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ADHD Performance on Nonverbal Measures of Set Shifting and Working Memory

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by

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Abstract

The relationship between language and cognition is an area of inquiry among many psychologists (Pellicano, 2010; Russel, 1996). The connection between thoughts, verbal language, and nonverbal communication turned researchers towards the relationship between language and executive functioning. Executive functioning (EF) is described as tasks involving working memory, inhibition, and set shifting (Miyake and Friedman (2012)). Despite studies demonstrating the correlation between language deficits and lower executive functioning there is not consensus on the directionality of the relationship (Kuhn, et al 2014; Boting et al., 2017).

Data from the Leiter International Performance Scale, Third Edition (Leiter-3) (Roid, et al., 2013) were used to compare participants with Attention Deficit Hyperactivity Disorder (ADHD) and participants who are Deaf/Hard of Hearing, with the normative sample using hierarchical regression. Scores on four subtests (Figure Ground, Form Completion, Attention Divided, and the Stroop Test) focus on inhibition, set shifting, or both working memory and set shifting. ADHD and Hard of Hearing/Deaf groups have additional barriers on cognitive tasks due to lowered executive functioning or language ability, when compared to peers in the normative

group. The nonverbal nature of the Leiter-3 removes the language barrier and highlights differences in EF abilities between groups independent of hearing and spoken language. Participants in the ADHD group should score lower on EF tasks than participants in the normative groups and lower than the deaf/hard of hearing group due to benefits from the mitigation of language requirements on the tasks required for these scales. Language is linked with working memory (Baddeley & Hitch, 1994) and therefore set shifting and language are also linked via executive functioning (Hooper et al., 2002).

Preliminary analysis of variance between groups indicated significant differences between means for Figure Ground and Form Completion but not for Attention Divided or the Stroop Test. Hierarchical regression clarified several demographic factors which influenced the variance between groups. Age had significant impact, whereas primary diagnosis contributed no more than 5.1% to the overall variance. The small differences among diagnoses speaks to the validity of the Leiter-3; it provides results largely altered by impairment in hearing or executive functioning.

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Chapter 1

Introduction

The relationship between language and thoughts is a long-debated subject spanning the past several decades. In 1962, Lev Vygotsky (as cited in Hanfmann & Vakar, 1962, p. 208). wrote:

> On the contrary, the basic methodological defect of nearly all studies of thinking and speech – that which underlies the fruitlessness of this work – is the tendency to view thought and word as two independent and isolated elements whose external unification leads to the characteristic features of verbal thinking. (p. 208).

Embracing unity of thought and word, studies then began to shift to look at the relationship between gestures and language and then language and broader cognitive tasks.

Baddeley and Hitch (1994) explained the three-component model of working memory. For them, working memory included four components: Central Executive, Visual-Spatial Sketchpad, Phonological Loop, and later the Episodic Buffer (Baddeley, 2000). They also proposed the role of executive functioning in the development of language in typically developing children but made no comment about atypical development.

Executive functioning is a top-down mental process allowing for the planning and control of other cognitive processes (Miller & Cohen 2001). Miyake and Friedman (2012) supported a hypothesis from Teuber (1972) which proposed the unity and diversity of executive function (EF) pieces. *Updating* is the continuous replacement of information in immediate awareness,

inhibition is the ability to control impulses, and *set shifting* is the unconscious change in attention between tasks. Miyake and Friedman (2012) focused on updating, inhibition, and set shifting; they discovered within these key components of common EF there was no significant variance updating and set shifting shared with inhibition. While inhibition is an important piece of EF, it loaded under common EF, demonstrating unity; but clear distinctions for set shifting and updating indicate diversity as well. Set shifting and cognitive flexibility are often used synonymously but the task of mentally moving from one set of stimuli to another will be referred to as set shifting.

Working memory is defined by Cowan (2017) as "the ensemble of components of the mind that hold a limited amount of information temporarily in a heightened state of availability for use in ongoing information processing" (p.1163). Adams, Nguyen, and Cowan (2018) identify this as a strong definition because it is broad, inclusive, and does not attempt to identify its potential structure, while still identifying its important role in the cognitive processes.

The negative impact of Attention Deficit Hyperactivity Disorder on executive functioning is a well-documented aspect of this neurodevelopmental disorder (Pineda et al., 1998), and often affects the individuals' performance on tests of attention and other executive functioning tasks (American Psychiatric Association [APA], 2013). An experiment by Gernsbacher (1993) proposed that readers who are less skilled have difficulty correctly rejecting incorrect words due to ineffective "suppression mechanisms."

Pellicano (2010) proposed that verbal ability among individuals with autism was an important factor to theory of mind. However, Pelicano concluded that verbal ability did not appear to contribute to development of planning ability, despite some research proposing the exact opposite (Russel, 1996). Joseph et al. (2005) and Whitehouse et al. (2006) continued

exploration of the relationship between language and executive functioning; they reported lower ability on executive control in autism is potentially due to lower language ability. But it remains unclear if lower executive ability is the result of lower language ability.

Findings from a study by Kuhn et al. (2014) demonstrated that the positive link between a child's use of gestures and later executive functioning capacity was mediated by the child's language development. This mediation was determined with the finding that 2-year-old language and EF predicted 3-year-old language skills independently, but EF of older ages were not predictable by 2-year-old EF. This means that while both language and EF of two-year-olds are predictive of the three-year-old's language, EF of later years is mediated by the language of the intermediate year (see Figure 1).

