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Comparison of Executive Function In Deaf Children With Early And Late Intervention

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ABSTRACT: Objective. The primary purpose of this study was to examine the comparetion between age of enrollment in intervention and executive function (EF) and Nonverbal intelligence in a group of deaf children. **Method:** Nonverbal intelligence and EF at 3 years of age were examined in a group of 20 children (14 boys and 6 girls) from Tehran, Iran, ages 3 to 5 years (*M* = 3/7 years, *SD* = 1/11) who were enrolled earliest (eg, by 11 months of age) demonstrated. The comparison group consisted of 20 children (11 boys and 9 girls) ages 5 to 7 years (*M* = 5/10 years, *SD* = 2/1) EF at 5 years of age than did later-enrolled children. who were enrolled at various ages in a comprehensive intervention program. EF were explored in a subgroup of 20 of these children. Participants were evaluated using of the EF Behavior Rating Inventory of Executive Function (BRIEF) was developed by Goya et al (1996)). For assessing Nonverbal intelligence we used the original Wechsler Intelligence Scale (Wechsler, 1949). **Result:** Executive function and Nonverbal intelligence revealed that deaf children that enrolled late in intervention classes compared with who that enrolled soon have deficits in executive functions. **Conclusion**: A statistically significant was found between age of enrollment and EF and Nonverbal intelligence

***Keywords*:** Executive Functions, Deaf, Late enrolled, Soon enrolled, Nonverbal intelligence.

INTRODUCTION

About 2 to 3 out of every 1,000 children in the United States are born deaf or hard of hearing. Over 90% of these children are born to parents who can hear. Early identification of children who are born deaf or hard of hearing is critical to ensure that their families have the resources they need to help their children acquire language, spoken and/or visual, and achieve age-appropriate communicative, cognitive, academic, social, and emotional development. At the time, the average age of identification of deaf children was about 2½ years old; children who were hard of hearing were often identified much later. Confirmation of hearing status by three months, and enrollment in an early intervention program for deaf and hard of hearing babies and their families by six months. Today, about 95% of newborns have a hearing screening before they leave the hospital. However, not all of these newborns who are suspected of being deaf or hard of hearing receive the necessary follow-up evaluations they need to confirm their hearing status. The NAD is actively seeking reauthorization of the EHDI bill with a focus on ensuring that every family gets the care, information, and services they need to give their deaf or hard of hearing children the opportunities they need to acquire spoken and visual language. This is a collective term for regulatory and controlling mechanisms that are essential if people are to perform goal-oriented and situation-oriented actions (Esslinger, Biddle, & Grattan, 1997; Konrad, 2007; Welsh, Zelazo, 1997) .executive functions encompass a rather heterogeneous collection of skills that, in various ways, aid in the monitoring and control of thought and action. These skills include self- regulation, inhibitory control, planning, attention flexibility, error correction and detection, and resistance to interference (Welsh et al. 1991; Zelazo et al., 1997).

They are mental processes of a higher order that are important when actions are planned or goals and intentions are being followed and monitored over many stages with regard to how successful they are. These skills are particularly relevant when people are faced with new or unexpected situations and therefore required to use new reaction patterns. These days, most investigators suggest that executive functions are various independent processes that can malfunction selectively (Drechsler, 2007; Klenberg, Korkman, & Lahti-Nuuttila, 2001). They include the ability to initiate problem-solving processes, inhibit the effect of stimuli or actions that distract the attention, select relevant goals for specific actions, organize complex problem-solving processes and adjust problem-solving strategies as needed, in addition to being able to constantly monitor one's own course of action and assess its success. Also working memory, where information is actively kept available for use in multi-step problem-solving processes is classified as a component of executive function. Research has shown that early intervention in deafness caused less damage to executive function and executive function impairment is reversed with respect to early intervention. Since 1980, the Center for Early Intervention on Deafness (CEID) has provided exemplary services for young children, from birth to age 5, who are deaf, hard of hearing or who have severe speech and language delays. To achieve our goal of maximizing the communication potentials of each of our students, they offer a comprehensive program of early education in combination with extensive therapy (speech, language, auditory, occupational, and physical the EF at 5 years of age were examined in a group of 40 children with hearing loss who were enrolled at various ages in a comprehensive intervention program. EF were explored in a subgroup of 40 of these children. The primary purpose of this study was to examine the relationship between age of enrollment in intervention and EF outcomes at 5 years of age in a group of deaf and hard-of-hearing children.

