Quality of Project Design

This project will develop a model within Fairfax County Public Schools (FCPS) for identifying, training, and implementing speech recognition technology for disabled students in an educational setting. The objectives were developed after analyzing the results of the existing scientifically-based research on speech recognition. Speech recognition technology converts speech into digitized signals which are transformed by the computer into word output. The research data indicates speech recognition’s many benefits such as use of more complex vocabulary and improved writing by disabled students. However, it is evident that more research is required to determine how to effectively identify the students who will benefit from speech recognition, then how to best train these students, and finally implement the software in an educational setting.

Objectives

- Develop a model for training and implementing speech recognition technology for students with disabilities
- Develop guidelines to train Integrated Technology Services (ITS) case managers to be effective instructors and facilitators of speech recognition technology
- Evaluate the effectiveness of using the Writing by Dictation Guide as an instructional tool to train students to use speech recognition software
- Develop guidelines for identifying the students that are most likely to benefit from using speech recognition technology
- Examine issues regarding the implementation of speech recognition in an educational setting
- Increase FCPS disabled students’ access to speech recognition technology
Activities to meet these objectives

Objective 1:

Develop a model for training and implementing speech recognition technology for students with disabilities.

A Project Team consisting of two assistive technology resource teachers, one assistive technology specialist, and the coordinator of Integrated Technology Services (ITS) for FCPS will develop a training model for implementing speech recognition technology. These team members are currently using speech recognition with students with learning disabilities and physical disabilities. This model will be a three-tiered approach to training that involves training other ITS case managers to properly identify and train students who would benefit from speech recognition technology. These ITS case managers will then be responsible for training the school-based staff member who will be implementing speech recognition technology with students. Once the school staff member is trained, that person will train the student. A visual representation of the model appears below.
Objective 2:

Develop guidelines to train Integrated Technology Services (ITS) case managers to be effective speech recognition technology instructors and facilitators.

The proposed grant will enable more students to have access to speech recognition technology. Consequently, the ITS case managers will need to be trained so they can support teachers and students at the school level. In order to support teachers and students, they must develop a level of expertise using this technology. In addition to learning the mechanics of the program and developing their own voice files, they will be taught how to select appropriate students who will benefit from using speech recognition. They also need to understand how to instruct the teachers and work with the students. The Project Team will develop guidelines for training the ITS assistive technology resource teachers so they can effectively support their teachers and students in this endeavor.

Objective 3:

Evaluate the effectiveness of using the Writing by Dictation Guide as an instructional tool to train students to use speech recognition software.

A Writing by Dictation Guide is being developed by the Project Team to provide teachers a comprehensive resource to facilitate writing by dictation. This guide allows teachers to effectively train students to be successful users of speech recognition. Based on past training experiences in Fairfax County, it was found that mastering the program alone was not sufficient for effectively using the software as a writing tool. Writing by dictation is a skill that needs to be taught. This guide provides activities that students can use to transition through stages to reach a level of “automaticity” with the technology.
In order to evaluate the effectiveness of this guide, a group of classroom teachers will be identified to provide feedback to the Project Team as they work through the guide with students. At the end of this trial period, the *Writing by Dictation Guide* will be published so staff in Fairfax County and other school districts can take advantage of what has been developed.

**Objective 4:**

**Develop guidelines for identifying which students are most likely to benefit from using speech recognition technology.**

The Project Team will develop guidelines for identifying which students are most likely to benefit from speech recognition. Students, teachers, and parents will fill out an interview form. The student interview form will address some of the following questions: How do you usually do writing assignments? Do you use a pre-writing strategy? Previous assistive technology experience will also be addressed with the following questions. What type of word-processor do you use for writing assignments? How often do you have access to some sort of computer for writing? What types of writing software have you tried? Student characteristics will also be addressed with questions such as, “When writing, I have trouble with…”

- [ ] Writing the actual letters
- [ ] Spacing the letters and words correctly
- [ ] Writing for long periods of time (endurance)
- [ ] Typing on a keyboard
- [ ] N/A

The questions will be formatted in a style similar to the above writing question.

