Title: Longitudinal Achievement and Predictors of Academic Outcomes in Elementary School for Students with Down Syndrome

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Introduction: Executive function (EF) has been found to better predict academic outcomes than IQ in typically developing students (Best et al., 2011). Initial evidence presented by our team found that students with Down syndrome (DS) performed significantly better than typically developing (TD), mental age (MA)-matched peers on letter-word identification, but did not significantly differ from the TD group on quantitative concepts or applied problem solving (Will et al., 2016). Working memory/inhibition was the only significant concurrent predictor of academic achievement for students with DS in this study. While preliminary work from our team has reported cross-sectional findings, there is a paucity of longitudinal research examining early predictors of later academic achievement in young students with DS. This study longitudinally examined academic achievement and its predictors from early elementary school in students with DS and a MA-matched TD comparison group.

Method: During early elementary (Time 1), and again at mid-elementary school two years later (Time 2), students with DS (n = 19, M MA = 46.16, SD= 7.72) and students with TD (n=18, M MA= 45.94, SD = 3.32) participated in testing including: The Leiter International Performance Scale-Revised Brief IQ composite (Leiter-R; Roid & Miller, 1997); Woodcock Johnson-III NU Tests of Academic Achievement (domains of Letter-Word Identification, Applied Problems, and Quantitative Concepts; WJ-III ACH/NU; Woodcock, McGrew, & Mather, 2001, 2007); and EF performance-based tasks assessing aspects of working memory, inhibition, cognitive flexibility, and planning (see Will et al, 2016). Pearson correlations were examined between EF lab tasks and Time 2 academic achievement for students with DS. The magnitude of the effect size for the association of all four EF tasks at Time 1 and achievement better than IQ suggests that EF skills may be an important target for intervention during or before the time that young students with DS in Letter-Word Identification. Furthermore, findings regarding early EF skills predicting academic achievement for students with DS and the three domains of academic achievement at Time 2 were moderate to large. As such, the EF lab tasks were transformed into a composite EF score for use in analyses.

Results: A repeated measures multivariate analysis examining differences between the two groups performance on three domains of academic achievement (WJ-III ACH/NU domains) from Time 1 to Time 2 indicated significant multivariate main effects for group (Λ=.22, F = 39.67 (3, 33), p≤ .001, η=.78, time ((Λ=.12, F = 80.81 (3, 33), p≤ .001, η=.88), as well as for the interaction between group and time ((Λ=.45, F = 13.45 (3, 33), p≤ .001, η=.55). Follow-up analyses of variance (ANOVA) indicated that change from Time 1 to Time 2 significantly differed between groups for both Applied Problems and Quantitative Concepts (F (1, 35) = 14.85, p=.001, η=.47 respectively) with the DS group demonstrating significant impairments for both domains at Time 2. However, the DS group did not significantly differ from the TD group from Time 1 to Time 2 on Letter-Word Identification (F (1, 35) = 3.45, p=.07, η=.09). Finally, the linear combination of early EF and IQ significantly predicted 54% of the variance in Letter-Word Identification, 52% in Quantitative Concepts, and 47% in Applied Problems at Time 2 using adjusted R²s with the EF composite being the only significant predictor for all three regressions.

Discussion: Findings indicated the students with DS performed similarly to their MA-, but not CA- matched, TD peers on achieving Letter-Word Identification skills from Time 1 to Time 2. This adds to our team’s previous cross-sectional findings (Will et al., 2016). The current finding may indicate that young students with DS are performing similarly to their MA-matched TD peers in this domain. However, data from additional time points is needed to better understand academic growth rates for young students with DS in Letter-Word Identification. Furthermore, findings regarding early EF skills predicting academic achievement better than IQ suggests that EF skills may be an important target for intervention during or before the time that young children with DS enter elementary school.

References/Citations: