

# The Use of Software and Internet Search Engines to Develop the Encoding and Decoding Skills of a Dyslexic Learner: A Case Study

Rabih Joseph Nabhan

**Abstract**—This case study explores the impact of two major computer software programs *Learn to Speak English* and *Learn English Spelling and Pronunciation*, and some Internet search engines such as Google on mending the decoding and spelling deficiency of Simon X, a dyslexic student. The improvement in decoding and spelling may result in better reading comprehension and composition writing. Some computer programs and Internet materials can help regain the missing awareness and consequently restore his self-confidence and self-esteem. In addition, this study provides a systematic plan comprising a set of activities (four computer programs and Internet materials) which address the problem from the lowest to the highest levels of phoneme and phonological awareness. Four methods of data collection (accounts, observations, published tests, and interviews) create the triangulation to validly and reliably collect data before the plan, during the plan, and after the plan. The data collected are analyzed quantitatively and qualitatively. Sometimes the analysis is either quantitative or qualitative, and some other times a combination of both. Tables and figures are utilized to provide a clear and uncomplicated illustration of some data. The improvement in the decoding, spelling, reading comprehension, and composition writing skills that occurred is proved through the use of authentic materials performed by the student under study. Such materials are a comparison between two sample passages written by the learner before and after the plan, a genuine computer chat conversation, and the scores of the academic year that followed the execution of the plan. Based on these results, the researcher recommends further studies on other Lebanese dyslexic learners using the computer to mend their language problem in order to design and make a most reliable software program that can address this disability more efficiently and successfully.

**Keywords**—Analysis, awareness, dyslexic, software.

## I. INTRODUCTION

**D**YSLEXIA is a common learning disability that exists in most academic institutions. However, most educators do not notice it and are unaware of its nature. According to the International Dyslexia Association Board of Directors [1], dyslexia is a specific learning disability characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. A deficiency in language phonology causes these difficulties leading to ineffective classroom learning. Secondary problems may result. Such problems might be evident in reading comprehension, which can affect growth of vocabulary, problems in writing ability resulting from weakness in spelling

and decoding.

There have always been a variety of methods and techniques to help the dyslexic learner overcome this disability. Most of these methods and techniques have been based on direct psychological procedures as well as on non-academic treatments such as resorting to special schools and institutions for the dyslexics. What is needed here is a method or tool that can help the dyslexics overcome their learning problems without making them feel that they are different from other learners. This tool may be the computer with its software and Internet access.

Dyslexic learners find it difficult to read and comprehend texts and write pieces of composition due to difficulty in reading and spelling. Misreading of words may lead these learners to experience a problem in comprehension and understanding of texts, for “if they could read the words, then they could comprehend the meaning of text” [2] and “poor word recognition diverts resources from the processes that are necessary for comprehension” [3]; furthermore, they misspell words (even the easiest ones) and that leads to poor composition writing. Thus, the solution is mending the roots of this problem, which is the decoding and spelling of words. A lot of techniques are used to help dyslexic learners overcome their problems. For instance, in private institutions for dyslexics, specialists use re-education methods where the student re-learns the alphabet, all sounds, and all the sound combinations, and odd word spellings etc., in addition to using tactile, kinesthetic, visual, and auditory senses simultaneously. However, these learners, especially those who are about to turn into teenagers, feel depressed and miserable for the special care they are shown. Students just need to feel they are learning in an environment or atmosphere where they do not feel inferior to or different from other learners. In addition, like normal learners, they need motivating methods and tools. An effective motivating tool which may help improve the spelling and reading abilities of dyslexic learners is the computer with its software and Internet material. According to [4], there are many highly motivating traditional teaching methods, but such methods are discarded when Computer-assisted Language Learning (CALL) is brought into the teaching process. When computers are used in a learning task, students may stay longer on task and their commitment to learning is increased [4]. Consequently, they achieve more by being more enthusiastic about their lesson. This notion of implementing the computer to create motivation may be applied on dyslexic learners in the same way it is applied on

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non-dyslexic learners.

The following questions arise in this context:

1. How efficient can the computer be on the decoding and spelling of dyslexic learners in home tutoring?
2. How motivating can the computer be for such learners?
3. What software is to be used?
4. Can the Internet be used? How?
5. Is it possible for the dyslexic learner to do self-tutoring using the computer?

## II. REVIEW OF LITERATURE

### A. Dyslexia - A Learning Disability

Experts agree that dyslexia is a learning disability that affects language processing. It is not due to inadequate intelligence, lack of motivation, poor instruction, vision or hearing problems, cultural disadvantages, or other extrinsic factors. Rather, it is a genetic neurobiological disorder in which an individual has atypical brain structure and/or function. It runs in families, and there is no medical cure [5], [6]. Reference [6] talks about a research conducted through using magnetic resonance imaging (MRI), which “has produced an unprecedented ability to visualize the human brain with clarity comparable to post-mortem evaluations” [7], to compare the brain structures of dyslexic learners with those of normal learners. The research shows that the rear portion of the brain left hemisphere, which processes language and communication, of the dyslexics is much smaller than that of the normal readers. The researcher adds that these findings have been amplified by Professor Albert Galaburda of Boston, Massachusetts. Through dissection, Dr Albert confirmed that dyslexics had clusters of large cells in the left area of the brain 30% smaller than non-dyslexics of similar IQ. This suggests that dyslexics find difficulty in processing detailed information quickly. This difficulty in quick processing of detailed information results in difficulties in phonological and phoneme awareness. Reference [8] confirms that “children who are slow in their language development of phonology may develop a disorder of reading”. References [9], [10], and [6] add that phonological and phoneme awareness has very strong effect on early reading success because children have to learn what letters stand for. According to [11], weakness in phonological processing can most often hinder early reading and spelling development for both students with or without disabilities but may have a stronger effect on those with a disability. These phonological and phoneme awareness deficits, as [3] argues, “account for a large proportion of the difficulties encountered by dyslexic children and adults”. According to [12], research from around the world assures that the main deficit in specific reading disability is in printed word decoding recognition, caused mainly “by underlying deficits in analytic language skills of phoneme awareness (reflecting on sounds within a syllable) and phonological decoding (translating print to sound)”. This decoding recognition, according to [13], is an important part of reading. Reference [13] adds that to read well “the reader needs two kinds of information. One is knowledge of the spelling-sound