The parent interview form will allow parents to provide input into the selection process. A questionnaire will be developed with similar questions as the student interview except that parents will be answering from their perspective. In addition, parents will be asked some logistical questions such as whether they will support the use of speech recognition technology in
the classroom and whether they support their child receiving training several times a week during
the training phase.

A teacher interview form will also be developed. This questionnaire will address previous
assistive technology used and student characteristics. In addition, teachers will be asked about
the student’s decoding level and speech patterns. They will also be asked several logistical
questions about the computer available for the student and whether they are willing to provide
training two to four times a week.

Objective 5:

Examine issues regarding the implementation of speech recognition in an educational setting.

There are many logistical issues that need to be considered when implementing speech
recognition in an educational setting. A checklist of issues will be developed and provided so
classroom teachers and case managers can make more informed decisions. Forms will be
developed that address issues such as: should the computer be a laptop or a desktop, where will
the student go to access speech recognition technology, and how does the student feel about
using speech recognition technology in an educational setting.

Objective 6:

Increase access to speech recognition technology for students with disabilities in FCPS.

Purchasing laptop and desktop computers for the purpose of speech recognition will
increase access. The hardware will be placed in classrooms with students that are identified as
candidates for speech recognition. In most cases, students will start with speech recognition
technology on a desktop computer. After a trial period, students’ achievement will be measured
and if the student appears to be benefiting from the use of speech recognition technology, then a
laptop will be considered. This will allow the student to use the technology in multiple settings.
Sixteen secondary students with learning disabilities and 15 secondary students with physical disabilities are now using speech recognition software. This proposal would grant speech recognition technology access to as many as 75 students. In addition, speech recognition software called *Dragon Naturally Speaking 7.0*, microphones and additional RAM to upgrade existing computers will be purchased.

**Scientifically Based Research on Speech Recognition**

Over the past decade, the emphasis to include all students in general education environments has increased. For many students, 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 disabled students to compensate for their written language deficits. Scientifically-based research related to using speech recognition as a tool for students with disabilities shows that this technology allows students to compensate for deficits in written language, use more complex vocabulary, and is a valid accommodation on statewide writing tests. The research also validates the need for further investigation regarding the implementation of speech recognition technology in educational settings.

The demands of written composition are a challenge faced by many 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 non-disabled 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 non-disabled students who took the exam. This was not the case when LD students 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. De La Paz and Graham (1997) also found that students use a simplified vocabulary when writing to avoid spelling errors even though they may want to use a more difficult word. Results showed that speech recognition assists students with learning disabilities in compensating for their difficulties in written composition and allows them to use more complex vocabulary.

Based on the previous research findings, Higgins and Raskind (2000) researched additional benefits of speech recognition technology for persons with learning disabilities. 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 of comparable ability: a control group that was assigned to a keyboarding class, a continuous speech group that participated in class assignments using continuous speech recognition to do class assignments, and a discrete speech group that 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.
As part of a grant from the U.S. Department of Education, MacArthur & Cavalier (2001) researched speech recognition technology as an accommodation in large-scale assessments for students with learning disabilities. According to the Individuals with Disabilities Education Act (IDEA), students with disabilities must be included in general state and district-wide assessment programs with appropriate accommodations. 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 human transcriber 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 ten students without learning disabilities. All students completed writing tests under three conditions: handwriting; dictation to a human transcriber; and dictation to a computer using speech recognition software. Results showed that essays produced by LD students who dictated using speech recognition software were not as good as when using a human transcriber but were better than their own 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 statewide writing tests.

While the 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 and Raskind (1995 and 2000) is that in 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.

Higgins and Raskind (1995) and MacArthur and 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 non-disabled 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.

A person’s independence is invaluable and speech recognition utilizes state of the art technology while allowing students to function in a more normal way. As technology has made speech recognition a more viable option for many students, it appears that more research is required to address issues regarding implementation of speech recognition technology into educational settings for students with disabilities.
### Quality of the Management Plan

