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## Successes of students with hearing impairment in math and reading with comprehension

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### Abstract

The submitted article introduces readers with the results of pupils with hearing impairment at 5th up to 9th year of school in the area of Math and language skills. The authors focus on factors which can probably influence the success of pupils with hearing impairment in Math. One of them is considered to be the reached level of reading in understanding of national language. The research group is created by 177 pupils with hearing loss higher than 61 dB from the Czech Republic, Slovakia and Hungary.

The statistical proceeded results confirm that among reached pupils' results with hearing impairment in reading with understanding and in Math there is an existing statistically significant correlation. At the same time it needs to be considered as by intact population the influence of congenital logical-mathematical intelligence and linguistic talent which can occur individually or simultaneously by pupils with hearing impairment.

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*Keywords:* mathematics; hearing impaired pupils; reading comprehension

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### 1. Introduction

Education of people with hearing impairment has gone through several important changes during the 20th century from application so called *oral method* in education, over *philosophy of total communication* up to the nowadays trend of *bilingvism*. First one study dealing with the issue of education of people with hearing impairment made in the sixtieth of the twentieth century showed the deficiencies of linguistic competences and study reports of pupils with hearing impairment. The results of the research oriented on reading skills highlight that the level of reading skills by pupils with hearing impairment in the period of 10 to 16 years of age rises up

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maximally by one degree and only 12% pupils with hearing impairment reach linguistic competences needed for full involvement into daily life (Furth, 1966). Sanders (1988) summarises the results of contemporary studies and she states that pupils with hearing impairment at the age of 9 drop behind 1,5 year in reaching study results in comparison with their hearing peers and at the age of 14 the difference is even 5 years. Nunes and Moreno (1999) give a comprehensive overview of studies in mathematics: e.g. already in the year 1965 Wollman justified the results of pupils with hearing impairment at upper primary school with more a lack of understanding than by mistakes in calculation and study results.

Kidd, Madsen and Lamb from the year 1991 focused on pupils with hearing impairment attending a boarding school showed that reading with understanding also relates to vocabulary and mathematical vocabulary of these children.

There are currently many international researches e.g. PISA, TIMSS ascertaining levels of acquired knowledge of a pupil in several school subjects. More or less satisfactory study results of intact peers in countries bring several questions and stimulus for further research activities. Apart from linguistic competences and reached reading level which is now understood as a basis so called *functional literacy*, mathematical skills are still being investigated more and more and not even their reached level but mainly the whole process of learning of mathematical understanding. The age limit for investigated children is shifted from the period of compulsory school attendance to early child's age where the basic assumptions for harmonious development of the child are formatted. As one of the factors involved in the process of formation and development of mathematical understanding increasingly shows the big role of mother tongue. In deaf children case, sign language (Genovese et al, 2005).

## 2. The aim of the research

Civic association Svet ticha in Bratislava organises an international competition in linguistic and mathematical skills since the year 2005. The purpose of this is to attract students with hearing impairment two basic school subjects and to motivate them in their further self-development.

In connection with school failure in math of children with hearing impairment (Minárová, 2002) and achieved lower level at reading with understanding of these children in comparison with intact population (Furth, 1966, Sanders, 1988, Tarcsiová, 2007, Vítová, 2008), we decided to prove the hypothesis: *Among achieved results of pupils with hearing impairment in a comprehensive reading test and results in mathematics there is a significant statistical correlation.*

## 3. The Research Sample

During the period of 2010 up to 2013 177 pupils of 5th – 9th graders out of three countries Slovakia, the Czech Republic and Hungary participated in the competition. The condition of participation of pupils was hearing loss higher than 60 dB, the participation also for pupils using hearing aids or pupils with cochlear implants.

## 4. Research Methods

For research methods we have used didactical tests based on Czech national curriculum, in case of mathematics. *Tests from mathematics* contained tasks corresponding with its content of material of the certain grade. The tasks map the pupils knowledge in the field of numerical calculation, units transfer, arithmetic word problem, basic geometric concepts reading charts and non-standard tasks type of “*a brain teaser*“.

*Tests from national language* (Slovak, Czech and Hungarian) were made by colleagues from Comenius University in Bratislava led by Associate Professor Tarcsiova. The tests are based in Slovak language and then they are only translated into other national languages. According to their concept there is a minimal need for

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