Kurzweil: A Computer-Supported Reading Tool for Students with Learning and Attention Challenges in Higher Education

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Abstract: *Kurzweil 3000* is a leading software program used in higher education by individuals who need reading assistance. This text-to-speech program is one of the most successful ways of helping students with reading and attention deficit hyperactivity disorder become more accurate and fluent by improving word recognition and decoding. In this presentation we summarize extant literature on *Kurzweil's* effectiveness as a reading tool. We describe the components within *Kurzweil* that respond directly to the reading challenges of students with Learning Disabilities (LDs), and also include the components that mitigate the attention limitations of students with Attention Deficit Hyperactivity Disorder (ADHD). In addition, we present one undergraduate student's experience using *Kurzweil* in her coursework and highlight the features of the program she finds most beneficial to aid her learning. We conclude the discussion with recommendations for instructors and students in higher education who use *Kurzweil*.

Introduction

National statistics show that approximately 11 percent of students enrolled in post-secondary education are students with disabilities (NCES, 2009). At the local level individual universities are experiencing significant increases in the number of students with disabilities. For example, at one Midwestern research institution the number of students with disabilities in 2007-2008 was 816, but by 2011-2012 the number increased to 994, showing a growth of almost 22 percent. Students with Attention Deficit Hyperactivity Disorder (ADHD) and Specific Learning Disabilities (LDs) are two populations of students whose numbers show an increasing enrollment trend in higher education. The number of students with ADHD in the same Midwestern research institution has gone up from 281 in 2007-2008 to 317 in 2011-2012. A similar shift occurred in the category of LDs, resulting in an increase from 334 to 353. This increase in addition to the unique academic challenges of these two populations of students with disabilities warrants special focus in higher education. To illustrate, the most common type of learning disabilities is a reading disability. Apart from causing problems in word decoding, reading disabilities also affect fluency and comprehension in the reading process (Hallahan, Kauffman, & Pullen, 2012). Similarly individuals with ADHD have trouble paying attention, staying organized, sustaining attention and are easily distracted (Hallahan, et.al., 2012). In addition, individuals with ADHD also experience difficulties with working memory, thus sequential tasks are problematic for them. The Americans with Disabilities Act (ADA, 1990), Section 504 of the Rehabilitation Act (1973), and the Technology Act (1998) are the federal policies that give rights to students with disabilities in higher education. Assistive technology circumvents access barriers (Hecker et al, 2002, Johnson, et al, 2009) and federal policies promote the use of assistive technology as tools to help individuals with disabilities circumvent learning limitations.

Kurzweil Components

Kurzweil 3000 (Kurzweil) is text-to-speech software designed to make reading accessible to individuals who need or desire a different way of accessing textual information (Ochoa, Kelly, Londergan, 2004). Kurzweil mimics the format of any reading material. With all reading functions, the user can see the entire formatting, layout, and graphics from the source document making it well-suited for scanning and reading textbooks. Therefore the reader navigates through the text page to page, or by flipping for a specific page. In addition the menu bar provides thumbnails bookmark options. Reading between 50 and 400 words-per-minute Kurzweil also provides a duel highlighting function as it reads (see Figure 1). With six different highlighting colors available, the reader can highlight the entire sentence being read in one color while the individual word being read in a different color. Highlighting colors can be changed along with the size of the font displayed. There is an option to read individual characters, individual words or entire sentences. The reader can also use Kurzweil to take notes in the text, choosing from footnotes, voice notes, sticky notes, text notes, and bubble notes (see Figure 1). Kurzweil also allows the reader to change the reading order on the page. All notes can be extracted from the text serving as an overview and detailed synopsis of the material. Kurzweil also has dictionary functions with synonyms, the syllable break down, and a feature that spells the word aloud (see Figure 2). Additionally, Kurzweil reads content from the web, making the Internet available to its users. The software provides access to several image and animation formats and can be embedded in the Internet Explorer and Firefox browsers for accessing and reading webpages. Kurzweil also embeds

a small application, called the Kurzweil Taskbar, in Windows that allows users to drag and read text from any application. It provides direct access to collections of online books with the ability to search these repositories by title or author. One of the most current features of Kurzweil brings PDF documents into the reading window. This feature allows the reader to access the material, other than the textbooks, without scanning. Kurzweil not only provides accessible features for students but it also provides range of tools for instructors. Instructors can use the fact that Kurzweil offers students an organized way to take notes. The read aloud function can be stopped and reset several paragraphs or pages if the student's attention wonders. Instructors can use this to help students self-monitor their attention, being able to correct the mistake without having the apprehension that their pace, or fluency will be at issue allowing them to practice sustained literacy attention. Another interesting feature for instructors is the use of bookmarking to help students control the reading material. Stopping the text at predetermined positions to have students stop and reflect or respond to questions planted in the footnotes of the book. In addition Kurzweil also offers test delivery and test-taking options. Instructors can create or extract word lists (for example, homophones and confusables) and instruct students to use them in reading and writing instruction.