<table>
<thead>
<tr>
<th>Objective</th>
<th>Staff Assigned</th>
<th>Timeline</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a training model</td>
<td>Nancy Icke, Rachel Perella, Cheryl Temple</td>
<td>• Develop - Summer 2003</td>
<td>• Project Team will develop training plan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Implementation – School year 2003-2004</td>
<td>• ITS case managers will be trained in August 2003.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• As students are identified, ITS case managers will train school staff member responsible for student.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• School staff member will train student with ITS case manager support.</td>
</tr>
<tr>
<td>Training Guidelines for case managers</td>
<td>Nancy Icke, Rachel Perella, Cheryl Temple</td>
<td>Summer 2003</td>
<td>• August 2003, ITS case managers will work through the <em>Writing by Dictation Guide</em>.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>• August 2003, ITS case managers will be provided guidelines for identifying appropriate students.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• August 2003, hardware and software issues will be presented.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Implementation plan will be shared- weekly visits the first month, monthly visits beginning second month, quarterly meetings with Project Team.</td>
</tr>
<tr>
<td>Evaluate effectiveness of <em>Writing by Dictation Guide</em></td>
<td>Nancy Icke, Rachel Perella, Cheryl Temple, selected classroom teachers</td>
<td>Fall 2003 - pilot Winter 2004 - revise</td>
<td>• During October and November 2003, identified teachers will pilot the <em>Writing by Dictation Guide</em> and provide feedback.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• During December 2003 and January 2004, the guide will be revised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• During Spring 2004, guide shared with other school districts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Student data will be collected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Report of student</td>
</tr>
</tbody>
</table>
| Guidelines for identifying appropriate students | Nancy Icke, Rachel Perella, Cheryl Temple | Summer 2003 | • Guidelines will be developed during Summer 2003  
• Guidelines will be introduced to ITS case managers in August 2003. |
|-------------------------------------------------|------------------------------------------|-------------|--------------------------------------------------------------------------------|
| Implementation Issues                           | Nancy Icke, Rachel Perella, Cheryl Temple | Fall 2003, Spring 2004 | • The Project Team or ITS case managers will make monthly visits to every student.  
• Anecdotal records kept regarding the issues of implementing speech recognition.  
• Project team will meet quarterly with ITS case managers to discuss and review the anecdotal records. |
| Increase access                                 | William Reeder                           | Fall 2003   | • Desktop and laptop computers will be purchased.  
• Microphones and extra RAM for existing computers will be purchased.  
• *Dragon Naturally Speaking 7.0* and additional resource materials will be purchased. |
Quality of Project Evaluation

Objective 1:

Develop a model for training and implementing speech recognition technology for students with disabilities.

During the Summer of 2003, the Project Team will develop a model for training and implementing speech recognition technology for students with disabilities. This plan will include how to identify appropriate students, timelines for implementation, and use of the Writing by Dictation Guide. This will be a document that is developed by the Project Team.

ITS case managers who work with students at the secondary level will be trained in August 2003. They will develop their own voice files using Dragon Naturally Speaking 7.0 and go through the Writing by Dictation Guide to practice using speech recognition. As students are identified, ITS case managers will train the school staff member responsible for implementing speech recognition technology with the student. The school staff member will train the identified student with support from their ITS case manager.

Quantitative data will be collected to measure the success of speech recognition training. An initial baseline writing sample and ongoing collection of data are imperative to tracking student achievement with speech recognition (see Rubric below). Effectiveness will be determined by comparing a student’s baseline writing sample with writing samples after the implementation of speech recognition. With the initial sample, students should utilize their preferred mode for written language (i.e. keyboarding, pencil & paper, etc.) Throughout the year, three writing assessments will be taken including the initial baseline sample. Between Chapters 6 and 7 of the Writing by Dictation Guide, a sample using speech recognition should be done to
use as a comparison to the original baseline writing sample. Another sample should be taken when the student is independent and using speech recognition within the curriculum.