correspondences of the language, or what we have called the orthographic cipher”. This cipher of English is very complex because the English letters do not stand in one-to-one correspondence with their phonemes. The English alphabet has 26 letters, whereas the spoken English contains over 36 phonemes. Therefore, some letters represent more than one phoneme, or some phonemes must be represented by the combination of letters [13]. Consequently, all learners need this cipher to spell and read well, particularly the dyslexics who have more difficulty (as mentioned earlier in this chapter, due to the malformation of some part of their brain) in dealing with this cipher which is represented in phoneme and phonological awareness.

On the human level, the main problem is the misconceptions of many educators regarding dyslexia, which results in wrong or no treatment for those with this learning disability. In a study by [5], which included university faculty as well as undergraduate and graduate students preparing to become administrators, counselors, elementary general education teachers, secondary general education teachers, speech therapists, and special education teachers, to study their beliefs regarding dyslexia, it was found that the majority of those included in the study had significant misconceptions about dyslexia. Reference [14] states that sometimes schools and local boards of education do not regard dyslexia as an entity because they do not have the resources to meet the needs of students with dyslexia. Thus, they refer to ways which frustrate the students, and instead of mending the problem, they worsen it. Reference [6] says:

The consequences of simple shouting at dyslexic people, of failing to understand their problems and what it feels like to have them, are simply to compound their frustration. Even worse, it is to increase their very large potential for low self-esteem and even humiliation (p. 9).

Reference [6] adds, “The worst problem any dyslexic has to face is not reading, writing or even spelling, but lack of understanding”, which so often takes an extreme form out of teachers’ ignorance and results in frustration for both teachers and learners alike. Consequently, [5] adds that as a result of school experiences, a lot of pupils grow with social and emotional problems such as low self-esteem, disappointment, powerlessness, shame, and hopelessness. Thus, students with dyslexia are more frustrated than other slow learners because they have more cognitive-awareness of their difficulties. The impact of such incidents on dyslexics’ self-esteem and self-confidence can be more damaging than dyslexia itself. Reference [15] says that students with dyslexia have less self-esteem, self-confidence and expect to fail in chores. She adds that teachers have a vital role in fostering their students’ self-esteem, but they can also reduce this self-esteem when they ignore or disregard this learning disability as a major deficit in their students. Teachers should remember that although dyslexia is “invisible,” it is a very real disability [16], and as [6] states, its “denial has potential for enormous harm”.

### B. The Computer - A Tool to Teach Reading and Spelling

The second section of this chapter emphasizes the computer

and its importance in teaching language, particularly reading and spelling. Computer technology has become a major technological influence on our lives in the last two decades. More and more of its unique features are found every day and it is not surprising that the field of education has been widely affected by this tool. Reference [17] states:

Technological literacy- meaning computer skills and the ability to use computers and other technology to improve learning, productivity, and performance- has become as fundamental to a person's ability to navigate through society as traditional skills like reading, writing, and arithmetic.

It has turned out that this technology, through computer assisted language learning (CALL), has brought significant benefits to teachers and students alike. Reference [18] says, "It is a most appropriate aid for language learning that has interaction as its goal". It creates all kinds of interaction in the language learning such as student's interaction in all language skills and fields through the use of different kinds of software and Internet material.

Learning is not the same with computers, which have revolutionized the way language is learned. Reference [19] believes that "From the home and the classroom to the market or workplace, computers are reshaping the environments in which language is learned, produced, and practiced". One of the best features of computers is that it can create motivation, which is essential in teaching and learning. Reference [20] believes that motivation is related to one of the most basic parts of the human mind and it can determine success or failure in any situation. He adds that without motivation, even the brightest students fail to attain any stated or targeted language objective. This aspect of motivation may be created by using the computer on any learners, with or without a learning disability. Reference [21] notes that the computer has a beneficial effect on learner motivation; they add that "It offers privacy, which relieves learners from the fear of being ridiculed for their mistakes by their classmates". It creates learning equality between all learners and makes low achievers feel they are high achievers.

Reference [4] argues that using the computer can be very motivating to low achieving students because many low achievers in language can be high achievers in computer technology and thus their self-esteem and self-confidence return to them in a way that has never been thought of. She adds that through the use of word processing, students who do poorly at writing and have little interest in this aspect of their work improve their self-esteem, their commitment and perseverance in learning tasks. Reference [22] says that "word processors, for example, facilitate the invention, revision, and editing processes of writing, allowing quick, easy reshaping of text". In a study by [23] of 144 pupils' opinions about how ICT (information and communication technology) contributed to their school work, over 70% of the pupils believed that it helped them to achieve a better quality of work.