Measurements

Wechsler Intelligence Scale

The original WISC (Wechsler, 1949) was an adaption of several subtests which not only was made of the Wechsler–Bellevue Intelligence Scale (Wechsler, 1939) but also featured several subtests designed specifically for it. The subtests were organized into Verbal and Performance scales, and they provided scores for Verbal IQ (VIQ), Performance IQ (PIQ), and Full Scale IQ (FSIQ). A revised edition was published in 1974 as the WISC-R (Wechsler, 1974), featuring the same subtests, however; the age range was changed from 5-15 to 6-16. The third edition was published in 1991 (WISC-III; Wechsler, 1991) and brought with it a new subtest as a measure of processing speed. The current version, the WISC-IV, was produced in 2003 followed by the UK version in 2004. Each successive version has re-normed the test to compensate the Flynn effect, ensuring the norms do not become outdated. This is suggested to result in inflated scores on intelligence measures; also they are representative for the current population. A number of concurrent studies were conducted to examine the scale's reliability and validity. Evidence of the convergent and discriminate validity of the WISC–IV is provided by correlation studies with the following instruments: WISC–III, WPPSI–III, WAIS–III, WASI, WIAT–II, CMS, GRS, BarOn EQ, and the ABAS–II. Evidence of construct validity was provided through a series of exploratory and confirmatory factor-analytic studies and mean comparisons using matched samples of clinical and nonclinical children. The number of questions presented depends upon a pre-determined basal and ceiling level. The minimum number of word-pairs presented is four while the highest is twenty-three. The child can receive a raw score between 0-44. The Wechsler Intelligence Scale for Children-Revised was standardized on a representative sample of 1400 children aged 6 to 13 years. The standardization sample was derived on the basis of father's occupation, age and sex according to the 1986 census of Iran. Tables for conversion of raw scores to standard scores and IQs were constructed. Retest reliability and split-half reliability of the test scores were comparable to the values reported by Wechsler (1974). Split-half reliability coefficients range from0/67 -.0/69 (mean = 0/68), depending on the age of the child. Test-retest reliability is reported to be 0/92-0/95. Correlations between WISC-R and WPPSI IQs, correlations between WISC-R scaled scores and IQs, the increase of raw scores with age, the relationship between scores and socioeconomic status of the family, and correlations between IQ and school achievement were interpreted as an index of validity of the scale(0/78-0/97). Gender difference in IQs were not significant(shahim, 2008).

Behavior Rating Inventory of Executive Function (BRIEF)

The Behavior Rating Inventory of Executive Function (BRIEF) was developed by Gioia et al. (1996), and it was used to assess executive function in the sample. The BRIEF is a rating instrument designed to assess impairment of executive function in individuals aged 5 - 18. Reliability is reported in terms of internal consistency (ranging from 0/80 -0/98) and test-retest reliability (ranging from 0/76 –0/85). The BRIEF is easily administered to either parents or teachers and it provides clinical scales on various executive function components. In this study a form was used for parents and teachers. The Meta cognition Index is composed of the Initiate, Working Memory, Plan/Organize, Organization of Materials and Monitor scales. The Global Executive Composite score is a composite score incorporating all eight scales of the BRIEF. The scale also contains items. Parents also completed the Brief Betrayal Trauma Scale – Parent version. Their mother completed this questioner (Nesayean & Alizadeh, 1392). This is in the form of a questionnaire, and the teacher's version used for this study comprised 73 items targeted at children and adolescents in the age range 5–18years. These 73 items are distributed over eight theoretically and empirically based clinical scales, with high scores indicating problems with executive functions.