Characteristics of Students with LD and ADHD

Table 1 describes how the Kurzweil program features respond to the reading characteristics and needs of undergraduate students who show LD and ADHD. Kurzweil's features can be broadly divided into two categories- Reading Capabilities and Note-taking Capabilities.

Table 1. Kurzweil features for LD and ADHD

Learning Disabilities	Attention Deficit Hyperactivity Disorder
Reading Capabilities	
Kurzweil allows reader to navigate through the book page to page, or by searching for a specific page number, similar to a regular book.	Kurzweil allows reader to navigate through the book page to page, or by searching for a specific page number, similar to a regular book.
The menu bar also provides thumbnails bookmark options.	-NA-
Kurzweil makes the reading experience more accessible by providing twelve different male and female reading voices.	-NA-
Kurzweil's reading speed variability feature allows reader to read between 50 and 400 words-per-minute	Kurzweil's reading speed variability feature allows reader to read between 50 and 400 words-per-minute
An option to read individual characters, individual words or entire sentences	-NA-
Kurzweil allows the reader to change the reading order on the page	Kurzweil allows the reader to change the reading order on the page
Kurzweil can also look up unknown words offering, the definition, the synonyms, the syllable break down, and a feature that spells the word aloud.	Kurzweil can also look up unknown words offering, the definition, the synonyms, the syllable break down, and a feature that spells the word aloud.
Note-taking Capabilities	
Kurzweil's note taking feature allows reader to engage more actively with the text.	Kurzweil's note taking feature allows reader to engage more actively with the text.
Kurzweil offers six different highlighter colors for notes, as well as options for footnotes, voice notes, sticky notes, text notes, and bubble notes.	Kurzweil offers six different highlighter colors for notes, as well as options for footnotes, voice notes, sticky notes, text notes, and bubble notes.
Highlighting colors can be changed along with the size of the font displayed	Highlighting colors can be changed along with the size of the font displayed
All notes can be extracted from the text serving as an overview and detailed synopsis of the material.	All notes can be extracted from the text serving as an overview and detailed synopsis of the material.

Method

We employed a case-study method to describe how Kurzweil features match / respond to the characteristics of LD and ADHD. The female participating in the study is a sophomore enrolled at a Mid-western University. She attended community college for two years prior to her current degree. Although not formally diagnosed with a disability she indicated having a history of reading difficulties. She described herself as being a slow reader and one who did not enjoy reading assignments. She also indicated academic trouble, particularly in test-taking. Despite mention of academic difficulties, her academic performance at both institutions of higher education has been strong. At the two year community college she achieved 3.61 GPA (Grade Point Average) with C being the lowest grade in any course. Similarly, her academic achievement at the four-year institution, where she is pursuing a dual certification program in general and special education has been positive. Currently she has achieved a 3.7 GPA with B- being the lowest grade in any course. The participant sought out the use of Kurzweil to carry out reading assignments for her coursework at the four year university since the fall 2011 semester. The participant, who is also a co-presenter, responded to open-ended survey. Responses were reviewed and compared to items on the questionnaire by two of the authors, looking for commonalities between the different characteristics associated with students with ADHD and LDs and matching them to how the participant used Kurzweil.

Results

Overall the participant's responses to the items about Kurzweil were positive. She attributed Kurzweil to improving peer collaboration and improving her grades. She said that Kurzweil allowed her to "participate fully in class discussion" as she could fully digest the reading, think about and integrate the topic's implications with previous knowledge. Noteworthy in the participant's response was the time it took her to complete the reading assignments without Kurzweil saying,

> "An unintended side effect of Kurzweil is that my reading speed has increased. After I passed the initial learning curve of navigating around the program I was able to increase the reading speed from 170 to 230 words per minute. This has allowed me to finish reading assignments with more time to devote to other school projects. Additionally, when I am reading texts that are not on Kurzweil my eyes have been trained to read at a faster pace and I am proud to say my reading speed without Kurzweil has also increased."