Computers are very useful machines. You can set out and present your work very well. You can type up essays and other information. When a mistake is made you can

go back and delete the mistake or amend your document unlike typewriters you have to use Tippex.  
(Secondary female pupil – aged 13)

Another good feature of the computer is that it can help improve the reading and spelling abilities of language learners. For example, there is a program in which learners read stories on the computer gaining speech feedback and decoding assistance for any difficult words. Whenever learners ask for help on a word by targeting it with a mouse, the program highlights and subsequently pronounces it, either as a whole, in syllables, or in sub syllable segments [12]. In addition, [12] developed a program that can help learners improve their spelling. The program is called *Spello*, in which the computer pronounces a word to spell. In the interactive speech version, the speech synthesizer pronounces any attempt typed in by students, so they can compare the sounds of spelling patterns as they change letters, as in "bak" to "bake". They can also request spelling feedback to learn which of their letters are in the correct word, and which are correctly placed [12]. Several computer programs have been designed and implemented with young readers to ameliorate or prevent literacy difficulties. *Writing to Read*, for example, was designed to improve the reading and writing performance of young students in kindergarten and first grade [24]. Therefore, with the abundance of educational programs, teaching of spelling and reading skills can be done through the computer.

### C. The Computer- A Tool to Help Dyslexic Learners

The third part of this review deals with implementing the computer in helping dyslexic learners improve their reading and spelling abilities. Reference [25] confirms that using technology with students of special needs is not just encouraged, but it is a law now. He adds that students with special needs and learning disabilities such as dyslexia must be provided equal access to education programs supported by technology, particularly the computer. With the advent of this technology and greater access to computers, well designed CAT (Computer-Assisted Teaching) with a reading emphasis may help students with learning disabilities practice their language better [26]. Educators and researchers such as [27] have predicted a positive impact of computers on students with learning disabilities. Simon X, a grade 8 student with a learning disability, specifically dyslexia, said:

"I prefer using the computer for learning spelling because it's more motivating and funnier than the normal way with the use of paper and pens. Also, the computer has taken a part in my life that makes it even easier and more effective than the paper and pens way. "

Reference [27] states that "computers have the capacity to deliver motivating, carefully monitored, individualized, and speed-oriented practice in concentrations far beyond those available in traditional instructional format". What is needed (as mentioned previously) is a method to teach the dyslexics in the same way as ordinary learners are taught.

Reference [28] remark that when working with students with special needs, it must be clear that they can benefit from the computer technology the same as other pupils. They give

an example of how the computer can be used with dyslexic students. A voice-activated computer is needed to allow pupils to input written work. The educational outcome of this is “Pupil independence and increased phonological awareness – improved reading and spelling skills” [28]. They also talk about specific software addressed to learners with disabilities such as dyslexia. Three such software programs are *Full Phase*, *Talking Pendown*, and *Keystone*, which give the learners the chance “to speak into a microphone and the computer ‘writes’ what it ‘thinks’ they have said”. Another program particular for the dyslexics is *Easyread*, a system for teaching reading that is based on colors. The way this software works makes it easy for dyslexic pupils to learn pronunciation. Adding to these programs is *Oxford Reading Tree*, which helps students to improve in reading and spelling. The student can read and reread and also point to individual words in order to have them repeated. Reference [28] adds that the internet can be useful for students with special needs who have problems with reading and writing. Such children can be motivated through the use of email pen-pals in other schools and different parts of the world.

As quoted by [12], phoneme awareness “is the major cause of problems in phonological decoding. Yet research suggests that they can be remedied with methods specifically designed to address them”. Thus, they have conducted a lot of research on dyslexic learners using computer-supported phonological awareness training. They have developed and studied computer-based remediation focusing specifically on dealing with deficits such as dyslexia. They have used in their studies the talking computer to provide “a powerful remedial tool by providing speech feedback for difficult words while students read stories of interest to them”. This method of “talking computer” is the focus of my choice of software that is used in treating the dyslexic student under study. The “talking computer method” plays an essential role in the progress of the dyslexic because he finds himself relieved from the stress imposed due to his dyslexic state when exchanging information, questions and opinions in the presence of another person. This method is a way of exchange of information, and the dyslexic’s anxiety is diminished to a certain extent that his response to the “talking computer” becomes highly interactive. This will lead him/her to cooperate more effectively and more comfortably than when exchanging information with another person. The progress in overcoming his/her learning difficulties becomes very acceptable and flexible in order to attain a certain level of confidence which paves the way for him/her to move forward on the right track. Therefore, the more confident the dyslexic is, the better his/her advancement in facing learning difficulties becomes. It turns out to be easier to reach its objective i.e. overcoming the learning disability.

To sum up, dyslexia is a deficit that is not so easy to mend, and there have been a variety of methods and techniques to help dyslexic learners. The computer is a tool of unique features that may help learners in all areas of language learning, particularly reading and spelling. This tool may be useful with dyslexic students to help them improve their

reading (decoding) and spelling skills.

### III. METHODOLOGY

The case study is the style of the educational research used in this project. As reported by [29], a case study is the study of a specific instance in action which is designed to reach a more general principle. Thus, the case study style could be used in this research since as [29] state that the single instance in action

“provides a unique example of real people in real situations, enabling readers to understand ideas more clearly than simply presenting them with abstract theories or principles”.

In addition to this, a case study can provide the reader with an in-depth view of the situation and how it is investigated. As [30] say:

Case studies enable the investigator to ground the observations and concepts with which she or he works. The detailed and rich data offered by the well-crafted case study permit the analyst to develop a solid empirical basis for specific concepts and generalizations.

Reference [31] supports this view, saying

“one of the pluses of using case study methodology and methods is that an in-depth situation/individual, and so on, can be explored fully”.