Inhibit: The child can control impulses and behavior; it holds back or modifies its own behavior at the appropriate timer according to the circumstances (10 items; examples: “Interrupts others,” “Is impulsive”).Shift: The child moves smoothly from one situation, activity, or problem component to another, depending on the demands of the situation; it masters transitions and has a flexible approach to solving problems (10 items; examples: “Becomes upset with new situations,” “Thinks too much about the same topic”).Emotional Control: The child can modify its emotional reactions according to the demands of the situation or the circumstances (nine items; examples: “Has explosive, angry outbursts,” “Has outbursts for little reason”).Initiate: The child is able to independently tackle set tasks or activities and at the sometime come up with ideas and problem-solving strategies of it sown(seven items; examples: “Is not a self starter,” “Does not take the initiative”).Working Memory: The child can keep information available in its memory so as to complete a task or choose a suitable reaction (10 items; examples:“When given three things to do, remembers only the first one,” “Has a short attention span”).Plan/Organize :The child can anticipate certain future event sarcoma sequences; it can direct its behavior t goals or instructions; it develops the appropriate steps needed to complete a task beforehand (10 items; examples: “Has good ideas but cannot get them on paper,” “Gets caught up in details and misses the big picture”).Organization of Materials: The child isable to keep its work and play areas tidy, including the places where belongings are kept (seven items; examples: “Cannot find clothes, glasses, shoes, toys, books, pencils, etc.,” “Back pack is disorganized”).

Monitor: The child is able to check the effectiveness of its work during and after the activity; it can gauge the effect of its behavior on other people (10 items; examples: “Does not check work for mistakes,” “Makes careless errors”).The subscale values can be summarized in two higher-order scales—the “Behavior Regulation Index (BRI)” (cumulative value of the “Inhibition,”“Shift,” and “Emotional Control” scales) and the “Met cognition Index (MI)“(cumulative value of the “Initiate,” “Working Memory,”“Plan/Organize,” “Organization of Materials,” and "Monitor” scales). In addition to these)” cumulated from the results of all eight subscales. Separate norms for hearing boys and girls are available for four age groups. The was very satisfactory (e.g., Cronbach’s alpha between .90 and .96 for all eight subscales, .97 for the BRI, .98 for the MI, and .98 for the GEC). We ran a reliability check on the results of our study separately for each type of school, which reliability of the results data for the U.S .normative sample of 720 children yielded slightly lower scores but was nevertheless very satisfactory overall (Cronbach’s alpha between .84and .95 for all eight subscales, .94 for the BRI, .97 for the MI, and .97 for the GEC). Strengths and Difficulties Questionnaire.

Tabel 1. Comparison of intelligence Wisc-R Performance IQ (PIQ)

Variables	Type III Sum of Squares	df	Mean Square	F	Sig.
Picture Completion,	171.841	1	171.841	589.721	.000
Picture Arrangement,	73.131	1	73.131	158.906	.000
Coding	115.013	1	115.013	394.298	.000
Block Design	177.390	1	177.390	1.315E3	.000
Object Assembly	177.390	1	177.390	1.315E3	.000

In table 1, where shows the significant defenses between two groups.

Table 2. Comparison of intelligence Wisc-R PIQ, in deaf children

	Value	F	Hypothesis df	Error df	Sig.
Pillai's Trace	0.906	1231.628	5	34	0.000
Wilks' Lambda	0.017	1241.628	5	34	0.000
Hotelling's Trace	72.980	1271.628	5	34	0.000
Roy's Largest Root	72.980	1291.628	5	34	0.000

Intelligence Wisc-R Performance IQ (PIQ) include of: Picture Completion, Picture Arrangement, Coding, Block Design, Object Assembly that early enrolment group in higher score in: Picture Completion, Picture Arrangement, Coding, Block Design and lower score in, Object Assembly.

