

# “Limits are relative” - Hearing-impaired children improve their musical potential

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## ABSTRACT

### Background

Hearing impairment (HI) is not normally associated with musical potential. It is defined as a physical hearing loss and/or a malfunction of perceptual processing in the auditory pathway, which seems to be an important predictor of reduced perception and performance of music.

Physical hearing loss is described as a conductive loss or a sensi-neural loss. Conductive losses concerning the loudness factor can be compensated by the use of hearing aids. Sensi-neural losses arise from disorders concerning the cochlea and affect the perception of sound quality or sound clarity.

Many hearing-impaired children suffer from conductive and sensi-neural losses. However, advanced technology in the last twenty years (digital hearing aids, cochlear-implants) enable hearing-impaired children to perceive sounds much better than before. It is conjecturable that these children can now discriminate musical patterns with all senses, including vibrotactile and visual stimuli and that they will be even able to generate auditory skills and voice capacities by musical practise.

HI in children most commonly leads to delayed speech and language acquisition, but is often accompanied by a range of multi-functional disorders ranging from somato-sensory to mental dysfunctions. Therefore, the developmental implications of HI may vary to a great degree from child to child. However only a small percentage of hearing-impaired individuals do not hear at all. Most of them have some residual hearing which can be fostered with musical programs. Musical capacities of hearing-impaired children might be limited by their hearing loss, but this does not vitiate musical responsiveness.

Both developmental and neuropsychological studies suggest close interactions between language and music domains in infancy and childhood as well as in adulthood. To date, there is paucity of research on musical competence and learning in children with hearing impairments (HI), and the relationships of musical competence to language acquisition

### Aims

The rationale of this study is to respond to the individual musical potential in hearing-impaired children in relation to general music skills and voice capacities. Moreover music and language perception can be modeled by a similar hierarchical structure. At the bottom we find the so called ‘Low-Level c

competences’. These competences are responsible for the solution of time and frequency information. The ability to judge pitch, duration and time of sounds leads to more complex abilities in the recognition of sentences and melodies. Thus, the recognition of non-verbal stimuli is important to guarantee a phonological consciousness concerning the language acquisition process. In that way, musical practice leads to benefits in both domains

### Method

A group of 31 children participated in this study. Each child was audio- and videotaped during spontaneous singing, dancing and movements and during their performances with music instruments (keyboards, guitar). The test battery is comprised of first a music attitude test for young children including time and pitch performances, second measures of intelligence (K-ABC) and measures of emotional aspects in spoken language. The control group had traditional rhythm lessons, whereas the model-group had active musical training with instruments (keyboard/guitar) – combined with embodied voicework.

### Results

All participants showed an improvement concerning both metric-rhythmical and tonal competences. Cognitive skills, especially complex capacities, can be highly improved by instrumental learning (MG:  $M=8.43$ ;  $SD=9.95$ ; KG:  $M=-2.6$ ;  $SD=7$ ;  $p=.01$ ). The subjects of the model group were able to enhance the difference frequencies of their voices mediated by instrumental learning and voice-work. That leads to a better modulation in speech; especially among those who have cochlear implants. This group profits significantly from voice development (MG/CI:  $p=.04$ ;  $d=1.2$ ).

### Conclusions

Musical training supports hearing-impaired children to develop musical capacities. Instrumental practise leads to improved competences for the recognition of complex structures. The aural-oral-loop mediated by instrumental lessons and singing supports an enhancement of voice frequencies. Musical experiences can be saved as “Hearing vocabulary” in the auditory cortex. This kind of learning process creates the base to develop a musical self-concept for those children and offers the opportunity to discover their own

musical culture. Hearing-impaired children have musical abilities above their language level. They are able to produce or reproduce melodies and perform on several instruments. The musicality of hearing impaired children is obvious and should no longer be neglected in music education programs.

## Keywords

Hearing Impairment, Cochlear Implant, instrumental practice, voice development, musical self-concept

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