To confirm this, as cited in [29], Sturman argues that the remarkable feature of case studies is that the human system has wholeness in them rather than being “a loose connection of traits” and this necessitates a deep examination.

The study undertaken in this research is how the computer with its software and Internet materials can help a dyslexic learner overcome the problem of spelling and reading. Therefore, this study, with all its parts, is conducted on a dyslexic student to see if the computer can help him, and consequently, other dyslexic learners to improve in spelling and reading.

In this case study, the researcher took an in-depth look at the participant in order to investigate all the aspects of his situation and try to find a solution for his problem.

However, the author of this study had little control over events since it was processed smoothly with no direct interference in events except when using the computer to apply the research plan. The teaching and learning process was carried on naturally and without controlling the track and progress of events taking place during the study. This aspect of the research in which the researcher has little control over events, according to [32], gives value to the case study approach by letting situations move on naturally without any outer intervention.

Besides all this, in a case study, a learner “might suddenly pass a single comment that indicates complete frustration”, which is very important to overlook and consider with value because this significant instance can give the researcher an important insight into the events and people engaged in the study [29].

#### IV. PARTICIPANT

A case study research can be applied on one or more participants. According to [29],

“the case study researcher typically observes the characteristics of an individual unit - a child, a clique, a school or a community”.

Reference [33] says that the unit of study in a case study “could even be one person, e.g. a student in a school or college”. References [31]-[34] confirm that a case study can focus on individual participants. Reference [35] asserts that the main focus of a case study can be on the “singular, the individual”. References [36]-[38] conducted case studies on single participants.

##### A. Character and Conditions

The student in this case study research is Simon X, a 13-year-old, right-handed Lebanese boy who attends the International School of Choueifat in the southeast region of Lebanon. Simon is a quiet and reserved boy. He is usually expressionless and his face is hard to read. In an educational evaluation report done on January 4, 2002, Ahamd Oueini, Ed.D., an educational specialist, certified by the City of New York, reported that Simon was evaluated due to the difficulties he faced with his reading and spelling skills. According to the doctor’s report, Simon’s case “is the fruit of a complicated pregnancy and delivery.” Dr. Oueini’s report added that Simon, who was born in Saudi Arabia, was a LBW (low birth weight) baby. Moreover, the subject of this study “reached his developmental milestones with a noticeable delay in most skills. Besides language delay, he reportedly was a stutterer.” However, Simon’s mother stated that his defects are currently controlled.

The third of four children, Simon’s learning problems turned out to be plain when he started grade school. Once more Dr. Oueini mentioned that Simon has been examined by a number of specialists for a range of purposes, “including psychological, psycho-educational, behavioral, and speech and language”. He has been diagnosed as having ADHD and specific learning disability (dyslexia). As a result, he has been put on psycho stimulant medication (Concerta), the improved version of Ritalin with longer-lasting effects. “He is reportedly responding favorably to the medication.” The report also mentions that Simon is currently “weakest in Arabic, but generally coping with the other subjects. He receives significant support at school, but he is still not up to par.”

##### B. The Learning Environment

Simon X, as we mentioned earlier, attends the International School of Choueifat, a member of the SABIS international education program. The school follows the objective type of exams, and since Simon’s cognitive abilities are average, fortunately, the subjects learning disability does not affect his performance in most subjects except the English language exams of spelling, reading, and of course, writing skills. The ambiance of his home is calm in general. His mother is very supportive and understanding to his case and tries to help her son by offering encouragement. She has always assigned a

private teacher to help him in all school subjects. However, she has not been able to find a special tutor who can help her son overcome his disability in reading, spelling, and writing (which is mainly affected by the numerous misspelled words). Simon does not receive any remark or criticism about his dyslexia problem except from his younger brother, who sometimes brags about his ability which excels that of his brother in the matters, as we said, of spelling and reading. In addition, Simon’s self-confidence and self-esteem are below average, as with most dyslexic cases. He feels weak no matter how he tries and he believes that it is all due to his “rotten brain”.

#### V. THE PLAN

Four hours of tutoring is given each week, two hours on Wednesdays and two hours on Saturdays. For each two hour session, a spelling and/or reading activity of about 30 minutes is given using the computer. As previously mentioned, what a dyslexic learner mainly needs is an increase in his/her phoneme and phonological awareness which, according to [11], is to have a general understanding at different levels. This is illustrated in Fig. 1 [11].

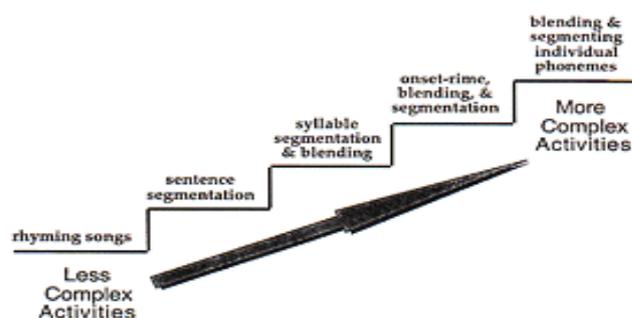


Fig. 1 A continuum of complexity of phonological awareness activities

Accordingly, three educational software programs which focus on this awareness are utilized: *Learn to Speak English*, *Learn English Spelling and Pronunciation*, and *Learn English Reading and Grammar*. In addition, the Internet is used for extra material and lessons related to reading and spelling, and as supplementary practice exercises for *Learn to Speak English*, which includes a part that can be practiced on the Net.

