

The Impact of Assistive Technologies on the Reading Outcomes of College Students with Disabilities

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Abstract

The aim of this study is to determine whether assistive technology (AT), specifically text-to-speech software, can be used to minimize the negative impact of students' disabilities and maximize the potential of their learning strengths, i.e. reading abilities. The study was conducted in Israel, at the Levinsky College of Education, between 2006 and 2008. It targeted 14 students assessed as dyslexics. The results confirmed our hypothesis that computer technology interventions, in our case text-to-speech software, measurably enhance our students' immediate and long-term academic reading performances.

Keywords: Assistive technology (AT), Text-to-speech programs, Learning disabilities, English for academic purposes (EAP).

Introduction

Aim of the Study

The investigation is designed to validate the competency of assistive technology to solve the problem of students at risk, namely students with learning disabilities. Our main aims are:

1. to evaluate the effectiveness of two text-to-speech programs (**ReadPlease** and **TextAloud**) in assisting our LD students to read academic texts in English;
2. to confirm our initial assumption that the use of the programs helps and motivates students to read longer texts in English;
3. to raise the awareness of English teachers about the existing assistive technology, specifically text-to-speech programs and to prepare them to more effectively participate in AT consideration processes for students with disabilities.

Reason for Implementation

In Israeli universities and colleges, English instruction is provided in the form of reading comprehension courses in English for Academic Purposes (EAP), aiming to equip students with the skills and strategies needed to meet their English reading requirements in academic courses.

The rationale underlying EAP courses is that English reading proficiency is an essential across-disciplines tool that can facilitate a student's academic studies and professional career.

The great majority of students cope with the task, but the weak students (poor readers) and students with learning disabilities (LD students) find the task of reading overwhelming.

Since such students cannot be denied full and equal access to educational opportunities, we decided to use Assistive Technology in order to help them read.

Research on Assistive Technology and Learning Disabilities

The use of technology has been shown to be effective in a wide range of content areas (Ashton, 2005; Edyburn, 2004; Okolo, Cavalier, Ferretti, & MacArthur, 2000). Research says that use of Assistive Technology (AT) can contribute to strengthening students' skills in **decoding, comprehension and reading with fluency** (Elkind, Cohen, & Murray 1993, Higgins & Raskind, 2000), **word recognition, reading comprehension, spelling and reading strategies** (Raskind & Higgins, 1999), **spelling** (Dalton, Winbury, & Morocco, 1990, MacArthur, Graham, Haynes, & DeLapaz, 1996), **organizing, reading and synthesizing information** (Anderson, Inman, Knox-Quinn, & Homey, 1996, Anderson, Inman, Knox-Quinn, & Szymanski, 1999), **proofreading** (Raskind & Higgins, 1995) and **writing** (Raskind & Higgins, 1995). AT has proved effective in assisting LD students perform better and more accurately, gain knowledge and confidence, gain independence in performing tasks, achieve better.

To set the context, we will start by briefly examining the definitions of learning disabilities, dyslexia and AT.

Learning Disabilities

The term **learning disability** (LD) (Wikipedia) refers to "a group of disorders that affect a broad range of academic and functional skills including the ability to speak, listen, read, write, spell, reason and organize information".

Students who have dyslexia, a reading disability, or a disability in being able to read fluently often find reading texts extremely difficult in the L1, and almost, if not, impossible in English as a foreign language. Our goal in the college has been to provide these students, who have been diagnosed as having dyslexia and other language-related difficulties with the possibility of learning to read fluently and cope with the texts to achieve reading fluency.

Assistive Technology

Assistive Technology (AT) is defined by Raskind and Higgins (1998) as "any technology that enables an individual with a learning disability to compensate for specific deficits". AT covers a wide range of software which helps students read, write, organize information and spell.

Tables 1 and 2 present the way AT can be used to assist specific needs and show examples of various existing software.

Table 1. Matching AT to students' specific needs

Specific Need	Assistive Technology
Decoding (sounding out words) Reading comprehension	Text-to-speech programs
Handwriting Directionality	Speech-to-text programs
Expressing words in written form	Word processors Word prediction programs
Encoding (spelling)	Proofreading programs Spell checkers
Organization	Outlining/brainstorming programs

Table 2. AT according to types of difficulty/impairment

Type of Difficulty	AT to Consider	Internet Site
Reading	ReadPlease Natural Reader TextAloud TextAssist Kurtzweil	www.readplease.com www.naturalreader.com www.textaloud.com www.textassist.com http://www.kurzweiledu.com
Writing	DragonNaturally Speaking Intellitalk	http://www.nuance.com/naturallyspeaking http://www.intellitools.com
Planning and Organization	Inspiration	http://www.inspiration.com
Spelling and Word Prediction	WordQ Predictor Pro	http://www.wordq.com http://www.readingmadeez.com/products/PredictorPro.html

Benefits of AT

AT increases students' independence, builds their self-esteem and enhances their motivation to actively participate in academic study and improve their reading performance. It helps students develop independent work strategies and organizational skills. It endows students with life-long learning skills.