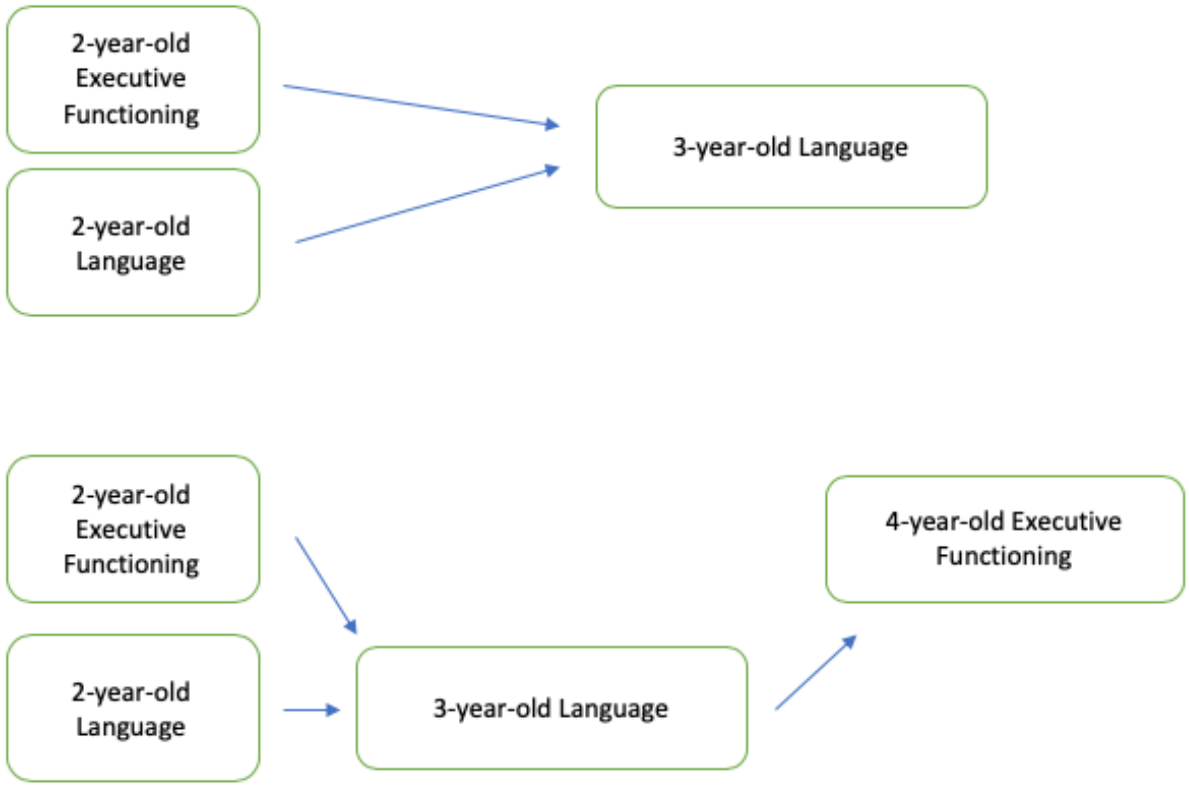
Booth et al. (2014) studied children with reading difficulties and compared their test scores on the Wechsler Individual Achievement Test second edition (WIAT-II) and Wechsler Abbreviated Scale of Intelligence (WASI) to age equivalent peers and reading level peers. Booth et al. discovered significantly lower scores on the inhibition composites. Their study demonstrated the predictive power of inhibition on reading ability in children, regardless of working memory scores or language ability. Booth et al. suggested this finding of inhibition as a factor in reading indicates that persons with ADHD are likely to have lower levels of reading ability than normal children who have otherwise equal cognitive ability.

Due to the complicated nature of this relationship between language and executive functioning, it is still unclear if language or executive functioning mediates the other, but Botting et al.'s research (2017) pointed again to language as the primary influencer of the two. Botting et al. compared the ability of deaf participants to their hearing peers on tasks of nonverbal

executive functioning and found deaf individuals demonstrated lower ability on these tasks. This also indicates language plays an important role in executive functioning ability.

Figure 1

Mediation of Language on Executive Functioning



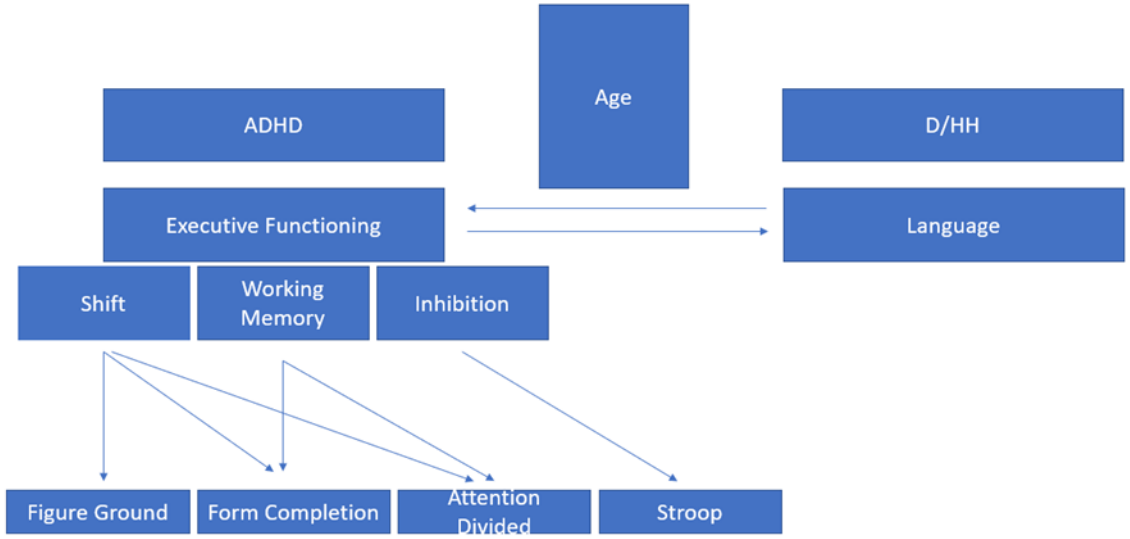
In summary, the interwoven natures of language and executive functioning provide several questions not yet answered. It is still unknown if either language or executive functioning is the predominant mediator of the other and if one is more important for development than the other. Comparing test results from deaf/hard of hearing children with children with ADHD may provide more insight into the working relationship between language and executive functioning.

The nonverbal nature of the Leiter-3 allows for deaf or hard of hearing participants to demonstrate executive functioning capabilities without the constraints of verbal language. It is hypothesized that participants with ADHD will score lower than those with hearing impairment

and the normative group on the Form Completion, Figure Ground, Attention Divided, and the Stroop Test on the Leiter-3 (see Figure 2).