As previously stated, individuals with ADHD generally face difficulties with the development of inner speech necessary for self-monitoring, and more specifically in monitoring reading activity. Furthermore individuals with ADHD also experience difficulties with working memory, making sequential tasks problematic for them. Even though the participant has not been diagnosed with ADHD or ADD, one of her answers clearly relates to Kurzweil's feature that can help individuals with ADHD.

> "I can easily stop and reread part of chapter if I get distracted or need to hear a particularly difficult piece of information again. I started to be able to assimilate entire chucks or sections of academic reading creating a framework that was easily accessible when taking exams."

Discussion & Conclusion

The undergraduate student who self-identified as needing reading assistance sought out Kurzweil as a reading tool to improve her reading. In large measure she attributes her success in the 4-year institution to Kurzweil indicating that the program has allowed her to keep up with her heavy reading load. Interestingly, she achieved a GPA of 3.7 without Kurzweil and a slightly higher GPA (3.x) at the 4 year institution. Clearly there is little difference in terms of overall GPA, yet the student asserts she is more successful with the use of Kurzweil. Perhaps she believes she is more successful because she's less frustrated and has more time to process the reading. It very well could be that because the text-to-speech software program reduced the amount of time the student spent decoding and that extra time allowed the student to process reading material more deeply leading the student to feel better prepared for discussion with peers and in class. It is likely that the participant's enthusiasm and the credit she attributes to Kurzweil suggests that Kurzweil removed the onerous aspects of reading when students with reading challenges read at low speed. Certainly, there are improvements that the student believes can improve Kurzweil, such as reducing the number of words Kurzweil mispronounces. Nonetheless, features such as note-taking, possibility of creating a study guide based on the notes, different color highlighting, and the built-in thesaurus helped the participant get organized, efficient, and retain the information from the readings.