Methodology

The research was conducted between October 2006 and June 2008. Fourteen students at the Levinsky College of Education in Tel Aviv participated in this research. The students had been assessed as students with learning disabilities.

The design of the research was one of pre-test intervention and post-test design. The independent variable was computer based reading software and the dependent variables were reading comprehension skills, attitude toward reading and AT. The teaching and learning process combined traditional, frontal teaching with individual student practice. The teacher worked with the whole group of students. The first part of the lesson was devoted to teaching reading strategies and vocabulary. The second part of the lesson consisted of the students' practical, individual reading of the articles. The students enrolled in the EAP course need to read and process an academic-style text. Accommodations provided to those students assessed as LD students include the right to have a reader read the text to them. In our case, the reading was done by the **text-to-speech software**. Each student worked with an individual computer provided with a headphone. A hard copy of the text plus questions was handed out by the teacher. According to the reading strategy which most suited to each individual, the students listened to the text and questions of the article and then answered the questions on paper.

Our first choice for **text-to-speech software** was **ReadPlease** which can read digital text aloud, highlight text as it reads, allow the reading rate and font size to be adjusted and provide options for voice type. Its advantage is that the simpler version (**ReadPlease 2003**) can be freely downloaded from the Internet site. Our LD students could use it to do homework. At the college, the students worked with the improved version of the software, **ReadPlease Plus 2003**, which offers more freedom for moving through the text. Most of the students were satisfied

with the performance of the software, though some students complained about the quality of the artificial voices. The solution was **TextAloud** which has more human-like voices. Our students found these voices satisfactory.

The research experiment started with 20 first-year LD students with three different levels of English. Teaching them all in the same class was kind of "mission impossible". Therefore, we decided to teach the 8 advanced level students on-line and to focus on the 14 lower level students who needed more guidance and practice. Upon reviewing the data collected, four cases were eliminated from the final analysis due to the fact that after the first year, four students dropped out. Two moved to another college in Jerusalem and two continued studying with a group of regular students since their personal study timetable had changed.

Results

We will present the individual students' scores over a three year period. The 14 LD students who took part in the pilot study started at the beginner level (Mehina B) then went through an intermediate level (Mitkadmim A) followed by an advanced level (Mitkadmim B). At the end of each semester, the LD students graduated a study level after passing a final test. The passing grade is 60. Data were collected between January 2007 and January 2008. The comparison between the first (January 2007), second (June 2007) and the last test (January 2008) is shown in Figure 1. Despite the graded difficulty of the texts, the students' grades got better, showing the fact that their reading rate, fluency, and comprehension improved. The graph below presents the LD students' improvement in reading texts in English.