Figure 2

Proposed Relationship of Language and aspects of Executive Functioning Measured Through Leiter-R Subtests



Chapter 2

Methods

Participants

Participants were selected from the standardization sample data from the Leiter-3 which utilized a stratified random sample to fit the 2009 U.S. Census (Roid et al., 2013). Leiter data includes 12 Special or Exceptional groups including 26 participants from the Deaf or Hard of Hearing group and 29 participants from the ADHD group, along with 1,340 from the Normative/ Typical Cases group. The Leiter-3uses thirteen age categories from 3 to 75+ and gender groups. Race/Ethnicity categories include White/Non-Hispanic, African American, Hispanic, Asian American, Native American, and Other/Mixed. For this study, participants from the ADHD, Hard of Hearing/Deaf, and Normative groups were selected in order to compare children with impairments with language or executive functioning to the normative sample. To establish a matching normative sample group, members of the Hard of Hearing/Deaf and ADHD groups were categorized based on the percent of participants in each category of demographics. This included age, gender, ethnicity, education level, and the years of education for each parent. Once arranged in a table, a random sample of examinees from the standardization sample were drawn from corresponding demographic categories selected to match as closely as possible to the percentages for both ADHD and Deaf Hard of Hearing groups.

Materials

Leiter-3 International Performance Scale

The Leiter-3 is an individually administered, nonverbal battery consisting of 10 subtests. It is used to measure General Intellectual Ability (IQ), Nonverbal Memory, and Processing Speed. The Cognitive Battery (four subtests plus alternative subtests) takes 30-40 minutes, and the Attention Memory portion requires 20-30 minutes. The Leiter-3 also provides an Examiner Rating Scale allowing the examiner to record additional details about performance and functioning. The Leiter-3internal consistency (Alpha) estimates for Figure Ground and Form Completion ranged from .74 to .93 at different age intervals (Roid & Koch, 2017). Attention and Memory subtests ranged from .61 to .81 and Stroop Effect Alpha ranged from .71 to .90 across age groups. The Examiner Rating Scale also shows a relatively high reliability with an Internal Consistency ranging from .89 to .97 for the Cognitive/Social Composite, and .85 to .96 for Emotional/Feelings Feeling Composite. For validity, the Leiter-R FSIQ correlated .86 with WISC-III FSIQ, the Leiter-3 FSIQ correlated between .77 to .92 with Woodcock-Johnson-III, and the Leiter-3 Nonverbal IQ correlated .77 with Stanford Binet -5 (Roid et al., 2013).

Subtests. This study utilized four subtests from the Leiter-3 which assess either set shifting, working memory, or both. Figure Ground (FG) requires the examinee to identify a target object presented on a background with increasing amounts of visual interference; it requires set shifting. Attention Divided (AD) requires the examinee to sort cards with different stimuli and associated tasks; it requires both set shifting and working memory. ADRaw[1] consists of six subscales: AD1cor, AD2cor, AD3cor, AD1in, AD2in, and AD3in. ADSS consists of two

[1]Raw indicates raw scores, SS means standard scores, “cor” indicates correct responses on the Attention Divided subtest and “inc” indicates incorrect responses.

subscales: ADcorSS and ADinSS. Form Completion (FC) requires the examinee to construct a whole picture from a set of pieces. Form Completion requires both set shifting and working memory. The Stroop Test requires the participant to ignore certain stimuli which conflict with the target stimuli, such as choosing the correct target word "red" while ignoring the green font it is written in. This subtest assesses the participant's ability to use appropriate inhibition (Roid & Koch, 2017).

Table 1

Executive Functioning Challenges Associated with Lieter-3 Subtests

	Executive Functioning Task			
		Shift	Working Memory	Inhibition
Subtest	Figure Ground	X		
	Attention Divided	X	X	
	Form Completion	X	X	
	Stroop			X

Procedure

Participants from the Deaf/Hard of Hearing and ADHD groups were compared with the Normative group for performance on Attention Divided, Figure Ground, Form Completion, and Stroop subtests. These Leiter-3 subtests require set shifting, working memory, and set shifting, or inhibition and represent executive functioning ability. Initial results were obtained using an analysis of variance to determine if the group means of performance on subtests (DV) are equal across groups with ADHD, Deaf or Hard of Hearing, and Normative groups (IV). Next,

hierarchical regression was used to first account for demographic differences, then differences between groups, with scores on the subtests as the dependent variable.

Chapter 3

Results

Following matching on demographic variables and selection of the sample, the raw data from the Attention Divided Subtest were examined for six subscales, including AD1cor, AD1in, AD2Cor, AD2in, AD3cor, and AD3in for analyses. Data were also examined for Figure Ground, Form Completion, and the Stroop Test.

The subtests are noted to have varied N for two main reasons. First, the Leiter-3 can be broken down to two separate sets: one for cognition, and the other for memory and the Stroop test, and each set can be administered without the other. Additionally, an effort was made to match demographic data, most significantly age, which also contributes to different N values for each subtest.

Initial Analysis of Variance was performed to assess for significant differences between the Normative sample, the ADHD sample, and the Deaf/Hard of Hearing sample. The ANOVA showed mixed results. Significant differences were discovered in the FGraw ($F_{2,433} = 13.17$, $p < .001$) and FCraw ($F_{2,434} = 15.50$, $p < .001$) subtests. No significant differences were found among the six means for the Attention Divided subtest. The Stroop subtest also did not show significant differences. The effect sizes for the ANOVAs were calculated using Cohen's *d*, and ranged from medium effects to no effect. See Table 2.