As reported earlier, Simon’s auditory processing is high average, so my focus is on using software that provides speech feedback and decoding assistance for any difficult word. *Learn to Speak English* is used to teach reading and spelling as its content integrates reading with spelling. This software, though its title refers to the speaking skill, can be used to teach reading since speaking is integrated with listening and most of its activities include listening to words, conversations, and documentaries with the ability to read them simultaneously. In other words, Simon listens and reads the words concurrently. To teach reading, the software works on letter sounds and letter combinations which is also appropriate for spelling. In

addition to this software, *Learn English Reading and Grammar* functions as supplementary software to teach reading. *Learn English Spelling and Pronunciation* is another program utilized specifically for spelling. For self-tutoring, the programs are left with Simon so that he practices alone as they are user-friendly.

To practice spelling, *Microsoft Word* is used to write words since this software can show that the word is misspelled and Simon can retry writing the word until it is spelled correctly or he can use the spell checker. For self-tutoring, the researcher recorded the words on *Windows Media Player* to which Simon can refer to at a later time, so as to listen to the words and practice spelling them. The software programs are to help Simon reach the normality level of decoding and spelling based on the PA-EFL program, which is outlined as follows:

#### **Pre-Phonics Level**

- A. Same-different
- B. Inclusion-exclusion
- C. Deletion and substitution

#### **Level One: Alphabet**

- A. Sound-letter-keyword recitation
- B. Cues for sound-letter associations

#### **Level Two: Segmentation**

- A. Alliteration
- B. Blending of CV's and CVC's (C = consonant, V = vowel)
- C. Rhyming with CVC's

#### **Level Three: Short Vowels**

- A. Multisensory experience
- B. Discrimination in CVC minimal pairs

#### **Level Four: Long Vowels and Diphthongs**

- A. Silent E
- B. Double vowel combinations
- C. R colored vowels
- D. Irregular combinations (e.g., ough)

#### **Level Five: Multisyllabic Sequences (2 and 3 syllables)**

#### **Level Six: Consonant Clusters (2 and 3 consonants)**

### VI. DATA COLLECTION

Reference [39] confirms that triangulation or “convergence of methods” is an effective technique to validate collection of data. Triangulation is the use of two or more methods of data collection in the study of a certain aspect of human behaviour. Reference [29] reports that “triangulation can be a useful technique where a researcher is engaged in case study, a particular example of complex phenomena”, and [35] assures that triangulation is obviously a significant feature in the process of analysis and interpretation. In addition to all this, [40] state that a number of authors believe that triangulation has an important role in the validation of findings. Therefore, to ensure validity of collecting data, four methods of collection are utilized: tests, observation, interviews, and accounts.

#### **Data Analysis**

According to [30], a case study is a “deep, multifaceted investigation”, using the qualitative methods, but some case studies have made use of both qualitative and quantitative

methods. Reference [41] confirms this by saying that the variety of perspectives and units of analysis which can achieve a complete case understanding requires the integration of both qualitative and quantitative methods. Reference [42] adds to this notion that “each of the two approaches provides a distinctive kind of evidence and used together they can offer a powerful resource to inform and illuminate policy and practice”. Reference [34] mentions that qualitative and quantitative analysis “both may be utilized in the same study”. In addition, the results of qualitative research can be measured to some extent in quantitative data, too. Thus, the data in this case study are analysed both qualitatively and quantitatively in three different ways. In the first, the qualitative data study precedes the quantitative one to help in devising areas of questioning for statistical study. In the second, the qualitative analysis is alongside the statistical enquiry to examine both the number and the nature of the same phenomenon. In the third, the qualitative analysis functions as a follow-up to statistical enquiry when there are instances where statistical enquiries present findings that need further explanations or where more detail or depth about a phenomenon is needed.

#### *A. Qualitative Analysis*

According to [34], for a qualitative analysis, a researcher can use a variety of methods and data collection strategies for “a holistic, in-depth understanding” of the study. Therefore, the data assembled in the methods of collection will be discerned, examined, and interpreted. Thus, data analysis includes the coding of the data and the production of verbal synthesis. The aim of this kind of analysis is a complete, verbose, detailed description of what has been explored and discovered and to present the findings as clearly, coherently and attractively as possible.

#### *B. Quantitative Analysis*

For quantitative analysis, features are classified, counted and presented in numbers to show differences and changes. According to [33], “data analysis requires the person to be painstaking, thorough, systematic and meticulous. It also requires a researcher to be ‘true to the data’ and to make a faithful representation of the data collected, especially when presenting it and publishing it”. Thus numbers and statistics can be straightforward, factual, faithful, and direct to the point.

To conclude, the data in accounts and observation as well as in the published tests will be analyzed qualitatively and quantitatively, whereas the focus of analysis in the interviews will be qualitative because, as [34] argues, the unstructured informal interviews are a good instrument to collect and analyze data qualitatively rather than quantitatively. Therefore, all the input variables will be analysed, as we said, qualitatively and quantitatively to produce output focal variables which provide goal achievement, new understanding, and truthful knowledge of this case study.

### VII. RESULTS AND DISCUSSION

#### *A. Comparison between Grade 7 and Grade 8*

As we concluded in phase two, Simon’s disability has

changed into ability, and thus altering him into an ordinary learner. Fig. 2 draws a comparison between Simon's grade 7 and grade 8 performances to show how he developed. In this figure, the final averages of both classes are utilized in term 3 to show the total achievements of each class.

Simon started and ended grade 7 very poorly in the spelling skill. Continuing into grade 8, Simon started very poorly; however, he improved in term 2 and ended term 3 with a relatively good score of 10.32/20 in the final exam. The final average of this class, as shown in Fig. 2, is below average due to the very poor score of term 1 (3.20/20). In spite of this, the final average of grade 8 (7.37/20) is still much better than the final average of grade 7 (4.73/20).