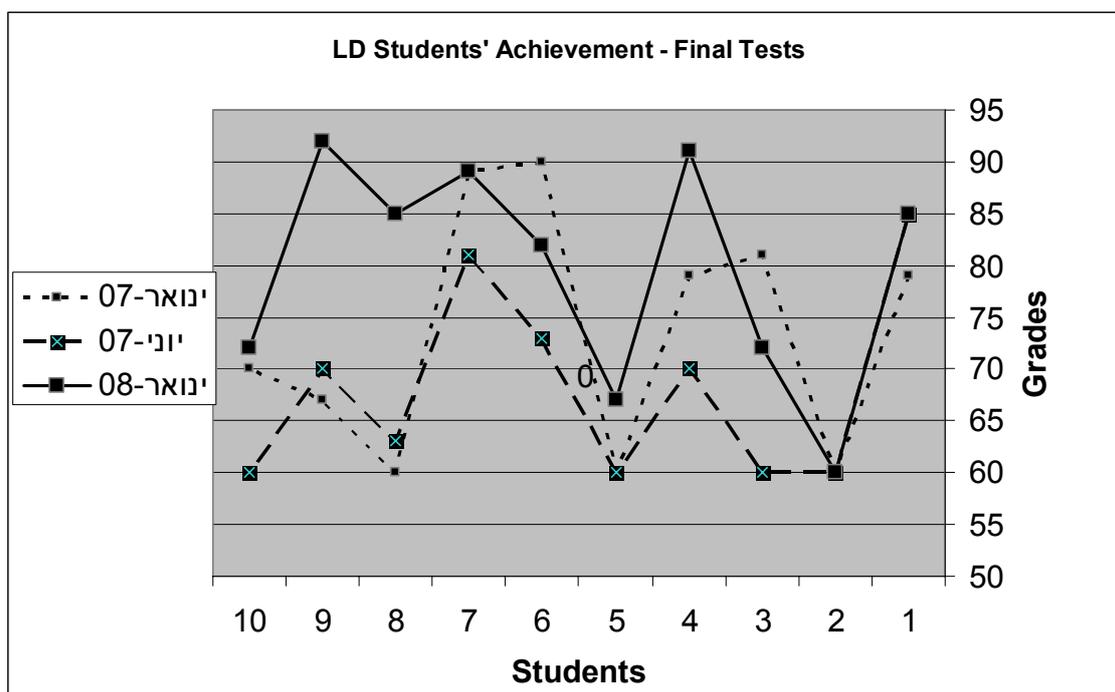


Figure 1. Grades obtained by the students - in each level final test

When we analyze the graph, we have to take into consideration the fact that in each semester the students had to deal with texts of different levels of difficulty. The EAP Unit offers a graded series of reading comprehension courses that enable the student to cope with academic texts. The goal of our courses is **to enable student to process texts of increasing length and linguistic complexity**.

The texts in the first semester, October 2006 – January 2007, had a lower reading difficulty. They were shorter (1500 words) and easier to understand. The texts in the second semester, February 2007 – June 2007, were longer (2000 words) and the vocabulary was more complex. The level was Mitkadmim A, which is a penultimate in the graded series of reading comprehension courses. The texts used in the fall semester of 2008 belonged to the level of Mitkadmim B texts. This is the most advanced course (2600 words). The focus of the course is on processing and understanding the details of an academic text in order to construct its more global meaning.

Looking at the grades obtained by the students at the end of each level, we can see how these LD students have improved their reading comprehension over the years. The grades are more explicitly presented in Table 3.

Table 3. LD Students' Grades over the 2006 – 2008 Period

Grades	60 – 70	70 – 80	80 – 90	90 - 100	Grade Average
Final exam					
January 2007	4 students	3 students	2 students	1 student	73.5
June 2007	5 students	3 students	2 students		68.2
January 2008	2 students	2 students	4 students	2 students	79.5

Looking at the results of the students' achievement graph, we notice that the range of grades obtained in the final exam of the second level of study (Mitkadmim A) was almost the same as the grades obtained in the previous one, even if the level of difficulty of the studied texts was higher. The class average (68.2) is lower, given the increased difficulty of the texts. The most conclusive graph, however, is the graph representing the scores of the LD students in the final test of the EAP course. It is the graph representing the LD students' results in the final Mitkadmim B test in June 2008. The texts used in this level of study were longer and the vocabulary more elevated. However, though the grades range was between 60 and 90, this time only 2 students got grades below 70, 2 students got grades between 70 and 80, 4 students got between 80 and 90 and two students' grades were over 90. The class average (79.5) is the highest.

The January 2008 graph shows that although the difficulty of the texts increased with each level, there is improvement in reading comprehension and in achieving the reading target level.

Discussion and Conclusions

We hoped to evaluate the effectiveness of the text-to-speech software use, including their strengths and weaknesses. The students' feedback was positive. 96% of the students who completed our feedback questionnaire were satisfied with the performance of **TextAloud**. They found the use of this software more user-friendly and more effective than the use of cassettes/CDs they had previously used in order to listen to the texts. All the students admitted that the use of AT improved their reading ability in English.

The use of **TextAloud** by the LD students helped them:

- decode/read texts in English by significantly gaining in word recognition and reading comprehension;
- improve their reading fluency;
- learn, apply, develop, maintain and generalize new reading strategies;
- become motivated to read in English;

- increase their level of participation in class or home assignments;
- achieve better grades;
- be better prepared to read articles in their individual field of study.

What made the difference? Was it the actual technology? Was it differentiated instruction?

We think that the combination of frontal teaching, differentiated instruction as well as the use of AT can help students with learning disabilities bypass their disability and achieve the goals of the EAP course.

We strongly believe that the use of text-to-speech software has great potential for improving not only the reading level of the students but also in providing additional benefits, namely, confidence to grapple with the texts and a more positive self-esteem. Further research is needed to quantify these conclusions.

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