Table 2

Descriptive Statistics and Analyses of Variance for Sample and Subgroups on Leiter-3 Measures

	Sample	N	Minimu	Maximu	*M*	*SD*	*F*	df	Sig.
1FGra	Normative	340	11	33	21.55	5.32			
	ADHD	66	8	31	18.89	5.49			
	D/HH	30	4	31	17.53	5.08			
	Total	436	4	33	20.87	5.48	13.17	2,433	<.001
2AD1c	Normative	26	3	22	14.19	4.16			
	ADHD	3	16	16	16.00	0.00			
	D/HH	2	12	16	14.00	2.83			
	Total	31	3	22	14.35	3.87	0.289	2,28	.750
AD2co	Normative	137	3	44	29.67	8.55			
	ADHD	28	17	32	29.57	4.48			
	D/HH	16	24	44	30.00	5.16			
	Total	181	3	44	29.69	7.78	0.02	2,178	.980
AD3co	Normative	144	33	66	45.07	9.82			
	ADHD	23	19	56	45.09	8.60			
	D/HH	8	39	66	48.63	7.62			
	Total	175	3	66	45.23	9.57	0.52	2,172	.590
AD1in	Normative	26	0	6		1.70			
	ADHD	3	0	0		0.00			
	D/HH	2	0	4		2.83			
	Total	31	0	6		1.68	0.89	2,28	.430
AD2in	Normative	137		18	1.60	3.06			
	ADHD	28	0	7	0.96	1.75			
	D/HH	16	0	8	2.00	2.61			
	Total	181	0	18	1.54	2.86	0.80	2,178	.450

Table Continues

Table 2 (*Continued*)

Descriptive Statistics and Analyses of Variance for Sample and Subgroups on Leiter-3 Measures

Descri	Sample	N	Minimu	Maximu	M	SD	F	df	Sig.
AD3in	Normative	145	0	48	1.70	4.85			
	ADHD	23	0	10	.91	2.21			
	D/HH	8	0	5	1.38	1.59			
	Total	176	0	48	1.59	4.49	0.32	2,173	0.73
3FCRa	Normative	340	13	36	27.44	5.15			
	ADHD	67	3	34	23.94	7.83			
	D/HH	30	2	33	23.30	7.33			
	Total	437	2	36	26.62	5.99	15.50	2,434	<.001
4Stroo	Normative	289	-7	28	4.94	4.85			
	ADHD	53	-10	12	3.68	3.91			
	D/HH	22	-6	12	4.45	4.78			
	Total	364	-10	28	4.73	4.73	1.63	2,361	0.200

Group Comparisons by Analysis of Variance

Figure Ground raw scores showed medium effects for Norm/ADHD (0.50) and Norm/DHH (0.78), and small effects for ADHD/DHH (0.26). Figure Ground scaled scores also showed medium effects for Norm/ADHD (0.65) and Norm/DHH (0.65), but no effect for ADHD/DHH (0.02). Form Completion raw scores showed medium effect for Norm/ADHD (0.53) and Norm/DHH (0.65), and no effect for ADHD/DHH (0.09). Form Completion scaled scores again show medium effect for Norm/ADHD (0.62) and Norm/DHH (0.54), and no effect for ADHD/DHH (0.11). See Table 3.

Table 3

Effect Sizes for Differences Between Means for Normal, ADHD and DHH Groups: Cohen's d/r²

	Norm/ADHD	Norm/DHH	ADHD/DHH	Sig
FGRaw	.50/.213	.78/.440	.26/.065	<.001
FGSS	.65/.327	.65/.327	.02/.004	<.001
FCRaw	.53/.236	.65/.327	.09/.008	<.001
FCSS	.62/.305	.54/.244	.11/.012	<.001

Group Comparisons by Hierarchical Regressions

After the analysis of variance was used to examine the differences between diagnostic groups, hierarchical regression was used to control for several demographic factors. These factors included gender and ethnicity, age in days, education level, mother years of school, and father years of school. After controlling for these, differences among groups due to primary diagnosis were examined (see Table 4). Analyses were performed for both raw scores and scaled scores; scaled scores were expected to show increased precision and hence smaller effects.

Gender and Ethnicity. In these regressions, gender and ethnicity generally showed no significant effects, with two exceptions. For FGSS gender and ethnicity were significant predictors that accounted for 1.3% of the variance; ethnicity was significant (t_{417} = 2.348, p = .019), Together they also accounted for about 17% of the variance for AD1cor and ethnicity was significantly related to AD1cor scores (t_{27} = -2.138, p = .042).

Age in Days. Age in days showed several significant relationships to group differences. Age in days accounted for 36.7% of the variance for FGRaw and was significantly related to scores on this subtest (t_{432} = 15.425, p = <.001). For the AD2cor and AD3cor subtests, age in days contributed 7.1% and 2.4% to the overall variance and again was significantly related to subtest scores (t_{177} = 3.615, p = <.001; t_{171} = 2.036, p = .043). Scaled scores for ADcor

Table 4

Effect of Prime Diagnosis on Leiter-3 Scores with Demographic Differences Controlled

Scale	Step	*R*	*R2*	*ΔR2*	*df*	*F*	*Sig*	*Beta*	*t*	*Sig*
FGraw	1 Gender/	.068	.005	.005	2, 417	.976	.378	.032	.662	.508
	Ethnicity							.059	1.213	.226
	2 AgeDays	.606	.367	.362	3, 416	80.33	<.001	.604	15.425	<.001
	3 EdLev	.621	.385	.018	4, 415	65.013	<.001	.137	3.527	<.001
	4 MoYrSch	.627	.393	.008	5, 414	53.549	<.001	-.146	3.527	.024
	5 FaYrSch	.629	.396	.003	6, 413	45.172	<.001	.118	1.545	.123
	6 PrimeDX	.647	.419	.023	7, 412	42.449	<.001	-.156	-4.020	<.001
FG SS	1 Gender/	.116	.013	.013	2, 417	2.847	.059	-.024	-.488	.626
	Ethnicity							.114	2.348	.019
	2 AgeDays	.131	.017	.004	3, 416	2.404	.067	.060	1.229	.220
	3 EdLev	.208	.043	.026	4, 415	4.697	.001	.164	3.376	.001
	4 MoYrSch	.237	.056	.013	5, 414	4.924	<.001	-.191	-2.371	.018
	5 FaYrSCh	.246	.061	.005	6, 413	4.444	<.001	.134	1.408	.160
	6 PrimeDX	.318	.101	.040	7, 412	6.610	<.001	-.208	-4.99	<.001
AD1cor	1 Gender/	.413	.170	.170	2, 27	2.772	.080	.158	.903	.375
	Ethnicity							-.375	-2.138	.042
	2 AgeDays	.461	.213	.043	3, 26	2.342	.096	-.208	-1.183	.247
	3 EdLev	.646	.418	.205	4, 25	4.480	.007	-.511	-2.965	.007
	4 MoYrSch	.662	.439	.021	5, 24	3.753	.012	.287	.954	.350
	5 FaYrSch	.688	.474	.035	6, 23	3.449	.014	.477	1.232	.230
	6 PrimeDX	.705	.498	.034	7, 22	3.112	.019	-.181	-1.025	.317
AD2cor	1 Gender/	.028	.001	.00	2, 171	.067	.935	.023	.302	.763
	Ethnicity							-.018	-.229	.819
	2 AgeDays	.269	.072	.071	3, 170	4.404	.005	.267	3.615	<.001
	3 EdLev	.273	.074	.002	4, 169	3.397	.011	.049	.649	.517
	4 MoYrSch	.281	.079	.005	5, 168	2.890	.016	.125	.934	.351
	5 FaYrSch	.315	.099	.020	6, 167	3.072	.007	-.321	-1.935	.055
	6 PrimeDX	.315	.100	.001	7, 166	2.621	.014	.011	.143	.887

