Executive Function and Behavioral Problems in Students with Visual Impairments at Mainstream and Special Schools

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Structured abstract: *Introduction:* In this study, executive function of school-aged children with visual impairments (that is, those who are blind or have low vision) is examined in the context of behavioral problems and communicative competence. *Methods:* Teachers assessed the executive function of a sample of 226 visually impaired students from mainstream schools and schools for students who are visually impaired, using a German version of the Behavior Rating Inventory of Executive Function (BRIEF-D) and a questionnaire measuring communicative competence and behavioral problems (German version of the Strengths and Difficulties Questionnaire; SDQ-D). *Results:* The results showed highly significant differences in all domains of executive function: the visually impaired students consistently scored more poorly compared to a normative sample of sighted children, even when visually impaired students with additional disabilities were not taken into account. A regression analysis revealed the significance of executive function for behavioral problems among students with visual impairments. *Discussion:* The findings demonstrate that a wide range of executive function domains that are significant for socioemotional development are not sufficiently developed in many visually impaired students. This lack of development seems to be particularly true for students who attend special schools. *Implications for practitioners:* In educational concepts for visually impaired students, a specific and early focus on competencies such as attention shifting and emotional understanding seems to be necessary, especially in the context of inclusion. Moreover, reinforcing communicative competence might also enhance the development of executive function and help to reduce behavioral problems.

The often atypical development of children with visual impairments (that is, those who are blind or have low vision) poses challenges for the children themselves, for their families, and for the vision professionals who work with them. Particularly in the early years, when vision plays a crucial role in the developmental process, a profound lack of vision encompasses various risks, notably in the domains of motor development and preverbal communication, as well as concept

formation (see, for example, Brambring, 2005; Warren, 1994). Verbal communication can also be affected by visual impairment. Even when good and potentially superior structural language skills such as the use of grammar and vocabulary are present in visually impaired students, lower pragmatic language skills (that is, using language appropriate to context) are found in visually impaired school-age children as compared to their sighted peers (Tadić, Pring & Dale, 2010). The difficulties related to visual impairment in the different developmental domains may further reinforce one another, especially when additional disabilities are present.

Visually impaired children who do not have additional disabilities usually catch up on developmental delays as soon as enough possibilities to compensate for the loss of vision (for instance, language) are available (Brambring, 2005). Green, Pring, and Swettenham (2004) have found, for example, that higher verbal ability promotes the development of theory of mind (that is, the ability to infer others' mental states such as intentions, desires, and beliefs) in visually impaired children.

However, behavioral problems defined as emotional or interpersonal maladjustment as measured, for example, by the Strength and Difficulties Questionnaire (German version: Rothenberger & Woerner, 2004), appear to occur more frequently in children with visual impairments than in sighted children. In a study by Pinquart and Pfeiffer (2012) the presence of emotional problems, peer problems, and total difficulties were significantly higher in visually impaired adolescents than among sighted adolescents. Moreover, behavioral problems might be more pronounced among students at special schools for visually impaired students, where a high incidence
of internalizing problems was reported (Kammerer, Köster, Monninger, & Scheffler, 2003) than among visually impaired students at mainstream schools (Maes & Grietens, 2004). *Mainstream schools* are schools in which children with special needs are educated alongside their typically developing peers, whereas *special schools* are only attended by children with special needs such as children with visual impairments.

Against the background of developmental conditions aggravated by visual impairments and the possibly ensuing behavioral problems that appear to be more frequent at special schools, the present study examined the role of executive function for behavioral problems among visually impaired children at mainstream and special schools as well as the relationships between executive function, communicative competence, and behavioral problems.

Executive function comprises regulatory and control mechanisms that are essential for performing goal-oriented and situation-related actions (Lezak, Howieson, & Loring, 2004; Miyake et al., 2000). They are described as higher-order mental processes that are particularly important for multistep action planning and goal monitoring. They are especially relevant when people are faced with new and unexpected situations that require new patterns of action.

Most experts in the field of neuropsychology suggest that executive function domains are independent processes that can malfunction selectively (Klenberg,

Korkman, & Lahti-Nuuttila, 2001). Executive function comprises the ability to initiate problem-solving processes, to inhibit the effect of distracting stimuli or actions, to select relevant goals for actions, to organize complex problem-solving processes, to flexibly adjust problem-solving strategies, and to constantly monitor one's own course of action and evaluate its success. Last, but not least, working memory that keeps information available for further problem-solving processes is a central component of executive function.

