

The Uses of Speech Recognition Technology in Education

Over the past decade, the emphasis to include all students in general education environments has increased. For many students, their difficulty with written language is an obstacle. By converting speech into digitized signals which are transformed by the computer into word output, speech recognition technology often allows students to compensate for their written language deficits. The research articles discussed address findings related to using speech recognition as a remediation tool and/or a compensatory tool for students with disabilities or nonnative speakers.

Summaries

The demands of written composition is a challenge faced by many postsecondary students with learning disabilities. In a study completed by Higgins and Raskind (1995), the effectiveness of speech recognition in helping postsecondary students with learning disabilities (LD) compensate for written language difficulties was investigated. Twenty-nine postsecondary students wrote essays under three conditions: without assistance; using human transcribers; and using speech recognition technology. The essays emulated a proficiency exam that students at California State University have to pass to graduate. Students composed an essay on an assigned topic within a fixed period of time. In addition, the researchers compared how the students with learning disabilities scored in comparison to their nondisabled peers. They found that the pass/fail rate for students using speech recognition on the mock exams showed no significant difference from the distributions of the nondisabled students who took the actual administration of the exam. This was not the case when students with LD wrote by hand or dictated. Students

received higher holistic scores when using speech recognition. The single most sensitive predictor of the holistic score was Words of Seven or More Letters which indicates that speech recognition technology allows students to utilize their oral vocabulary when writing. Results showed that speech recognition assists postsecondary students with learning disabilities in compensating for their difficulties in written composition.

Based on the previous research findings, Higgins and Raskind (2000) researched additional benefits of speech recognition technology for persons with learning disabilities (LD). Besides being a tool for writing, they were interested in improvements in word recognition and reading comprehension as a result of using speech recognition software. For this study, 52 students were divided into three groups: a control group which was assigned to a keyboarding class, a continuous speech group which used continuous speech recognition to do class assignments and a discrete speech group which used discrete speech recognition technology to do class assignments. Both discrete and continuous speech recognition groups showed significant gains on the post-test when compared to control subjects in reading comprehension and word recognition. In this study, the use of speech recognition software served as a compensatory tool for writing and a remediation tool to improve word recognition and reading comprehension.

MacArthur & Cavalier (2001) researched speech recognition technology as an accommodation in large-scale assessments for students with learning disabilities as part of a grant from the U.S. Department of Education. As part of the Individuals with Disabilities Education Act (IDEA), students with disabilities must be included in general state and district-wide assessment programs with appropriate accommodations, where necessary. An appropriate accommodation is one that removes a barrier to valid

assessment based on a student's disability without changing the nature of the construct assessed. This study investigated the use of dictation to a scribe and dictation to a computer using speech recognition software as an accommodation. This raises the question as to whether dictation functions to overcome a barrier to writing based on a disability or whether it would improve the writing of most students making it an unfair accommodation for students with disabilities. The participants of this study included 37 high school students: 27 students with learning disabilities and 10 students without learning disabilities. All students completed writing tests under three conditions: handwriting; dictation to a scribe; and dictation to a computer using speech recognition software. Results showed that essays produced by students with LD by dictating to speech recognition software were not as good as when using a scribe but were better than their handwritten essays. Since students without LD performed equivalently in all three conditions, these results indicate that speech recognition software was providing an accommodation for the students' disabilities in writing rather than providing them with support that would help any student. These results support the validity of using speech recognition as an accommodation on state-wide writing tests.

Derwing, Munro, & Carbonaro (2000) assessed the accuracy of speech recognition software for high-proficiency English speakers whose native languages are Cantonese, Canadian English, and Spanish. Specifically, they wanted to determine whether the software would identify the problems in pronunciation that affect humans' understanding of nonnative speech. There were 30 participants in this study. They were trained to use speech recognition, created speech samples using the software, and had listeners transcribe and rate speech samples. Results showed that the software performed

less well than the human listener. The software recognized native English speech at 90% accuracy but Cantonese and Spanish accented speech at 71% - 73% accuracy. The data showed that the properties of ESL speech that adversely affect the software do not tend to interfere with comprehensibility and intelligibility for human listeners. The authors suggest that to be useful in classrooms, speech recognition software should perform similarly to human listeners if a student is to learn from computer feedback on errors.

Comparisons

The results from these four studies indicate that speech recognition can be used to compensate for writing difficulties, increase word recognition and reading comprehension skills, be used as an accommodation on state-wide tests but is not accurate enough to provide a way for ESL students to practice their speech. All of the research studies involved a small number of samples probably due to the complexity of training students to use speech recognition technology.

While the four research articles looked at different aspects of speech recognition, they all reported issues that still need to be addressed. All of the articles discussed the amount of time needed to train students to be accurate with speech recognition as a significant issue. In all studies, the reading level required for the training selections was an issue. Derwing, et al. (2000) added the additional issue of the reading material being culturally bound. Another issue that is addressed in Higgins & Raskind (1995 & 2000) is that when studying students with learning disabilities who have written language deficits, there is a wide range of writing problems including spelling, organization, fluency, auditory memory, and reading difficulties. These deficits affect written language in different ways, and speech recognition technology may address some of these issues

better than others. Since Higgins & Raskind (1995), MacArthur & Cavalier (2001) and Derwing, et.al (2000) researched postsecondary students, their findings cannot necessarily be generalized to other age and ability levels.

Higgins and Raskind (1995) and MacArthur & Cavalier (2001) used assessments that students are required to pass for successful graduation. In their studies, both groups compared students with learning disabilities to their nondisabled peers. In both studies, the use of speech recognition appeared to level the playing field and was a tool that allowed the students with learning disabilities to compensate for their written language disability thus demonstrating their true capabilities. In all of the studies conducted with students with disabilities, the importance of preplanning their document was emphasized.

As technology has made speech recognition a more viable option for many students, it appears that more research will be required to determine the benefits and drawbacks of using this software as a compensatory or remedial tool. Assessment of effectiveness, efficiency and independent execution across diagnoses and age ranges is needed.

References

- Derwing, T., Munro, M. & Carbonaro, M. (2000). Does popular speech recognition software work with ESL speech? *Tesol Quarterly*, 34, 592-603.
- Higgins, E. & Raskind, M. (2000). Speaking to read: the effects of continuous vs. discrete speech recognition systems on the reading and spelling of children with learning disabilities. *Journal of Special Education Technology*, 15, 19-30.
- Higgins, E. & Raskind, M. (1995). Compensatory effectiveness of speech recognition on the written composition performance of post secondary students with learning disabilities. *Learning Disabilities Quarterly*, 18, 159-174.
- MacArthur, C. & Cavlier, A. (2001). Dictation and speech recognition technology as accommodations in large-scale assessments for students with learning disabilities. Data from study, unpublished.