Table Continues

Table 4 (*Continued***)**

Hierarchical Regressions Controlling for Demographic Factors

Scale	Step	*R*	*R2*	*ΔR2*	*df*	*F*	*Sig*	*Beta*	*t*	*Sig*
AD3cor	1 Gender/	.040	.002	.00	2, 164	.129	.879	.011	.139	.890
	Ethnicity							.038	.485	.629
	2 AgeDays	.162	.026	.024	3, 163	1.470	.225	.157	2.036	.043
	3 EdLev	.207	.043	.017	4, 162	1.814	.129	.129	1.673	.096
	4 MoYrSch	.209	.043	.000	5, 161	1.464	.205	.040	.319	.750
	5 FaYrSch	.209	.044	.001	6, 160	1.223	.297	-.035	-.243	.808
	6 PrimeDX	.210	.044	.000	7, 159	1.050	.398	.020	.246	.806
ADcor SS	1 Gender/	.037	.001	.001	2, 361	.248	.781	.034	.651	.516
	Ethnicity							.012	.237	.813
	2 AgeDays	.128	.016	.015	3, 360	2.007	.113	.123	2.349	.019
	3 EdLev	.130	.017	.001	4, 359	1.540	.190	.021	.391	.969
	4 MoYrSch	.178	.031	.014	5, 358	2.290	.045	.202	2.284	.023
	5 FaYrSCh	.215	.046	.015	6, 357	2.897	.009	-.248	-2.404	.017
	6 PrimeDX	.225	.051	.005	7, 356	2.707	.010	.067	1.242	.215
AD1in	1 Gender/	.254	.064	.000	2, 27	.930	.407	-.238	-1.279	.212
	Ethnicity							-.098	.523	.605
	2 AgeDays	.254	.064	.000	3, 26	.597	.622	.007	.039	.969
	3 EdLev	.375	.141	.077	4, 25	1.022	.415	.312	1.488	.149
	4 MoYrSch	.506	.256	.115	5, 24	1.653	.185	-.669	-1.931	.065
	5 FaYrSch	.517	.267	.011	6, 23	1.396	.258	-.267	-.583	.565
	6 PrimeDX	.517	.268	.001	7, 22	1.149	.370	.034	.160	.874
AD2in	1 Gender	.120	.014	.00	2, 171	1.257	.287	-.099	-1.296	.197
	/Ethn							-.062	-.820	.413
	2 AgeDays	.210	.044	.030	3, 170	2.603	.054	-.172	-2.288	.023
	3 EdLev	.210	.044	.000	4, 169	1.941	.106	-.001	-.012	.991
	4 MoYrSch	.258	.067	.023	5, 168	2.405	.039	-.273	-2.029	.044
	5 FaYrSch	.261	.068	.001	6, 167	2.041	.063	.089	.525	.600
	6 PrimeDX	.274	.075	.007	7, 166	1.921	.069	-.087	-1.088	.278

Table 4 (*Continued***)**

Hierarchical Regressions Controlling for Demographic Factors

Scale	Step	*R*	*R2*	*ΔR2*	*df*	*F*	*Sig*	*Beta*	*t*	*Sig*
AD3in	1 Gender/	.059	.003	.00	2, 165	.286	.752	-.053	-.688	.493
	Ethn							-.023	-.295	.769
	2 AgeDays	.060	.004	.001	3, 164	.195	.900	.010	.133	.895
	3 EdLev	.084	.007	.003	4, 163	.288	.885	.059	.754	.452
	4 MoYrSch	.102	.010	.003	5, 162	.342	.887	-.095	-.747	.456
	5 FaYrSch	.123	.015	.005	6, 161	.411	.871	.127	.871	.385
	6 PrimeDX	.133	.018	.003	7, 160	.409	.896	-.051	-.638	.524
ADin SS	1 Gender/	.082	.007	.007	2, 360	1.227	.294	.069	1.309	.191
	Ethnicity							.042	.795	.427
	2 AgeDays	.105	.011	.004	3, 359	1.334	.263	.066	1.243	.215
	3 EdLev	.117	.014	.003	4, 358	1.251	.289	-.053	-1.001	.318
	4 MoYrSch	.173	.030	.016	5, 357	2.212	.053	.217	2.447	.015
	5 FaYrSch	.203	.041	.011	6, 356	2.552	.020	-.211	-2.037	.042
	6 PrimeDX	.208	.043	.002	7, 357	2.283	.028	.045	.826	.409
FC Raw	1 Gender/	.093	.009	.009	2, 418	1.817	.164	.030	.623	.534
	Ethnicity							-.089	-1.822	.069
	2 AgeDays	.572	.327	.318	3, 417	67.601	<.001	.567	14.052	<.001
	3 EdLev	.594	.357	.030	4, 416	56.798	<.001	.163	4.091	<.001
	4 MoYrSch	.595	.354	.001	5, 415	45.499	<.001	.049	.741	.459
	5 FaYrSch	.596	.356	.002	6, 414	38.089	<.001	.080	1.012	.312
	6 PrimeDX	.626	.392	.036	7, 413	38.033	<.001	-.197	-4.965	<.001
FCSS	1 Gender/	.053	.003	.003	2, 418	.595	.552	-.033	-.670	.503
	Ethnicity							-.041	-.836	.403
	2 AgeDays	.054	.003	.000	3, 417	.403	<.001	.007	.114	.885
	3 EdLev	.211	.045	.042	4, 416	4.862	<.001	.207	4.265	<.001
	4 MoYrSch	.214	.046	.001	5, 415	3.984	<.001	.057	.704	.482
	5 FaYrSch	.218	.047	.001	6, 414	3.430	<.001	.079	.823	.411
	6 PrimeDX	.310	.096	.051	7, 413	6.272	<.001	-.228	-4.718	<.001

