

# EduLink: Improves speech understanding in noisy classrooms

## Summary

EduLink improves speech clarity and signal-to-noise ratio in school environments, which is a main objective of APD management. Intermediate data from a long-term study confirm that speech understanding in noise is significantly improved. Both children and teachers report a subjective improvement in speech understanding with use of the personal FM systems in the classroom. In addition, EduLink is well accepted by both the users and their peers. This is of great practical importance, as a high level of person and peer acceptance is a prerequisite for successful use of personal FM systems.

## Introduction

Many school-aged children have normal auditory thresholds, yet appear to have a hearing impairment. They are described by their parents and teachers as children who are uncertain about what they hear, have difficulty listening in the presence of background noise, struggle to follow oral instructions and experience problems in understanding rapid or degraded speech. In a significant portion of these children, the listening problems result from an auditory processing deficit: the defective processing of auditory information in spite of normal auditory thresholds<sup>1</sup>. Management of an Auditory Processing Disorder (APD) can be described as a tripod consisting of three "legs": (1) Direct therapeutic remediation; (2) Compensatory strategies; (3) Environmental modifications<sup>2,3</sup>. Environmental modifications are designed to improve acoustic clarity, and enhance learning and listening. It is generally accepted that all listeners perform better in an

environment with acoustic clarity and favorable signal-to-noise ratios. The use of a personal FM system such as EduLink is the most effective way to improve clarity and the signal-to-noise ratio in school environments (where "signal" refers to the voice of the teacher).



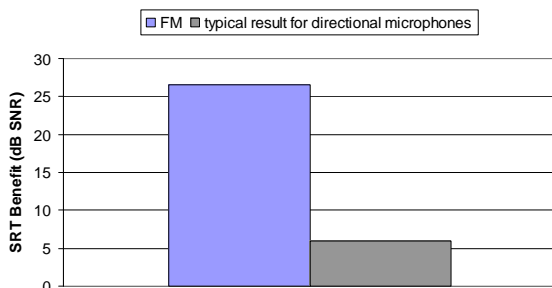
## Setup of the study

EduLink is currently being evaluated in a long-term field trial which is conducted in a school for children with learning disabilities in Switzerland. In total, 28 children diagnosed with performance deficits related to APD are participating in the trial. Half of the children are equipped with personal ear-level FM systems (treatment group A), and half of the children constitute the matched control group B. The use of an FM system supplements and does not replace other intervention measures such as speech-language or occupational therapy. The age of the children ranges from 6-12 years. The children are distributed across three classes. In each class, half of the children belong to group A and B, respectively. Several outcome measures are used in the trial. Speech intelligibility in noise is assessed with the Basler Sentence Test, which adaptively determines the signal-to-noise ratio (SNR) where 50% speech intelligibility is reached (speech reception threshold - SRT). Speech is presented from the front direction with a distance of 3m between speaker and subject. For speech tests with FM systems, the microphone is fixed at 7cm from the speaker. Speech shaped noise is presented from behind at

a distance of 1m. In addition, auditory memory is assessed using a software-based game where the children have to repeat strings of 3-6 digits (depending on the child's individual performance to avoid floor and ceiling effects). The subjective impression of teachers and children is assessed using questionnaires. Outcome measures were taken at the onset of the study (Nov 2003) and repeated after four months of experience in school.

## Results so far

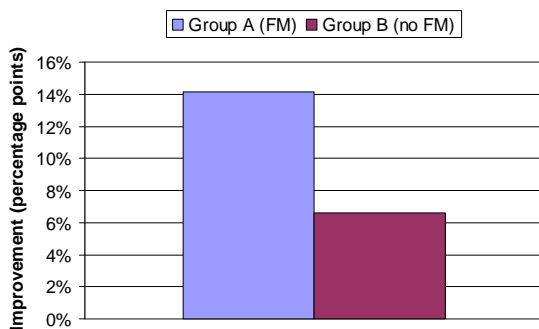
Speech intelligibility in noise was measured with and without FM in group A. The benefit, defined by change in SNR, is shown below.



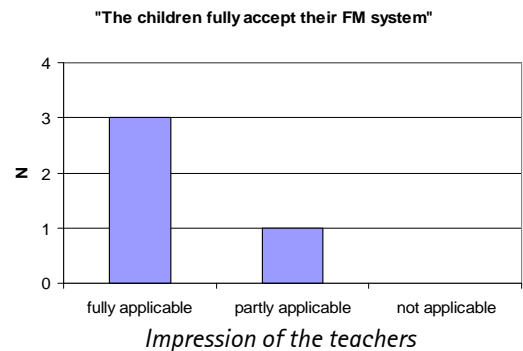
Speech test in noise: benefit from personal FM

The average measured benefit from FM was 26.6 dB, predicting an outstanding enhancement of speech understanding in classroom environments. By comparison: the typical SNR benefit when using directional microphones in this situation would be about 6 dB.

In terms of auditory memory, both subject groups improved after 4 months, but the improvement of group A was significantly higher (see Figure below).

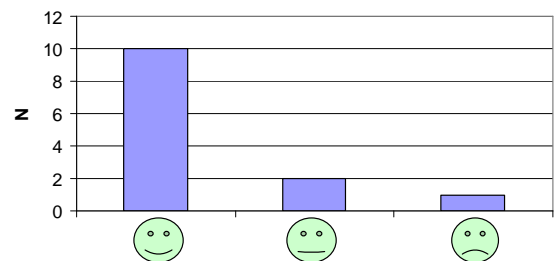


Auditory memory: improvement after 4 months



All involved teachers (three principal teachers and one assistant teacher) reported subjective improvements in speech understanding for the children with personal FM, as compared to controls. In addition, they stated that the children accept their FM systems (see Figure above). They stated that the other children (from group B) did also accept the devices to the same extent, which is an important point, as a perceived stigma is strongly dependent on the peer group. The children confirmed that they can indeed understand the teacher much better with their FM systems (see below).

"Do you get what's going on in class much better?"



Impression of the children (group A) after 4 months. Ratings were symbolized with "Smileys".

In conclusion, the data collected so far confirm that children utilizing personal FM systems in the classroom demonstrate improvement in understanding the teacher's speech. Both these children and their peers experience a high level of acceptance of the FM systems.

## References

- <sup>1</sup>Jerger J, Musiek F, J Am Acad Aud 11:467-474, 2000
- <sup>2</sup>Bellis T, When the brain can't hear, Pocket Books, 2003
- <sup>3</sup>Rosenberg G, Sem in Hearing 23(4):309-317, 2002