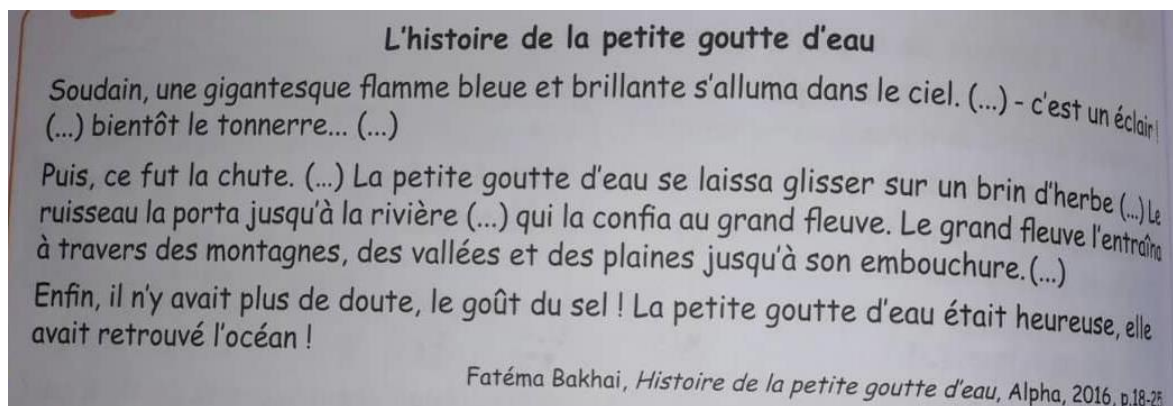Les océans couvrent une très grande partie de la surface de la terre.

Ils abritent beaucoup d'espèces de poissons et de mammifères. Ils nous apportent aussi de la nourriture et des ressource précieuses comme le pétrole. Pourtant, les hommes polluent les océans avec des eaux usées, du pétrole et des déchets d'usines.

Learner two: Text before adaptation

L'histoire de la petite goutte d'eau

Soudain, une gigantesque flamme bleue et brillante s'alluma dans le ciel. (...) - c'est un éclair ! (...) bientôt le tonnerre... (...)

Puis, ce fut la chute. (...) La petite goutte d'eau se laissa glisser sur un brin d'herbe (...) Le ruisseau la porta jusqu'à la rivière (...) qui la confia au grand fleuve. Le grand fleuve l'entraîna à travers des montagnes, des vallées et des plaines jusqu'à son embouchure. (...)

Enfin, il n'y avait plus de doute, le goût du sel ! La petite goutte d'eau était heureuse, elle avait retrouvé l'océan !

Fatéma Bakhai, *Histoire de la petite goutte d'eau*, Alpha, 2016, p.18-25

Text after adaptation

L'histoire de la petite goutte d'eau

Soudain, une gigantesque flamme bleue et brillante s'alluma dans le ciel. C'est un éclair ! bientôt le tonnerre.

Puis, ce fut la chute. La petite goutte d'eau se laissa glisser sur un brin d'herbe. Le ruisseau la porta jusqu'à la rivière qui la confia au grand fleuve. Le grand fleuve l'entraina a travers des montagnes, des vallées et des plaines jusqu'à son embouchure.

Enfin, il n'y avait plus de doute, le gout du sel ! la petite goutte d'eau était heureuse, elle avait retrouvé l'océan !

Appendix 07: The Interview

Q 01: how frequently do you find cases of dyslexics in classes?

Q 02: how do you think they are treated?

Q03: what are the processes followed to detect these learners? Are there any tests?

Q 04: how many times do you treat dyslexics per month?

Q 05: are there any suggest solutions? What are they do they have any impact?

Q 06: are these solutions taken into account in the classrooms?

G 07: in your opinion, do you think Aidodys can help?

Appendix 08: declaration of the speech therapist

Declaration

I hereby declare that I have agreed to work with Miss Temagoult Nabila and help her to have complete information about the sample of dyslexic learners, and answered the necessary questions asked in the interview.