In addition to some older work considering executive function rather indirectly (for a summary, see Warren, 1994), there are a few recent studies that have investigated specific domains of executive function such as attentional control or domains that are closely linked to executive function such as self-regulatory learning among visually impaired individuals. According to these studies, preschool-aged children with congenital visual impairments showed a reduced capacity to regulate their attention as compared to sighted children (Tadić, Pring, & Dale, 2009), and visually impaired students used rather global self-regulatory learning strategies that do not adapt to the specific demands of distinct school subjects (for example, language and mathematics; Argyropoulos, Sideridis, Botsas, & Padeliadu, 2012). These findings suggest that executive function might be less well developed among visually impaired individuals.

Aims of the study

The study presented here aims to verify the significance of executive function for the development of visually impaired children using a sample of school-aged German students. Although many studies have accentuated the specific challenges in the socioemotional development of visually impaired children and adolescents, and although it is well known that executive function is associated with adaptive socioemotional functioning (Barkley, 1997), no empirical study has explicitly linked executive function with behavioral problems in visually impaired students. The link might be found to be strong, since compensating for vision-related developmental disadvantages presumably makes high demands on executive function. For example, visually impaired children often struggle with the acquisition of a theory of mind (Green et al., 2004), and thus might be particularly reliant on executive function that predicts theory of mind development (Perner & Lang, 1999).

The study will first investigate whether there are differences in executive function between visually impaired students and a normative sample of sighted children, and whether visually impaired students at mainstream schools differ in their executive function from visually impaired students at specialized schools. Based on previous research, we hypothesize that visually impaired students from both educational settings have more problems in developing age-appropriate regulation and control functions to plan their actions than students with typical vision. Moreover, since Hintermair (2013) has found that deaf and hard-of-hearing students at mainstream schools had better scores on most scales of executive function than students at special schools for that population, we aim to explore whether visually impaired students at mainstream schools

Table 1
Descriptions of the students with visual impairments ($N = 226$).

Variables	Characteristics	Mainstream schools ($n = 90$) *n* (%)	Special schools ($n = 136$) *n* (%)	χ^2
Gender	Male	43 (47.8)	78 (57.3)	1.99
	Female	47 (52.2)	58 (42.7)	
Age (Median = 11.11, $M = 12.0$, $SD = 3.5$)	5 to 6 years	3 (3.3)	3 (2.2)	14.89**
	7 to 8 years	20 (22.2)	26 (19.1)	
	9 to 13 years	52 (57.8)	52 (38.3)	
	14 to 18 years	15 (16.7)	55 (40.4)	
Immigration background	Yes	21 (23.3)	52 (38.3)	5.68*
	No	69 (76.7)	83 (61.0)	
	Missing data		1 (.7)	
Degree of visual impairment	Low vision (visual acuity from 20/60 to 20/400)	55 (61.1)	80 (58.8)	4.28
	Profound visual impairment (visual acuity from 20/400 to 20/1000)	14 (15.6)	37 (27.2)	
	Blindness (visual acuity < 20/1000)	16 (17.8)	17 (12.5)	
	Missing data	5 (5.5)	2 (1.5)	
Additional disability	Yes	68 (75.6)	41 (30.1)	43.13***
	No	21 (23.3)	90 (66.2)	
	Missing data	1 (1.1)	5 (3.7)	
Parental education	Elementary or middle school	20 (22.2)	32 (23.5)	1.95
	Junior high school	25 (27.8)	33 (24.3)	
	High school	26 (32.2)	24 (17.6)	
	Missing data	19 (21.1)	47 (34.6)	

Numbers in parentheses indicate column percentages.
* $p < .05$; ** $p < .01$; *** $p < .001$.

also have better executive function than such students at special schools.

Second, we will explore whether there are any relationships between executive function, communicative competencies, and behavioral problems. Since we hypothesize executive function to be less well developed in visually impaired students at special as well as at mainstream schools, it is expected that this lack of development is associated with a higher rate of behavioral problems. Moreover, we hypothesize that due to the fundamental role of language in the development of visually impaired individuals, children with higher communicative competencies will perform better in executive function and show fewer behavioral problems than children with lower communicative competencies, independent of the type of school they attend.

Method

Sample

Table 1 shows the sociodemographic characteristics of the visually impaired students included in this study by type of school. All information is based on teachers' reports and evaluations.