**Writing By Dictation Rubric**

**Found in “Averages”- Readability Statistics (MS Word)**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentences Per Paragraph (MS Word)**</td>
<td>6 or more</td>
<td>5</td>
<td>4</td>
<td>3 or less</td>
</tr>
<tr>
<td>Words Per Sentence (MS Word)**</td>
<td>7 or more</td>
<td>6</td>
<td>5</td>
<td>4 or less</td>
</tr>
<tr>
<td>Characters per Word (MS Word)**</td>
<td>12 or more</td>
<td>7.9 – 11.9</td>
<td>5.6 – 8.0</td>
<td>5.5 or less</td>
</tr>
<tr>
<td>Run-on Sentences</td>
<td>0</td>
<td>1-2</td>
<td>3-4</td>
<td>More than 4</td>
</tr>
<tr>
<td>Capitalization / Punctuation Errors</td>
<td>0</td>
<td>1-2</td>
<td>3-4</td>
<td>More than 4</td>
</tr>
<tr>
<td>Spelling Errors</td>
<td>0</td>
<td>1-2</td>
<td>3-4</td>
<td>More than 4</td>
</tr>
<tr>
<td>Focus on Topic (Content)</td>
<td>There is one clear, well-focused topic. Main idea stands out and is supported by detailed information.</td>
<td>Main idea is clear but the supporting information is general.</td>
<td>Main idea is somewhat clear but there is a need for more supporting information.</td>
<td>The main idea is not clear. There is a seemingly random collection of information.</td>
</tr>
<tr>
<td>Conclusion (Organization)</td>
<td>The conclusion is strong and summarizes the topic.</td>
<td>The conclusion is recognizable but all of the topic was not summarized.</td>
<td>Student attempted to conclude, but did not summarize.</td>
<td>There is not clear conclusion. The paper just ends.</td>
</tr>
</tbody>
</table>
Writing By Dictation Statistics Chart
(Use “Counts” in readability statistics MS Word)

Initial Baseline Writing Sample (Before starting)

<table>
<thead>
<tr>
<th># of words</th>
<th># of paragraphs</th>
<th># of sentences</th>
</tr>
</thead>
</table>

Writing Sample # 2
(Between stages IV and V)

<table>
<thead>
<tr>
<th># of words</th>
<th># of paragraphs</th>
<th># of sentences</th>
</tr>
</thead>
</table>

Writing Sample # 3
(At the independent Level)

<table>
<thead>
<tr>
<th># of words</th>
<th># of paragraphs</th>
<th># of sentences</th>
</tr>
</thead>
</table>

The purpose of the rubric and statistics chart is to identify a baseline in which to assess student progress. The rubric should continue to be used throughout the year as a tool for monitoring written progress. It is expected that the students will be able to write more in the same amount of time as the baseline data, have less spelling errors, and less grammatical errors using speech recognition technology. An analysis of this data will be presented to the Coordinator of FCPS’ Integrated Technology Services section in June 2004.

Objective 2:

Develop guidelines to train Integrated Technology Services (ITS) case managers to be effective instructors and facilitators of speech recognition technology.

The Project Team will develop training guidelines for ITS case managers to use in identifying appropriate students for speech recognition. A training session for the appropriate
Objective 3:
Evaluate the effectiveness of using the Writing by Dictation Guide as an instructional tool to train students to use speech recognition software.

As the case managers use the Writing by Dictation Guide to train teachers and students, they will provide feedback to the Project Team. Modifications, additions or deletions will be made to the Guide based on this feedback.

Objective 4:
Develop guidelines for identifying which students are most likely to benefit from using speech recognition technology.

The Project Team will prepare guidelines for identifying appropriate students for speech recognition technology. These guidelines will be presented at the training for the ITS case managers to facilitate the selection process. At the quarterly meetings with the case managers, the accuracy of the guidelines will be discussed. The number of appropriately identified students who become successful users of speech recognition technology will be the measure of the accuracy of the guidelines.

Objective 5:
Examine issues regarding the implementation of speech recognition in the classroom.

The Project Team or ITS case managers will conduct monthly visits to every student. Anecdotal records will be kept regarding the issues of implementing speech recognition. The Project Team will meet once a quarter with ITS case managers to discuss and review the
anecdotal records. Logistical issues such as type of class, location of computer in class, whether a laptop or desktop was used, etc., will be reviewed. A final report will be provided to the ITS Coordinator in June 2004.

**Objective 6:**

*Increase access to speech recognition technology for students with disabilities in FCPS.*

Additional desktop and laptop computers, *Dragon Naturally Speaking 7.0* software programs, microphones, and RAM will be purchased. This will allow as many as 75 students to benefit from speech recognition technology which is an increase of more than 50%.
Quality of Project Personnel

Project Supervisor:

William Reeder, Coordinator, Integrated Technology Services, Fairfax County Public School

William S. (Bill) Reeder is the Coordinator of Integrated Technology Services (ITS) for FCPS. He currently supervises 40 training, support and clerical staff who provide technology support to all FCPS special programs. Reeder has been the ITS Coordinator since 1989, when his position was created with a staff of three. ITS’ primary mission is to provide “state-of-the-art” assistive technology support to FCPS students with disabilities. FCPS has a student population of more than 160,000 students, including approximately 25,000 students with disabilities.

Mr. Reeder served as co-chair of Fairfax County’s Strategic Technology Planning Council for three years and was a founding member in 1995. He has been a consultant to other school systems and for the U. S. Department of State’s Office of Overseas Schools. Overseas consultations and presentations have included: Abidjan, Athens, Barcelona, Bermuda, Cairo, Crete, Helsinki, Hong Kong, Istanbul, Kobe, La Paz, Madrid, Nouakchott, Rome and Trinidad.

Other Team Members:

Cheryl Temple, Assistive Technology Specialist, Integrated Technology Services, FCPS

Cheryl Temple, M.Ed., is endorsed in the area of Learning Disabilities in the state of Virginia. She taught students with learning disabilities from grades K – 8 in resource and self-contained settings for 17 years. She was an assistive technology resource teacher for seven years and was responsible for providing assistive technology support to students and teachers in FCPS. For the last two years, she has been in an administrative role and currently supervises all of the elementary assistive technology resource teachers employed at Integrated Technology Services. In addition, she organizes the Assistive Technology Certificate program, the Technology
Outreach Program Support (TOPS) Teacher program, and works with the Coordinator of ITS on many other special projects and assistive technology trainings.

Ms. Temple became involved in the speech recognition program three years ago when the pilot for students with learning disabilities was initiated. The creation of a curriculum guide, *Writing By Dictation*, with her colleagues Rachel Perella and Nancy Icke, was a result of this pilot. She has shared her knowledge and expertise in the area of speech recognition at state, national, and international conferences during the past three years. In addition, she is a user of speech recognition technology in her ongoing doctoral degree studies at George Mason University.

*Nancy Icke*, Assistive Technology Resource Teacher, Integrated Technology Services, FCPS

Nancy Icke, M.Ed., is endorsed in the areas of Mental Retardation, Learning Disabilities, Crippling Conditions, and Severe and Profound Disabilities in the state of Virginia. She has been working with students with physical disabilities for the past 28 years in a teaching and technology capacity. As an assistive technology resource teacher, she assesses individuals from ages to 5 – 22 and makes recommendations for adaptive devices and software related to computer access and instructional technology.

Ms. Icke initiated a speech recognition pilot seven years ago for students with physical disabilities. Due to the success of this pilot, she has continued to expand the program for the past three years for students with learning disabilities. Her extensive work with the students and the program has led to the creation of a curriculum guide, *Writing By Dictation*, with the aid of her colleagues Rachel Perella and Cheryl Temple. Ms. Icke has shared her knowledge and expertise in the area of speech recognition at state, national, and international conferences since she began using speech recognition with her students.
Rachel Perella, Assistive Technology Resource Teacher, Integrated Technology Services, FCPS

Rachel Perella, M.Ed., is endorsed in the areas of Learning and Emotional Disabilities in the state of Virginia. She began her career in a 5th grade classroom with students who had severe emotional disabilities. She found that with this type of student, the key to success in the classroom was the use of technology. Ms. Perella expanded her teaching experience in a middle school working with students with learning disabilities.

While working at the middle school, she became involved with the Technology Outreach Program Support (TOPS) program supported by Integrated Technology Services (ITS), FCPS. This led to her being selected to participate in a speech recognition pilot for students with learning disabilities. Her experience with the pilot led to her being hired by ITS as an assistive resource teacher. In this capacity, she assesses individuals at the secondary level and makes recommendations for software and hardware that will assist them within the curriculum. For the past three years, she has continued to work with her colleagues in the area of speech recognition. Her experience with speech recognition has led to the creation of a curriculum guide, *Writing by Dictation*, in collaboration with her colleagues Nancy Icke and Cheryl Temple. Ms. Perella has had the opportunity to share her expertise in the area of speech recognition at state conferences.
References