As to reading/decoding, Simon ended grade 7 with an average of 10.09/20, whereas he ended grade 8 with an average of 15.44/20. The progress is apparent in this skill between one class and another.

Concerning the reading comprehension skill, Simon ended grade 7 with a score of 10.60/20, while he ended grade 8 with 11.59/20. The difference is slight, but it is worth considering the difficult comprehension final exam given at the end of grade 8, which was confirmed in the interview with Mr. Tiliani (Fourth interview, phase 2).

Simon ended grade 7 with a final average of 11.63/20 in composition writing, while grade 8 was ended with 11.31/20. However, as mentioned earlier, the composition scores of grade 7 cannot be reliable because Simon's composition writing assignments were done with the help of the private tutor, corrected by Simon's teacher at school and then a score was given. To confirm this, we notice in Fig. 2 that the composition scores of grade 8 term 1 and term 2 were below average. In other words, the passing scores of term 1 and term 2 of grade 7 were unreasonable and thus not constructed on a

good basis.

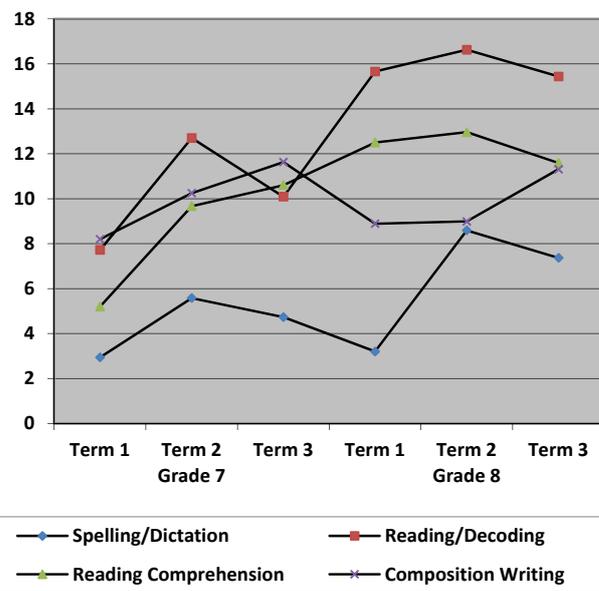


Fig. 2 Comparison between Simon's achievements grade 7 and grade 8 of spelling/dictation, reading/decoding, reading comprehension, and composition writing

### B. Writing Samples before and after the Plan

To show the development in the spelling skill and its effect on composition writing, two samples of Simon's writing will be presented. The first is a paragraph written one week before starting the plan (Fig. 3), whereas the second was written one week after ending the plan (Fig. 4).