Gender distribution did not differ by type of school. The mean age of the children was 12.0 years (SD = 3.5). At special schools, there were significantly more participants in the highest age group. Participants were mainly German citizens, although nearly one-third of them had immigrant backgrounds—that is, the children themselves or at least one of their parents had immigrated to Germany. An immigration background was significantly more frequent at special schools. The degree of visual impairment was reported based on the classification from the German Social Act defining low vision, profound visual impairment, and blindness (see Table 1 for the corresponding visual acuity ranges). Children with low vision were the most prevalent in our sample and accounted for 60% of the students. Degree of visual impairment did not differ by type of school. Additional disabilities were present in nearly half of the children (more than half of the group had slight to severe intellectual disabilities; not shown in Table 1). There were more children with additional disabilities at special schools. Parental education was more or less uniformly distributed.

Measures

Behavior Rating Inventory of Executive Function

The Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) was used to assess the executive function of visually impaired students. The teachers' questionnaire version used in this study comprises 73 items targeting children and adolescents aged 5 to 18 years (for example, "has explosive, angry outbursts"; "does not check work for mistakes"). These 73 items are distributed over eight theoretically and empirically based clinical subscales, with higher scores indicating more problems with executive function. The subscale values can be summarized in two higher-order scales. One is the Behavioral Regulation Index (BRI) (cumulative value of the inhibition, shift, and emotional control subscales). The second is the Metacognition Index (MI) (cumulative value of the initiate, working memory, plan or organize, organization of materials, and monitor subscales). In addition, a Global Executive Composite (GEC) can be derived from the results of all eight subscales. The reliability of the data from the U.S. normative sample of 720 children (see Gioia et al., 2000) was very satisfactory (for example, Cronbach's alpha was between .90 and .96 for the total of all eight subscales, .97 for the BRI, .98 for the MI, and .98 for the GEC). We ran a reliability check with the data from our study separately for each type of school, which yielded slightly lower scores but was nevertheless very satisfactory (Cronbach's alpha was between .84 and .95 for all eight subscales, .94 for the BRI, .97 for the MI, and .97 for the GEC).

Strengths and Difficulties Questionnaire (SDQ-D)

Behavioral problems of visually impaired children were measured with the teachers' version of the SDQ-D. The questionnaire assesses strengths and difficulties as perceived by the teachers (emotional problems, conduct problems, hyperactivity, peer problems, total difficulties score, and prosocial behavior; Rothenberger & Woerner, 2004). It contains 25 statements pertaining to the child (for instance, "constantly fidgeting or squirming"; and

"considerate of other people's feelings") that teachers have to rate as not true (0), somewhat true (1) or certainly true (2). Thus, the score for any of the subscales (5 items each) ranges from 0 to 10, and the total difficulties score (20 items) ranges from 0 to 40. A study that employed the SDQ-D among visually impaired students yielded mainly satisfactory reliability scores (Cronbach's alpha was between .68 and .86; Pinquart & Pfeiffer, 2012). A reliability check with the data from the present study, run separately for visually impaired students at special schools and at mainstream schools, was also very satisfactory (Cronbach's alpha was between .69 and .87 for the subscales, and .81 and .84, respectively, for the total difficulties score).

Communicative competence scale

To measure communicative competence, we used a scale that has proven to be reliable in previous studies, especially in deaf and hard-of-hearing children (Hintermair, 2013), but also in children with intellectual disabilities (Janz, Ege, Heitner, & Hintermair, 2012). The scale comprises four items that are answered based on a 5-point Likert-type format (for example, "The child is able to understand the things I/people want to tell or explain to him/her"). The reliability of the scale based on the data from the present study was very satisfactory (Cronbach's alpha was .87 for visually impaired students at special schools and .86 for visually impaired students at mainstream schools).

Additional data

In addition, potentially moderating variables were assessed (see also Table 1). These included sociodemographic variables (gender, age, immigration background, type of school, parental education) and variables related to impairment (degree of visual impairment, additional disabilities).

Procedure

The study was conducted with teachers of visually impaired students from special schools and from mainstream schools in several German states. Participation in the study was voluntary, and informed consent was obtained. One hundred and ninety-five questionnaires were distributed at special schools, and 136 of them were sent back with all items completed (rate of return: 69.7%). Teachers of visually impaired students at mainstream schools received the questionnaire in digital form. Ninety questionnaires were fully completed. Due to the digital distribution of the questionnaire, the rate of return cannot be specified here, but might have been lower than at the special schools. At mainstream schools, the questionnaire was completed by teachers of visually impaired students (73%), mainstream education teachers (20%), or both (7%). The ratings of the teachers were based on the teachers' observations of students in their mainstream classroom settings.