Table 4 (*Continued***)**

Hierarchical Regressions Controlling for Demographic Factors

Scale	Step	*R*	*R2*	*ΔR2*	*df*	*F*	*Sig*	*Beta*	*t*	*Sig*
Stroop Raw	1 Gender/	.093	.009	.009	2, 346	1.530	.218	.040	.753	.452
	Ethnicity							-.086	-1.616	.107
	2 AgeDays	.335	.112	.103	3, 345	14.632	<.001	.323	6.363	<.001
	3 EdLev	.341	.116	.004	4, 344	11.346	<.001	.061	1.196	.232
	4 MoYrSch	.355	.126	.010	6, 343	9.949	<.001	.172	1.993	.047
	5 FaYrSch	.364	.133	.007	7, 342	8.776	<.001	-.165	-1.635	.103
	6 PrimeDX	.376	.142	.011	8, 341	8.086	<.001	-.099	-1.885	.060
Stroop SS	1 Gender/	.088	.008	.008	2, 346	1.350	.261	-.073	-1.362	.174
	Ethnicity							-.045	-.847	.398
	2 AgeDays	.091	.008	.000	3, 345	0.969	.407	-.025	-.462	.645
	3 EdLev	.110	.012	.012	4, 344	1.047	.383	.061	1.131	.259
	4 MoYrSch	.135	.018	.006	5, 343	1.277	.273	.137	1.478	.140
	5 FaYrSch	.169	.029	.023	6, 342	1.684	.124	-.205	-1.915	.056
	6 PrimeDX	.181	.033	.004	7, 341	1.650	.120	-.067	-1.199	.231

demonstrated age in days contributing 1.5% and it was again significantly related to scaled scores (scores (t_{360} = 2.349, p = .019). For the AD2in subtest, age contributed 3% to the overall variance (t_{177} = -22.288, p = .023). Next, for the FCRaw subtest, age in days contributed 31.8% to the overall variance and was significantly related to the FCRaw scores (t_{433} = 14.052, p = <.001). Finally, for StroopRaw scores Age in Days contributed 10.3% of the variance (t_{345} = 6.363, p < .001), but Age in Days was not related to StroopSS.

Education Level. Education level demonstrated several more significant relationships with groups. In the Figure Ground subtest, education level contributed 1.8% of the overall variance for raw scores and 2.6% for scaled scores and showed significant relationship between

education level and FGRaw scores (t_{432} = 3.527, p = <.001) and FGSS scores (t_{432} = 3.376, p = .001). On AD1cor, education level contributed 20.5% to the overall variance and showed significant relationship between education level and AD1cor scores (t_{27} = -2.965, p = .007). Similar to Figure Ground, Form Completion showed raw and scaled scores were significantly predicted by education level and both demonstrated significant relationships between education and scores. FCRaw contributed 3.0% to the overall variance (t_{433} = 4.091, p = <.001) and FCSS contributed 4.2% (t_{433} = 4.265, p = <.001).

Mother's Years of Schooling. Mother's years of schooling showed several significant relationships with group differences as well. In the Figure Ground subtest, mother's years of schooling contributed 0.8% of the overall variance for raw scores and 1.3% for scaled scores and showed significant relationship between mother's years of school and FGRaw scores (t_{432} = 3.527, p = .024) and FGSS scores (t_{432} = -2.371, p = .018). ADCorSS also showed a significant effect for Mother's Years of Schooling; it accounted for 1.2% of the variance (t_{xx} = 2.284, p = .023*)*. AD2in indicated mother's years of schooling also contributed 2.3% to the overall variance and demonstrated a significant relationship with the subtest scores on AD2in (t_{177} = -2.029, p = .044). Similarly, ADin Scaled Scores showed mother's years of school added 1.6% to the overall variance and these scores demonstrate a significant relationship (t_{359} = 2.447, p = .015). Finally, Mother's years of school also contributed 1.0% for the overall variance for StroopRaw (t_{360} = 1.993, p = .047).

Father's Years of Schooling. Father's years of schooling showed a couple more significant relationships with scaled scores. ADcor SS demonstrated father's years of schooling contributed 1.5% to the overall variance (t_{360} = -2.404, p = .017), and Adin SS showed similar

results with father's years of school contributing 1.1% and demonstrated another significant relationship between ADcor scaled scores and father's years of school (t_{360} = -2.037, p = .042).

Prime Diagnosis. Finally, with these demographic variables controlled, prime diagnosis showed some remaining significant relationships to Leiter-3 scores. For FGRaw, prime diagnosis accounted for 2.3% of the variance (t_{433} = -4.020; p < .001); similar results were found for FGSS which accounted for 4.0% of the variance (t_{433} = -4.990; p < .001). A similar pattern was found for FCRaw, prime diagnosis accounted for 3.6% of the variance (t_{432} = -4.965; p < .001); and FCSS which accounted for 5.1% of the variance (t_{432} = -4.718; p < .001). No other significant differences between diagnostic groups were found in the final level of the regressions.