Table 3. Comparison of EF in deaf children

Variables	Type III Sum of Squares	df	Mean Square	F	Sig.
working	178.681	1	178.681	1143.942	0.000
Inhabit	200.657	1	200.657	129.084	0.000
Metacognition	213.070	1	213.070	2008.675	0.000
Regulation	76.157	1	76.157	237.583	0.000

Tabel 3. Group means for the five BRIEF scales are presented in Table 3. There was a significant multivariate group effect for five scales (P<.0001). Univariate tests for the two scales considered to be useful for differentiating the subtypes (Working Memory and Inhibit) and three primary index scores revealed significant group differences (P<.0001). There were significant differences between the BRIEF scales or indices between the age of enrollment in intervention . However in the analyses reported above, there was difference between the individuals with age of enrollment in intervention and controls on four out of the five BRIEF indices; however, normal individuals had higher ratings (P<.05) than age of enrollment in intervention participants on the Executive function.

Table 4. Comparison of EF in deaf children

	Value	F	Hypothesis df	Error df	Sig.
Pillai's Trace	0.989	783.546	4	34	0.000
Wilks' Lambda	0.011	783.546	4	34	0.000
Hotelling's Trace	92.182	783.546	4	34	0.000
Roy's Largest Root	92.182	783.546	4	34	0.000

RESULTS AND DISCUSSION

Result

A statistically significant negative correlation was found between age of enrollment and language outcomes at 5 years of age(Blamey,Sarant, 2002). Children who were enrolled earliest (eg, by 11 months of age) demonstrated significantly better vocabulary and verbal reasoning skills at 5 years of age than did later-enrolled children(Burgess, 1997). Regardless of degree of hearing loss, early-enrolled children achieved scores on these measures that approximated those of their hearing peers. In an attempt to understand the relationships among performance and factors, such as age of enrollment, family involvement, degree of hearing loss, and nonverbal intelligence, multiple regression models were applied to the data. The analyses revealed that only 2 of these factors explained a significant amount of the variance in language scores obtained at 5 years of age: family involvement and age of enrollment. Surprisingly, family involvement explained the most variance after controlling for the influence of the other factors underscoring the Importantly, there were interactions between the factors of family involvement and age of enrollment that influenced outcomes(Oberg, 2007). Early enrollment was of benefit to children across all levels of family involvement(Hintermair, 2007). However, the most successful children in this study were those with high levels of family involvement who were enrolled early in intervention services. Late-identified children whose families were described as limited or average in involvement scored >2 standard deviations below their hearing peers at 5 years of age. Even in the best of circumstances (eg, early enrollment paired with high levels of family involvement), the children in this study scored within the low average range in abstract verbal reasoning compared with hearing peers, reflecting qualitative language differences in these groups of children.One of these programs proven to be successful in hearing children with respect to the promotion and development of executive functions (Diamond, Barnett, Thomas, & Munro, 2007). Studies on working memory training (Conway, Jarrold, Kane,Miyake,& Towse, 2007) have to be examined from the perspective of their significance for Deaf children and for cochlear implanted children in particular, where this competence is critical, especially for their success with spoken language. Essentially, the basic concept behind these programs is to strengthen the competencies that are attributed to the executive functions (impulse control, emotional understanding, acquisition of problem-solving strategies(Hauser, Lukomski, Hillman, 2007). It is essential that concepts for educational sup-port programs take executive functions into account early enough because data from other studies show that the correlations between executive functions and social–emotional development in deaf children shown here appear very early on in life (Piskoraetal.,2010).Greater care must be taken at the schools for the deaf in particular, but also at the general schools, to ensure that the development of deaf children is discussed in the wider context of developmental psychology so that besides the supposed “main job” of meeting special language needs, we also enable these students to acquire competencies that contribute to improved self-efficacy and self-control. Given the totally inclusive schooling of children with special education needs that many countries are striving to introduce, the results of the deaf student in this study corroborate (Hintermair, Krieger, Mayr, 2011)the fact that the challenges we face in Germany and elsewhere are huge, but must be met if we are to do justice to the development needs of D/HH students(Marschark & Hauser, 2012). Consistent with the findings of Yoshinaga-Itano et al,(1998) significantly better language scores were associated with early enrollment in intervention. High levels of family involvement correlated with positive language outcomes, and, conversely, limited family involvement was associated with significant child language delays at 5 years of age, especially when enrollment in intervention was late. The results suggest that success is achieved when early identification is paired with early interventions that actively involve families

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