All statistical analyses (chi-square tests, analyses of variance, correlation analyses, and multiple regression analyses) were performed with IBM SPSS statistics version 20.0.

Results

Comparison of executive function in sighted and visually impaired students

To investigate possible differences in executive competencies of sighted students and visually impaired students, univariate analyses of variance (ANOVAs) were conducted separately for each BRIEF

Table 2
Comparison of BRIEF scores between students with typical vision, students with visual impairments (VI) at mainstream schools, and students with VI at special schools.

Scale	(1) Students with typical vision from normative sample (N = 720)		(2) Students with VI at mainstream schools (n = 90)		(3) Students with VI at special schools (n = 136)				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	*ES*	Significant difference
Inhibit	12.5	4.0	14.1	5.0	16.9	5.8	58.86***	.75	1 < 2 < 3
Shift	11.9	3.0	15.5	4.1	17.7	5.0	184.26***	1.42	1 < 2 < 3
Emotional control	10.7	3.1	12.2	4.5	14.7	5.7	68.09***	.81	1 < 2 < 3
Initiate	9.4	3.0	11.9	3.6	13.3	3.8	99.87***	1.05	1 < 2 < 3
Working memory	12.9	3.9	16.2	5.5	18.2	5.6	97.81***	1.03	1 < 2 < 3
Plan/organize	13.1	3.9	15.9	4.5	17.7	4.9	81.71***	.94	1 < 2 < 3
Organization of materials	8.5	2.6	10.4	3.5	11.7	4.5	72.16***	.88	1 < 2 < 3
Monitor	13.4	3.7	16.4	4.9	18.9	5.4	113.41***	1.10	1 < 2 < 3
BRI	35.0	9.0	41.8	11.2	49.3	14.1	122.78***	1.12	1 < 2 < 3
MI	57.4	15.4	70.8	19.0	79.8	20.5	118.67***	1.13	1 < 2 < 3
GEC (BRI + MI)	92.5	22.6	112.6	26.1	129.1	31.5	142.55***	1.23	1 < 2 < 3

BRI = Behavioral Regulation Index; MI = Metacognition Index; GEC = Global Executive Composite; ES = Effect size (Cohen's *d*).
*** $p < .001$.

scale with the data from the American normative sample (Gioia et al., 2000). The alpha level was adjusted by a Bonferroni correction. The normative sample comprised a representative group of sighted children from one state in the United States.

The results show that both groups of visually impaired students differed significantly from the sighted group of children in all domains of executive function (see Table 2).

There were also significant differences between visually impaired students at mainstream schools and those at special schools, as well in all domains. The three cumulative scores show that both groups of visually impaired students have far more problems in developing executive function than do sighted students from the normative sample and, again, that visually impaired students at special schools have even more problems than those at mainstream schools. The effect sizes of the differences between the three groups (Cohen's *d*) were high for all domains. Moreover, after Bonferroni correction, all single comparisons indicated in Table 2 remained significant, at least at $\alpha < .05$.

Because nearly half of the sample consisted of children with additional disabilities, we reran the analyses without students with additional disabilities (resulting in samples of $n = 68$ visually impaired students at mainstream schools and $n = 41$ at special schools). Again, both groups of visually impaired students differed significantly from the group of sighted children in all executive function domains. However, the differences between both groups of visually impaired students were no longer significant. Thus,

Table 3
Correlations (Pearson) between BRIEF, SDQ, and communicative competence scores ($N = 226$).

Scales	Total difficulties score	Emotional symptoms	Conduct problems	Hyper-activity or inattention	Peer relationship problems	Prosocial behavior	Communicative competence
Inhibit	.65***	.16*	.63***	.63***	.30***	−.26***	−.22***
Shift	.52***	.59***	.22***	.20**	.42***	−.19**	−.35***
Emotional control	.66***	.45***	.63***	.35***	.41***	−.28***	−.19**
Initiate	.51***	.35***	.18**	.33***	.46***	−.30***	−.40***
Working memory	.59***	.22***	.30***	.64***	.33***	−.18**	−.36***
Plan or organize	.55***	.28***	.35***	.55***	.25***	−.12T	−.18***
Organization of materials	.41***	.11	.28***	.44***	.21***	−.12T	−.14*
Monitor	.67***	.29***	.52***	.54***	.45***	−.37***	−.30***
BRI	.72***	.47***	.59***	.47***	.43***	−.29***	−.29***
MI	.60***	.25**	.36***	.56***	.36***	−.24***	−.31***
GEC (BRI + MI)	.72***	.40***	.49***	.58***	.44***	−.27***	−.32***
Communicative competence	−.36***	−.18***	−.11T	−.29***	−.35***	.43***	

BRI = Behavioral Regulation Index; MI = Metacognition Index; GEC = Global Executive Composite.
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$; T $p \leq .10$.

executive function differences between visually impaired students at special and mainstream schools might be due to differences between student populations.

Relationships between executive function, behavioral problems, and communicative competence

Table 3 shows the correlations between executive function assessed by the BRIEF scales, behavioral problems assessed by the SDQ-D scales, and the communicative competence scale.

With the exception of some scores, significant correlations were observed consistently in the direction expected: increased problems with executive function were connected to a higher probability of behavioral problems as well as to a lower level of communicative competence. Communicative competence also correlated with most of the socioemotional development scales: the more communicatively competent the visually impaired children are, the less likely is the occurrence of behavioral problems.

Finally, a multiple linear regression analysis of behavioral problems (SDQ-D total difficulties score) was conducted with independent variables included simultaneously (see Table 4). Sociodemographic and visual impairment–specific characteristics were used as independent variables to control for their impact on behavioral problems. The communicative competence score as well as both of the BRIEF scores were included as potentially relevant psychological variables for explaining behavioral problems of visually impaired students.

The results indicate that 62% of the variance in the total difficulties score could be explained by the variables included in the analysis. Apart from gender and age, the children's executive function and communicative competencies were contributing factors. The BRIEF Behavioral Regulation Index had a particularly

Table 4
Multiple regression analysis with total difficulties score (SDQ) as criterion ($N = 226$).

Predictor variables	SDQ total difficulties score	
	β	t score (df 199)
		F (df 9,199) = 38.96
(Constant)		.17
Gender	−.18	4.11***
Age	−.19	−4.00***
Immigration background	.02	.50
Degree of visual impairment	.004	−.09
Additional disability	.03	.51
Type of school	−.02	−.40
Communicative competence	−.09	−1.85^{T}
BRIEF Behavioral Regulation Index	.63	10.30***
BRIEF Metacognition Index	.21	3.55***
		R = .80; R^2 = .64; adj. R^2 = .62

***$p < .001$; ^{T} $p < .10$.

strong effect. Overall, visually impaired students with better communicative competencies and better executive function exhibit fewer behavioral problems. The older the students are, the fewer behavioral problems occur, and boys show more problems than girls.

Discussion

This study examined executive function among visually impaired students in Germany and compared it to those of sighted students. It also investigated the correlations between executive function, communicative competence, and behavioral problems. The results are based on teacher reports for a sample of 226 visually impaired students who attended either special schools or mainstream schools.

As was expected from previous research (Tadić et al., 2009; Argyropoulos et al., 2012), a comparison of the executive function of visually impaired students with the data from the U.S. normative sample of sighted students revealed highly significant differences in all domains of executive function, with the visually impaired students performing more poorly. Similar results—albeit with a different number of domains affected—have been found in studies on deaf and hard-of-hearing children (Hintermair, 2013; Pisoni, Conway, Kronenberger, Henning, & Anaya, 2010) as well as with students with intellectual disabilities (Janz et al., 2012). Significantly, there were also considerable within-group differences: visually impaired students at mainstream schools showed better executive function than those at special schools. Since the within-group differences disappeared when students with additional disabilities were removed from the analysis, one reason for this finding might be that visually impaired students with additional disabilities are overrepresented at special schools as compared to those in mainstream schools. Indeed, our data revealed that the two groups differed in some relevant characteristics—for instance, the group of mainstreamed visually impaired

students comprised significantly fewer children with additional disabilities or an immigration background. These findings are in line with results from a study by Kim and Corn (1998), which showed that various students' characteristics—for example, a higher intellectual level or good orientation and mobility skills—increased the likelihood that visually impaired students would be placed in mainstream schools.

The results of the study presented here also show significant correlations between almost all domains of behavioral problems and the executive function domains assessed, between communicative competence and executive function, as well as between communicative competence and behavioral problems. The visually impaired students with lower executive function had more behavioral problems and showed fewer communicative competencies.

