EXPERIENCES WITH THE USE OF COMPUTER PROGRAMS WITH SPEECH OUTPUT IN TEACHING READING AND WRITING

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ABSTRACT

Feedback from a synthesizer when typing a text has been found useful for children with reading and writing problems. Increased motivation and improvement in spelling skills were observed. A recent project has shown further potentials of this new approach. Children can experiment with speech sounds and practice identifying phonemes, discriminating between short and long vowels, rhyming, discovering missing phonemes, syllables, mispellings, and so on. The first series of computer programs were developed during 1983-84. They were intended to train children's phonological awareness in a stimulating and effective way. In a first pilot project, nine subjects from second to fifth grade (8-11 years old) were trained. Tests before and after the experiment show a higher improvement than expected. A better collaboration between teacher and pupil, and an increase in the pupils' self-esteem was also observed. The Infovox speech synthesizer was used. The programs can be run on the Epson HX-20, the Multi-Talk and the IBM-PC.

INTRODUCTION

A reading and writing disability is a serious handicap in a time when we pay much attention to reading and writing ability. Serious reading and writing problems by children who otherwise learn normally are generally referred to as dyslexia.

Grown-up dyslexics very often suffer from lack of understanding for their handicap. Dyslexia, is often invisible, and together with other types of reading and writing problems, are our most frequent handicaps. Mirror writing, e.g. "was" instead of "saw," letter reversal and omission are common writing mistakes in dyslexia. A dyslexic also has trouble reading his own writing. In absence of feedback for their decoding errors in silent reading, the development of better decoding skills is actively retarded by incorrect learning trials, and, of course, comprehension suffers.

Researchers all over the world are working with mapping these difficulties and finding remedies for them. For a rather long time the main theory about these problems was assigned to visual deficits (Orton, 1928).

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Today most researchers in this area consider dyslexia to be a subtle language deficiency, where lack of phonological awareness is assumed to be the central problem. Hence, for reading and writing an important pre-requisite is to be aware of the phonemes and the connection between the sound and the letter (ref 1-8). In Scientific American, March, 1987, Frank R. Vellutino presents an explanation of what he calls "The library model":

"To understand this definition of disorder, one can conceive of the mind as an extremely sophisticated reference library. The library model is appropriate because recent studies seem to indicate that dyslexia is as closely aligned with the cross-referencing and retrieval of coded information already stored in memory as it is with the storing and coding of new information."

The library model is based on the assumption that the processing of information to be stored in memory proceeds in stages. The first stage of processing takes place in a sensory storage system, where a replica of a given stimulus is held briefly. The second stage is believed to take place in a short-term "working" memory: a limited - capacity system for which an encoded (transformed) version of the stimulus is available for no more than 30 seconds. In this working memory, physical information is transformed into a more abstract symbolic representation for storage in long-term memory, which is thought to have an unlimited capacity. During the final stage of memory processing, the encoded form of the stimulus is either categorized and stored in long-term memory, discarded or inadvertently lost from working memory."

AN INTERDISCIPLINARY PROJECT

Recent developments in this field of speech technology offer new possibilities to deal with these problems. Synthetic speech can provide efficient feedback in training sessions. During earlier experiments with speech-impaired children, several positive effects were observed: an increased motivation for writing and a faster development of their skills.

Based on these early experiences an exploration of this new approach was started in 1983. The text-to-speech system developed at our department, known as the model SA 101, had become available. Although the first application were directed towards the use of the system as an aid for the speech impaired, we could foresee its potential in the special education of children with reading and writing disabilities in ordinary public schools.

Integrating the speech output into computer programs offers special features, such as:

* Immediate and simultaneous auditory and visual feedback,
* Explorative activities, e.g., identifying phonemes and reversed or omitted letters, discriminating long and short vowels, and training in analysis and synthesis, and so on.

Our collaboration started as a result of discussions at a summer school that people with various backgrounds but a common interest in speech, sound and hearing attended. We outlined a number of programs aimed at training of different skills necessary for
reading and writing based on the theory of the importance of linguistic awareness, e.g., identifying phonemes, discriminating between short and long vowels, rhyming, discovering missing phonemes or syllables, misspellings.

The first series of computer programs were developed during 1983-84. They were intended to train children's phonological awareness in a stimulating and effective way. The first pilot project was run in a normal school with nine subjects from second to fifth grade (8-11 years old) with great difficulties in reading and writing.

The training period lasted for 12 weeks with two 20-minute long sessions per week. The programs were tested during these sessions and the experiences resulted in gradual improvement of their design. The pupils were tested before and after the experiment. A second grade class served as a control group.

The training sessions were effective and this method enhanced the collaboration between teacher and pupil. The sessions were as Frank R. Vellutino recommends "based on one to one tutoring and balanced reading program - one that makes generous use of both the holistic/meaning and the analytic/phonetic approaches" (Vellutino, 1987). The most apparent effect was the increase in motivation to read and write. The motivation lasted during the whole training period. The post-test clearly showed a higher proportional improvement in the experiment group than in the control group.

A final test was made to evaluate the effect of the feedback with synthetic speech. Two texts (short stories) were reproduced in two different ways: handwriting and typing on a computer keyboard with feedback from the synthesizer. The children had feedback of the phonemes while typing and they could repeatedly listen to the words and the sentences typed. Although the stories were short and easy, and the words were known to the children, there were several spelling errors (3.88 average per story) in handwriting. When reproduced with feedback from the synthesizer, the texts were free from spelling error. Spelling errors also occurred in handwriting when the text had been reproduced with feedback earlier (1.88 average).

The results demonstrate the usefulness of the feedback provided by the synthesizer. It is remarkable that the children not only could detect spelling errors but were able to correct them.

The equipment used in the project consisted of the Infovox SA 101 speech synthesizer and the Epson HX-20 computer. The programs were written in Basic. The experiments were carried out in Umeå, on a distance of over 600 km from Stockholm. In spite of the distance between us, the collaboration worked smoothly, and up-dated programs on micro-cassettes were sent by mail. Several of the programs have been used in other schools as well and the project gave inspiration to the development of other interactive programs, some of them for mentally retarded children.
The Infovox speech synthesizer and the Epson computer have recently been packaged into an attache case to form a portable and battery operated device, the Multi-Talk. It has been manufactured by Fonema AB since 1986. Multi-Talk is presented in the paper "Multi-Talk, a New Portable Multilingual Speech Output Communication Aid." Although designed to be an aid for the handicapped, the widest application of the device so far has been in teaching reading and writing.

The programs have been transferred to the IBM-PC computer which can be equipped with a speech synthesis board from Infovox. The programs are written in Turbo Pascal.

REFERENCES