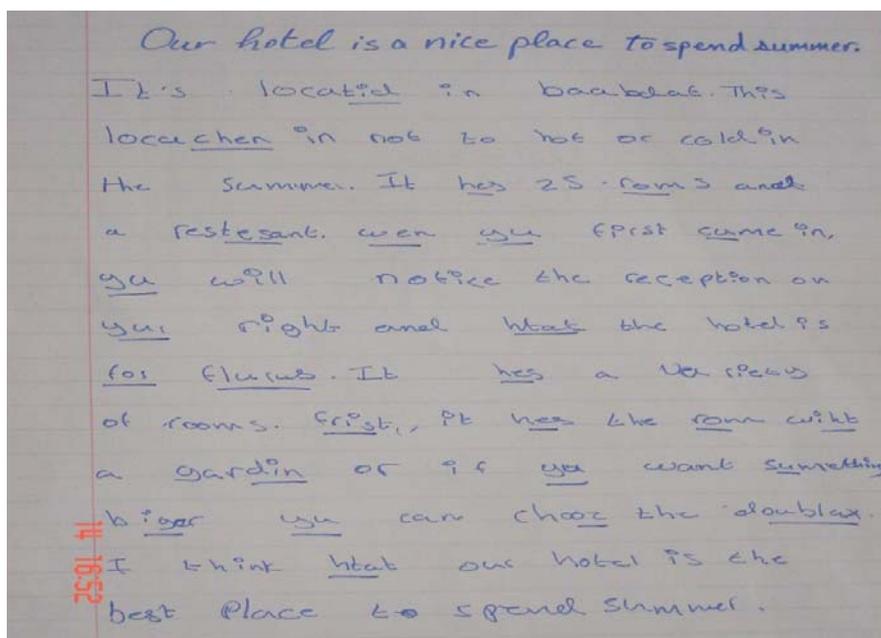


Fig. 3 Simon's paragraph writing before the implementation of the plan

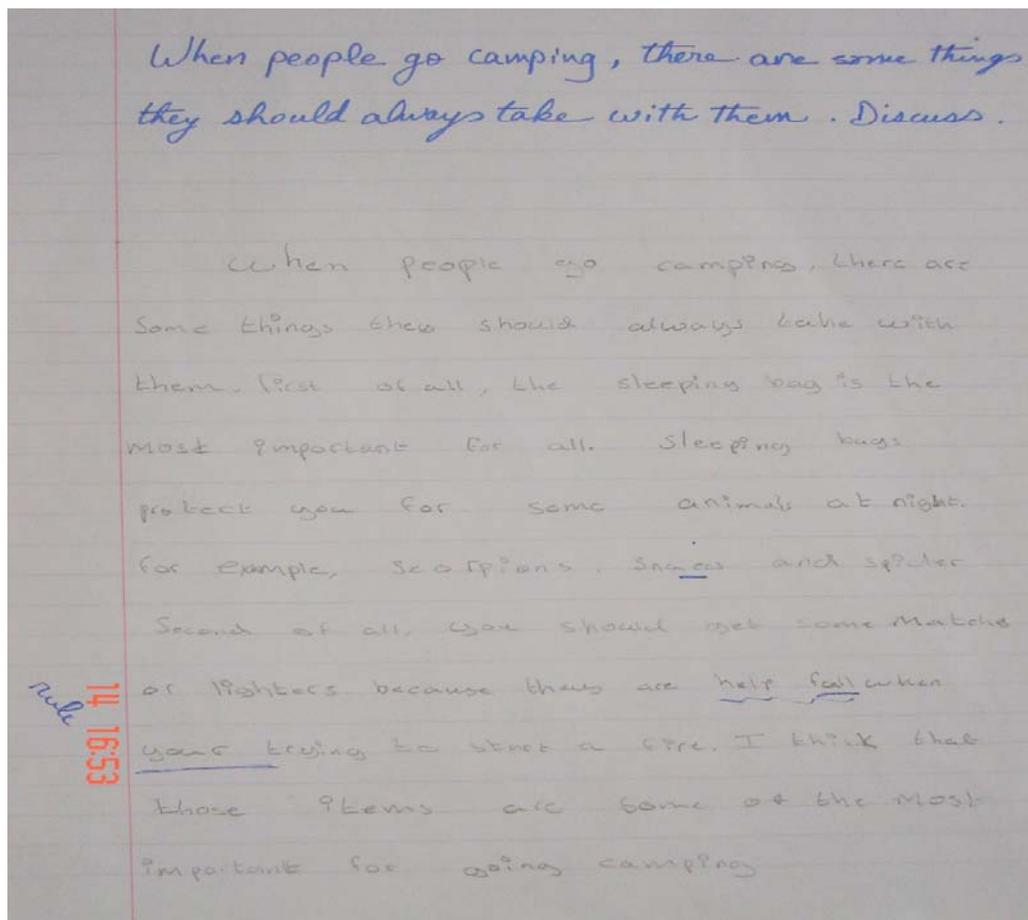


Fig. 4 Simon's paragraph writing after the implementation of the plan

The first sample provides us with a clear idea about Simon's quantity and quality of spelling errors. The number of mistakes is 26 varying from consonant sounds like 'chooz' (choose), 'fos' (for), and 'restesant' (restaurant), vowel sounds like 'locatid' (located), 'cume' (come), 'hes' (has), 'sumething' (something), and 'gardin' (garden), consonant combinations like 'htat' (that), 'wen' (when), and 'wiht' (with), vowel combinations like 'rom' (room), 'restesant' (restaurant), 'yur' (your), and 'yu' (you), letter strings like 'flurus' (flowers), 'locachen' (location), and 'frist' (first), silent letters like 'wen' (when), and suffixes like 'biger' (bigger). On the other hand, the second sample presents a good idea about the development that occurred during the plan and its result on Simon's phoneme and phonological awareness. The number of mistakes is only three. There is one error in the consonant sound 'snaces' (snakes), one in suffix 'help full' (helpful), and one in homophone 'your' (you're). The subject no longer writes 'you' as 'yu', 'that' as 'htat', 'with' as 'with', 'frist' as 'frist', 'for' as 'fos', 'when' as 'wen', and 'some' as 'sume'. In addition to these examples, the sounds and combinations of other words seem much better. For example, he writes a lot of words correctly like 'people', 'important', 'should' (silent letters), 'night' (silent letters), 'example', and 'think', in addition to many others.

### Recent Chat Conversation Sample

In addition to the two samples, the following is a recent messenger conversation between Simon and me, asking him for a favor. "Survival of the fittest" is Simon's nickname on the messenger chat window.

"Rabih" says:

hi Simon

Survival of the fittest says:

hey sir

Survival of the fittest says:

how are yoy

Survival of the fittest says:

you\*\*\*\*

"Rabih" says:

good

"Rabih" says:

u?

Survival of the fittest says:

good

"Rabih" says:

is ur mom there?

Survival of the fittest says:

no she in baabdat

"Rabih" says:

do u know if she got me the grades?

Survival of the fittest says:

mhhh..... i think she does but im not sure wait a sec. so ill call her

“Rabih” says:  
**thank you so much**  
Survival of the fittest says:  
she called the school they told to come and get them  
tom.  
“Rabih” says:  
**do all ur grades appear on the school website?**  
Survival of the fittest says:  
no i dunno  
“Rabih” says:  
**Simon can i ASK U FOR A FAVOUR?**  
Survival of the fittest says:  
sure  
“Rabih” says:  
**can ask ur mom now if i can take ur grades from  
Baadat tomorrow evening?**  
“Rabih” says:  
**can she do me this favour?**  
Survival of the fittest says:  
okay wait a sec.  
Survival of the fittest says:  
she said when she gets the grades she ll call you  
“Rabih” says:  
**ok**  
“Rabih” says:  
**tell her thanks**  
Survival of the fittest says:  
okay  
“Rabih” says:  
**and a lot of thanks to u for helping me**  
Survival of the fittest says:  
sure thing  
“Rabih” says:  
**ok Simon**  
“Rabih” says:  
**see u**  
“Rabih” says:  
**bye for now**  
Survival of the fittest says:  
alright c u  
Survival of the fittest says:  
bye

The conversation also presents a vivid idea about how Simon’s spelling skill improved. His writing of correctly spelled words even appears in the chat window, where most people (the author of this paper included), in order to save time, use nonstandard words and abbreviations to convey meaning. Other than the informal chat language, you can hardly find a spelling error.