Result Summary

In summary, preliminary analyses of variance found significant differences between groups throughout the subtests (See Table 5). Gender and ethnicity were found to contribute significantly for FGSS and AD1cor. Age in days accounted for significant difference for multiple subtests, including FGRaw, AD2cor, AD3cor, ADSS, AD2in, FCRaw, and StroopRaw. Education level showed significance in FGRaw, FGSS, AD1cor, FCRaw and FCSS. Mother's years of school then found significant differences in FGRaw, FFSS, ADcorSS, AD2in, ADinSS, StroopRaw, while father's years of school found significance only for ADcorSS and ADinSS. Finally, primary diagnosis found FGRaw, FGSS, FCRaw and FCSS all showed significant differences.

In summary, preliminary analyses of variance found significant differences between groups throughout the subtests (See Table 5). Figure Ground scaled scores demonstrate significant difference between groups for gender and ethnicity, educational level, mother's years of school, and primary diagnosis. Attention Divided scaled scores showed significant different

Table 5

Percent of Variance Accounted for by Demographic Variables and Prime Dx

Scale	Function	Gender/Ethnicity	Age/Days	Edlevel	MyrsEd	FyrsEd	PrimeDx
FGRaw	Shift		36.7%	1.8%	0.8%		2.3%
FGSS		1.3%		2.6%	1.3%		4.0%
AD1cor	Shift/WM	17.0%		20.5%			
AD2cor			7.1%				
AD3cor			2.4%				
ADcorSS			1.5%		1.4%	1.5%	
AD1in							
AD2in			3.0%		2.3%		
AD3in							
ADinSS					1.6%	1.1%	
FCRaw	Shift/WM		31.8%	3.0%			3.6%
FCSS				4.2%			5.1%
StroopRaw	Inhibition		10.3		1.0%		
StroopSS							

for age in days (ADcorSS), and both mother's and father's years of school (ADcorSS and ADinSS). Form Completion scaled scores, again, demonstrated significant difference for education level and primary diagnosis. Stroop scaled scores did not demonstrate any meaningful differences between group means.

Chapter 4

Discussion

Preliminary Analysis of Variance for differences between groups indicated significant differences between means for both Figure Ground and Form Completion but not for Attention Divided or the Stroop Test. Through hierarchical regression it became clear several demographic factors slightly influenced the variance between groups. Controlling for these demographic differences removed significant differences between groups due to diagnosis for all but four instances. Each of these was trivially small, accounting for no more than 5.1% of the variance.

The lower scores on these subtests found by the preliminary analysis of variance for the ADHD population compared to the normative population was an expected outcome given the impact of ADHD on tasks of executive functioning in general and more specifically set shifts, inhibition and working memory (APA, 2013). Scores on both significant subtests displayed medium effect sizes between Normal and ADHD samples [FCSS d = .65; FGraw d = .50] identifying ADHD as potentially an important factor in the differences in scores. Similar results were found when comparing normal and D/HH samples [FGSS d=.65; FCSS d=.54]. A significant difference with a small effect size was observed between ADHD and D/HH samples on FGRaw as well.

Preliminary analysis appeared to indicate significant differences between the normative and ADHD and Deaf/Hard of Hearing samples, as predicted. However, effect sizes between ADHD and Deaf Hard of Hearing groups before controlling for demographic factors

demonstrated smaller differences than were hypothesized and may suggest spoken language contributes less to executive functioning ability than hypothesized. Due to distraction, participants with ADHD are presumably less able to use verbal skills to mediate their performance, giving the advantage to D/HH participants whose verbal ability is typically a barrier to performance (Booth et al., 2014)). Because the Leiter-3 does not require language, it was predicted that D/HH participants would not be handicapped, while ADHD participants would be impaired and would thus score lower (Botting et al., 2017). Finding little significant difference between ADHD and Dear/Hard of Hearing participants was thus unexpected (Kuhn et al., 2014). This result leads to the question regarding the moderating role of all language—including sign language—rather than strictly vocal communication. It is possible D/HH participants may have performed better because they are able to use a nonvocal form of language, perhaps even motor activities, or perhaps they utilized some form of symbolic internal dialogue for this task. But differences between D/HH and AD/HD participants were only found for this one task and were small.

In the stepwise regressions gender and ethnicity, age, education level, mother and father years of school, and primary diagnosis are addressed. Among these variables, the percentage of the variance they accounted for varied, but gender and ethnicity only significantly affected a couple scores. It had a significant medium-sized effect on the AD1cor subscale of the Attention Divided subtest and a trivial effect on FGSS.

Age in days has a relatively large predictive value for Figure Ground raw scores which was completely removed with scaled scores. Age in days demonstrated some predictive value for several Attention Divided subtests, including AD2cor, AD3cor, AD2in, along with ADcorSS.

Other significant contributions were added in Form Completion raw scores and Stroop raw scores, but both were nullified for the scaled scores.

Education level demonstrated some predictive value for Figure Ground raw scores, which then increased with the addition of scaled scores. Education was also seen to have large predictive value for one of the Attention Divided subscales (AD1cor) and again was not seen in the other subscales. Form Completion demonstrates a similar relationship with education indicating some predictive value for raw scores which were increased with scaled scores.

For mother's years of schooling, several subtests showed some predictive value for Figure Ground raw and scaled scores, both Attention Divided scaled scores along with AD2in, and finally for Stroop raw scores.

Father's years of school was only significant for the attention Divided scaled scores and did not add any predictive value to the other subtests.

Finally, Primary diagnosis was demonstrated to have predictive value for Figure Ground raw which increased with scaled scores. The same pattern is again seen for Form Completion with raw scores shown as significant and then increased with standard scores.

These results highlight the differences between scaled scores and raw scores, with significant variability throughout all of the subtests. While some subtests demonstrated significant effects for one demographic variable, the predominant trend shows scaled scores generally reduce the amount of variance due to demographic factors noted in the raw scores. The age demographic highlights these dissimilarities consistently throughout the subtests and point to the importance of matching samples along with utilizing scaled scores. Although an attempt was made to match the samples, particularly in terms of age, it was understood the ADHD sample was much younger than the Deaf/Hard of Hearing sample. This is likely due to both the etiology

and age of onset for ADHD and hearing difficulties; their onsets are concentrated on opposite tails of the age curve.