Multiple regression analysis was used to investigate the role of executive function and communicative competence for the development of behavioral problems while controlling for sociodemographic and visual impairment–specific characteristics. Results show that 62% of the variance in behavioral problems could be explained by the variables included in the model and that, in addition to age, gender, metacognitive abilities, and a tendency for communicative competence, the executive function domain of behavior regulation is particularly significant. Regarding gender and age, our findings are in line with prior research that found that boys are more prone to behavioral problems than are girls (Lahey, Miller, Gordon, & Riley, 1999) and that symptoms of behavioral problems such as hyperactive behavior frequently decline with age (Hart, Lahey, Loeber, Applegate, & Frick, 1995). Moreover, our findings on the significance of executive function and communicative competence for behavioral problems are in accord with the results of some other German studies on the relationship of executive function, communicative competence, and socioemotional behavior (Hintermair, 2013; Janz et al., 2012). They also fit with findings from studies from other countries on children with different disabilities. For example, Raaijmakers and colleagues (2008) used neuropsychological tests to investigate pronounced aggressive behaviors in students and found significant deficits in inhibition and adjustment processes as well as in working memory.

Limitations

With regard to method and data sources, it has to be considered that the information on executive function did not come directly from the children themselves, but from questioning the teachers of these children. Thus, further studies should also include children's self-report data from the BRIEF-SR questionnaire, as was already done in a study on adolescents with language impairments (Hughes, Turkstra, & Wulfeck, 2009).

Teachers reported the degree of visual impairment of their students according to the German Social Act classification that provides rather broad categories covering large visual acuity ranges, particularly regarding low vision. Unfortunately, more information on visual functioning was not available for the students. Future research on executive function needs to allow for further refinement regarding the degree of visual impairment.

Since the open-ended reports on additional disabilities provided by the teachers varied considerably in specificity (some reported, for example "intellectual disability" without further details; some reported further details—for instance, on severity; some reported "developmental delay" without further details; and some reported diagnoses that are likely to be associated with intellectual disability but did not mention mental retardation), the true number of children with a specific type of additional disability could not be determined. Thus, we were only able to distinguish between those with and without additional disabilities. Future research should put more emphasis on type of additional disability and its associations with executive function.

We compared data on German visually impaired students with data on a normative sample from the United States, since at the time of data collection there were no German normative data available. There are differences in both educational systems and there may also be cultural differences in the development of German and American children. Thus, the comparative findings of the present study have to be regarded as preliminary.

Finally, it cannot be ruled out that some behaviors exhibited by visually impaired children might be because of their lack of vision and are not necessarily indicators of executive or behavioral problems. Therefore, items such as "Cannot find things in room or school desk" (BRIEF) and "Nervous in new situations, easily loses confidence" (SDQ-D) might have led to an overestimation of executive and behavioral problems, respectively. However, even if these behaviors should not be interpreted as indicative of executive or behavioral problems among visually impaired students, the results of the present study have shown an increased occurrence of these behaviors, and thus a specific need for support among visually impaired students.

Educational conclusions

According to the results of the present study, knowledge about executive function is important for the education of visually impaired students, and such awareness seems to be particularly true for those attending special schools, whose executive function is especially vulnerable. Knowledge about executive function is also very important in order to be prepared for inclusion. Our findings indicate some challenges with regard to specific behavior regulation issues and metacognition problems among visually impaired students that require increased attention to ensure social and academic success, especially in the context of inclusion. According to our own findings as well as to recent research supporting a link between toddler-age communication and later development of executive skills (Aro, Laakso, Määttä, Tolvanen, & Poikkeus, 2014), strengthening communicative competence might enhance the development of executive function and help to reduce behavioral problems.

Even though intervention studies on the effectiveness of programs promoting executive function among visually impaired students are lacking, there is a great deal of practical expert knowledge on how to support the development of visually impaired children from early childhood (Ferrell, 2011). Moreover, there are well-evaluated early intervention programs that focus on executive function

among students with typical vision that might be adapted to the needs of visually impaired children (Bodrova & Leong, 2007; Diamond, Barnett, Thomas, & Munro, 2007). Essentially, the basic concept of these programs is to strengthen the competencies that are attributed to executive function (attentional shift, emotional understanding, and acquisition of problem-solving strategies). It is crucial that educational support programs take executive function into account as early as possible, since findings from different studies have shown that the major developmental challenges for visually impaired children emerge in the first years of life (Brambring, 2005).

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