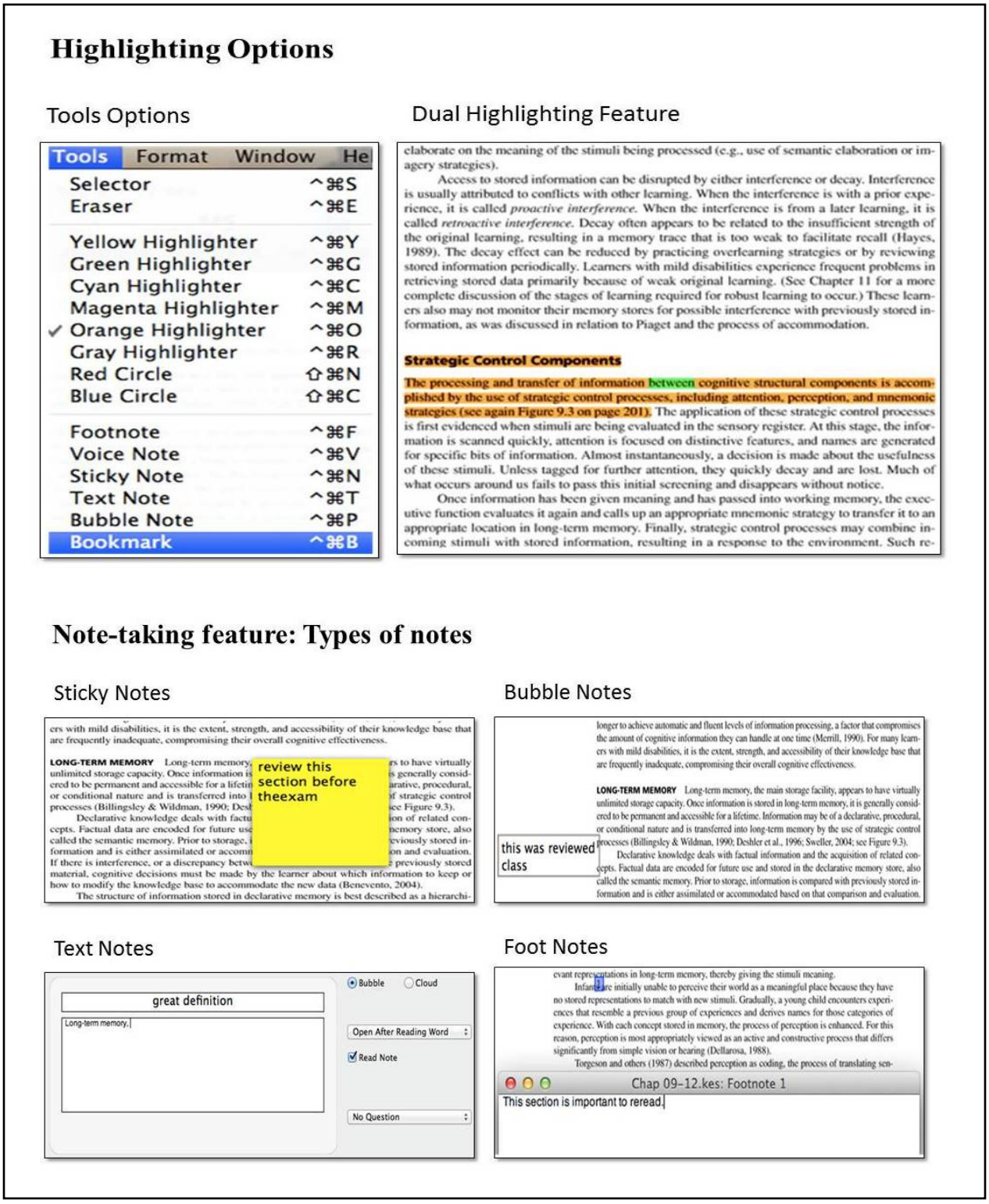

Figure 1. Highlighting and Note-taking features of Kurzweil

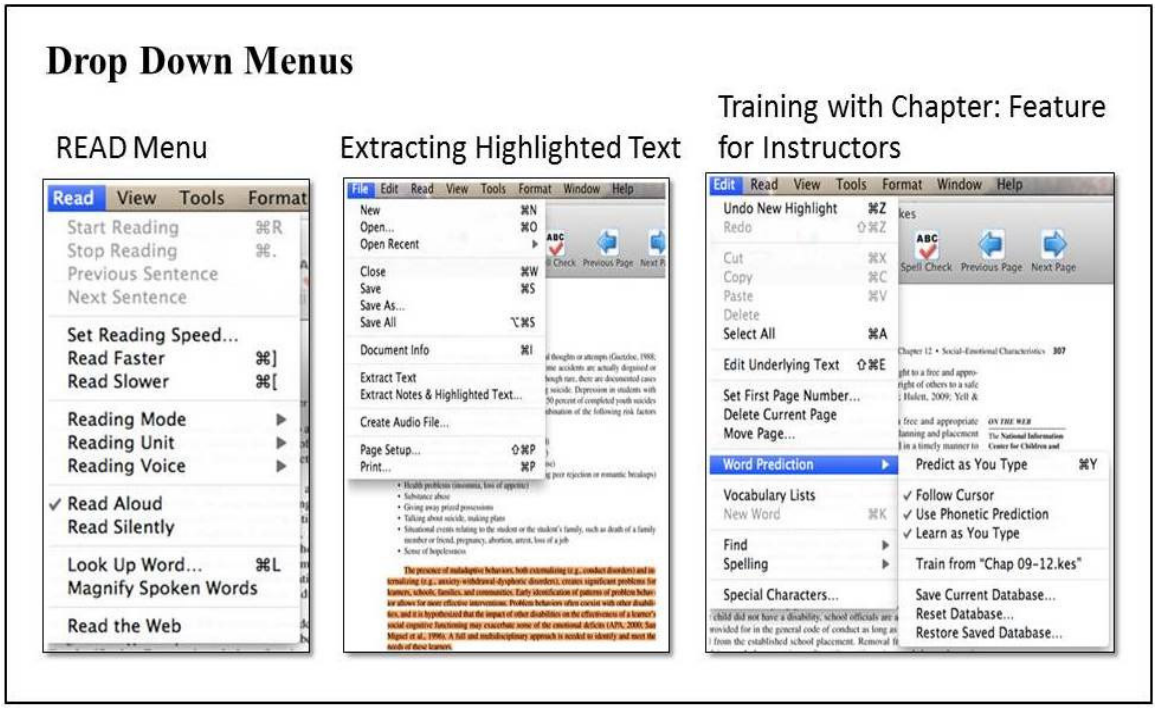

Figure 2. Examples of different drop-down menus

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