### C. Grade 9 Scores

To confirm that Simon’s language competency in the four under-study skills was established on a good and correct basis in grade 8, his grade 9 class scores of reading comprehension and composition writing are presented to prove this fact. Table 1 presents the scores (decoding and spelling skills do not have separate scores in this class, so they do not appear in the table). It is important to note that Simon attended the grade 9 IP (International Program) which is a rather difficult program.

For the first time in years, the reading comprehension and composition writing scores are all successful. The reading comprehension scores of term 1, term 2, and term 3 are 10.38/20, 12.46/20, and 11.70/20, respectively. The

composition writing scores of the three terms are 10.50/20, 11.25/20, and 10.55/20, respectively. Even if they are not so high, they are considered good results for two reasons, the first of which is that Simon attended, as we said, a difficult international program, and the second is that they are unwavering and based on steady scores.

TABLE I  
READING COMPREHENSION AND COMPOSITION WRITING SCORES OF SIMON’S  
GRADE 9 IP

	Term 1	Term 2	Term 3 <b>Final average</b>
Comprehension	10.38	12.46	11.70
Composition	10.50	11.25	10.55

### D. Results of Phase 3

Phase 3 practically demonstrates the considerable progress that Simon did during grade 8 academic year. The comparison between the scores of grade 7 and grade 8 classes provides us with results that show the big change in this student who is capable now of performing in the language in the same as ordinary students and even better in some skills. The two writing samples append to the scores and prove the considerable development in spelling and its effect on composition writing. The chat conversation also presents a different Simon, who is capable of writing correctly in an environment where everyone is tempted to write informally using nonstandard language. In addition to all this evidence, the scores of grade 9 substantiate that improvement really occurred, for all the results in reading comprehension and composition writing are passing scores that are constant the entire year to show steadiness in Simon’s level in the researched skills.

This phase can answer research question 1, question 3, question 4, and question 5, and further confirms question 2, which was answered in phase 2. The computer has proved to be very efficient on the dyslexic learner subject of this study, whose problem is not a weakness but a disability. The results of the plan, in which the personal computer was utilized, show a significant improvement in Simon, who suffered from not only lack of phoneme and phonological awareness but also low self-confidence and self-esteem. This in-home tutoring tool has helped him acquire the missing awareness and regain his confidence and esteem.

The positive effect of the computer was established through a plan prepared to address the dyslexic deficit in this student who had to learn and practice the phonology of the language through a set of activities specially made to address this problem. The activities made use of four software programs specifically designed to work on pronunciation and spelling skills by starting from the lowest level of the language (consonants and vowels) to the highest (homophones, words with suffixes). The learner started with single consonant and vowel sounds, continued with combinations of vowels and combinations of sounds, and then moved into whole words and additional parts such as suffixes. In addition, the programs integrate pronunciation with spelling as each complements the other. They also contain the sound feature which is important

for the dyslexic student in this study, whose auditory processing is high above average.

The Internet was very effective in this study because it functioned as a catalyst to create motivation and a provider of a lot of supplementary exercises to many activities. Simon did a lot of practice and preparations using the processor alone and without the presence of the researcher.

Further practice on a lot of activities was done through self-tutoring using the computer software and the Internet. Simon was very active and eager to utilize the computer by repeating some activities and downloading items of interest to the available activities such as the list of homophones. Therefore, the results of the study can conclude that some types of computer software like *Learn English Spelling and Pronunciation* and *Microsoft Word*, in addition to Internet search engines like Google, may help in improving the reading and spelling skills of dyslexic learners in private home tutoring and self-tutoring, thus confirming the statement of the hypothesis that has been tested.

### VIII. CONCLUSION

Reference [11] states that lack of phonemic and phonological awareness can be an obstacle for spelling and reading development for all learners, in particular the dyslexics. However, according to [12] the problem of phonemic and phonological awareness can be remedied with methods specifically designed to deal with them. Simon X is a dyslexic learner who has a deficiency in this awareness. The method employed to address his problem is computer software and Internet materials which through a series of activities mend the defect. Some types of computer software like *Learn English Spelling and Pronunciation* and *Microsoft Word*, as well as Internet search engines like Google, can help in improving the reading and spelling skills of dyslexic learners in private home tutoring and self-tutoring.

The software utilized in this study is based on the 'talking computer' technique which, according to [12], is a powerful tool to mend this disability. The three utilized programs *Learn to Speak English*, *Learn English Spelling and Pronunciation*, and *Learn English Reading and Grammar* contain the sound recognition technology, voice recording and playback, and automatic text reading. A plan which contains a series of activities using these programs is established to fix the problem. The implementation of the plan proved to be successful and Simon could develop his language from a low to an ordinary achiever.

The computer and its software addressed Simon's problem directly and resulted in language improvement. At first, this tool functioned extrinsically and motivated him to work as he was good at such technology. When he started to have the language awareness and his language developed, he became intrinsically motivated and worked willingly to establish more phonemic and phonological awareness. Consequently, his self-confidence and self-esteem also developed, for according to [15], dyslexic learners have less self-confidence and self-esteem, and thus they always anticipate failure. However, this confidence and esteem can be regained through more

motivation which "can determine success or failure" [20]. This motivation can be created by the computer which can help restore this missing self-confidence and self-esteem, according to [4]. Simon suffered from low confidence and esteem. Nevertheless, the computer helped him restore these two qualities needed for success. He became very enthusiastic to work during the plan and he was even motivated to complete extra work by himself.

Simon's considerable improvement backs up [12], [23], [25]-[28] notion that the computer is a powerful tool to mend the dyslexic deficiency.

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