Name of the speech therapist: Bousyouda Fares

Name of the center: المركز الخاص بالمعاقين ذهنيا

Location : Draa Zitoun, Arris, Batna

Date:12-03-2020

Signature:

/

Résumé

Construire un apprentissage réussi commence par le processus naturel de déchiffrer des symboles écrits et de les convertir en ensembles de mots, de phrases et de textes pour forger un sens : C'est la compétence de base affûtée dans les écoles qui garantit un apprentissage systématique de nouvelles compétences et expériences. Néanmoins, la dyslexie, l'incapacité de déchiffrer et décoder les lettres à lire, non seulement entrave le cheminement normal de l'apprentissage, mais condamne également les dyslexiques comme étant des «apprenants ayant des besoins spéciaux». Pointant les classes algériennes, ces besoins ne sont pas assez pris en charge et les dyslexiques abandonnent l'école en raison de leurs échecs fréquents. Apparemment, un tel problème ne peut avoir de solution ; mais la combinaison de la pédagogie et des TIC peut apporter des améliorations remarquables. Dans cette ligne, la présente étude propose l'application Aidodys comme aide pédagogique pour les apprenants dyslexiques algériens et vise principalement à améliorer leurs lecture. Au niveau de la méthodologie, en optant pour une approche de méthodes mixtes, nous avons mené cette enquête sur une population d'un groupe de jeunes apprenants dyslexiques à partir d'une expérimentation dans laquelle le temps passé à lire était compté, une observation qui a permis de vérifier certains éléments. de la maîtrise de la lecture, et enfin un entretien pour recueillir des données informatives et approfondies. Après analyse et interprétation des résultats, cette étude a validé l'efficacité de l'application Aidodys pour l'amélioration de la fluidité de lecture, confirmant ainsi les hypothèses proposées au début de l'étude.

ملخص

يبدأ بناء التعلم الناجح بالعملية الطبيعية المتمثلة في كسر الرموز المكتوبة وتحويلها إلى مجموعات من الكلمات والجمل والنصوص لتكوين المعنى: إنها المهارة الأساسية التي يتم اكتسابها في المدارس التي تضمن التعلم المنهجي للمهارات والخبرات الجديدة. ومع ذلك ، فإن عسر القراءة ، وعدم القدرة على فك رموز الحروف للقراءة ، لا يعيق المسار الطبيعي للتعلم فحسب ، بل يدين أيضًا عسر القراءة باعتبارهم "متعلمين ذوي احتياجات خاصة". في إشارة إلى الصفوف الجزائرية ، لا يتم التعامل مع هذه الاحتياجات بشكل عادل حيث يتم طرد المتمدرسين الذين يعانون من عسر القراءة من المدارس بسبب فشلهم المتكرر. على ما يبدو ، لا يمكن أن يكون لمثل هذه المشكلة أي حل. لكن لحسن الحظ. يمكن للجمع بين علم أصول التدريس وتكنولوجيا المعلومات والاتصالات في الوقت الحاضر إجراء تحسينات ملحوظة. في هذا السياق ، تقترح Aidodys كمساعدة تربوية للمتعلمين الجزائريين الذين يعانون من عسر القراءة وتهدف بشكل الدراسة الحالية تطبيق أساسي إلى تحسين القراءة . على مستوى المنهجية ، من خلال اختيار نهج الأساليب المختلطة ، أجرينا هذا البحث على مجموعة من المتعلمين الصغار الذين يعانون من عسر القراءة باستخدام تجربة تم فيها حساب الوقت الذي يقضونه في القراءة ، وهي ملاحظة سمحت بفحص بعض العناصر طلاقة في القراءة ، وأخيراً مقابلة لجمع بيانات إعلامية ووافية. بعد في تحسين طلاقة القراءة ، وبالتالي أكدت الفرضيات Aidodys تحليل النتائج وتفسيرها ، أثبتت هذه الدراسة فعالية تطبيق المقترحة في بداية الدراسة.