Despite the hypothesis that participants in the ADHD group will score lower than those in the Deaf/Hard of Hearing group and the normative group on the Form Completion, Figure Ground, Attention Divided, and the Stroop Test on the Leiter-3, when demographic factors were controlled, the diagnosis group had no significant effect on performance for half of subtests (Stroop, and AD). For the FCSS and FGSS subtests, primary diagnosis was significant but accounted for only a trivial amount of the variance between groups. These results are not consistent with prior findings that language ability influenced executive functioning, resulting in poorer performance for deaf individuals (Botting et al., 2017). Perhaps age of onset for deafness or inclusion of hard of hearing individuals affected these results.

It is also important to note since the literature indicates a connection between executive functioning and language. Thus differences were expected between ADHD and D/HH groups (Joseph et al., 2005; Whitehouse et al., 2006). However, the absence of significant differences among diagnoses may indicate several things. First, it seems to speak to the validity of the Leiter-3 for these populations as it appears to give a largely unbiased result, despite deficits in executive functioning for ADHD participants, and deficits in hearing and potentially language ability for D/HH participants. For the D/HH sample, this may add to the theory that internal facets of language are more important for tasks of executive functioning than vocal or spoken language ability.

Finally, present results may give more evidence towards the diversity theory of Executive Functioning over the unity theory, due to the apparent inconsistency of outcomes in the subtests which represent the three primary pieces of executive functioning (Teuber, 1972). Since the shift

ability is required for Figure Ground, Attention Divided, and Form Completion, more similar results were anticipated for these subtests when compared to the Stroop test which mainly requires inhibition. However, these results also support the observation from Miyake and Friedman (2012) who suggests inhibition does not add significantly to the variance, unlike shifting. Further study should seek tasks that can assess the effects of shifting and working memory independently as the overlap in these executive functioning components in Leiter-3Leiter-3 subtests precludes independently gauging their effects on the results.

In summary, preliminary analyses of variance found that Figure Ground and Form Completion subtests showed significant differences between means of the diagnosis groups and indicated medium to small effect sizes. However, after using a hierarchical regression to control for demographic differences little significant impact was shown for primary diagnosis on any Leiter-3 subscale examined. These findings lend support to the diversity theory of executive functioning and cast doubt on the importance of inhibition at least in Leiter-3 performance. Finally, on the whole they indicate that the Leiter if bias free for AD/HD and D/HH groups.

References

Adams, E. J., Nguyen, A. T., & Cowan, N. (2018). Theories of working memory: Differences in definition, degree of modularity, role of attention, and purpose. *Language, Speech, and Hearing Services in Schools*, *49*(3), 340–355. https://doi-org.georgefox.idm.oclc.org/10.1044/2018_LSHSS-17-0114

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Baddeley, A. (2000). The episodic buffer: A new component of working memory? *Trends Cogn. Sci. (Regul. Ed.)*. *4*(11): 417–423. doi:10.1016/S1364-6613(00)01538-2. PMID 11058819.

Baddeley, A. D., & Hitch, G. J. (1994). Developments in the concept of working memory. *Neuropsychology*, *8*(4), 485–493. https://doi-org.georgefox.idm.oclc.org/ 10.1037/0894-4105.8.4.485

Booth, J. N., Boyle, J. M. E., & Kelly, S. W. (2014). The relationship between inhibition and working memory in predicting children's reading difficulties. *Journal of Research in Reading, 37*(1), 84–101. https://doi-org.georgefox.idm.oclc.org/10.1111/1467-9817.12011

Botting, N., Jones, A., Marshall, C., Denmark, T., Atkinson, J., & Morgan, G. (2017). Nonverbal executive function is mediated by language: A study of deaf and hearing children. *Child Development, 88*(5), 1689–1700. https://doi-org.georgefox.idm.oclc.org/10.1111/cdev.12659

Cowan N. (2017). The many faces of working memory and short-term storage. *Psychonomic Bulletin & Review, 24*(4), 1158–1170

Gernsbacher, M. A. (1993). Less skilled readers have less efficient suppression mechanisms. *Psychological Science, 4*(5), 294–298. https://doi-org.georgefox.idm.oclc.org/10.1111/j.1467-9280.1993.tb00567.x

Hooper, S. R., Swartz, C. W., Wakely, M. B., de Kruif, R. E. L., & Montgomery, J. W. (2002). Executive functions in elementary school children with and without problems in written expression. *Journal of Learning Disabilities*, *35*(1), 57–68. https://doi-org.georgefox.idm.oclc.org/10.1177/002221940203500105

Joseph, R. M., Steele, S. D., Meyer, E., & Tager-Flusberg, H. (2005). Self-ordered pointing in children with autism: Failure to use verbal mediation in the service of working memory. *Neuropsychologia*, *43*, 1400–1411.

Kuhn, L. J., Willoughby, M. T., Wilbourn, M. P., Vernon, F. L., & Blair, C. B. (2014). Early communicative gestures prospectively predict language development and executive function in early childhood. *Child Development, 85*(5), 1898–1914. https://doi-org.georgefox.idm.oclc.org/10.1111/cdev.12249

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience*, *24*, 167–202. https://doi-org.georgefox.idm.oclc.org/10.1146/annurev.neuro.24.1.167

Miyake, A., & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Science, 21*, 8–14. doi:10.1177/0963721411429458

Pellicano, E. (2010). The development of core cognitive skills in autism: A 3-year prospective study. *Child Development, 81*(5), 1400–1416. https://doi-org.georgefox.idm.oclc.org/10.1111/j.1467-8624.2010.01481.x

Pineda, D., Ardila, A., Rosselli, M., Cadavid, C., Mancheno, S., & Mejia, S. (1998). Executive dysfunctions in children with attention deficit hyperactivity disorder. *International Journal of Neuroscience, 96*(3–4), 177–196. https://doi-org.georgefox.idm.oclc.org/10.3109/00207459808986466

Roid, G. H., Miller, L. J., Pomplun, M., & Koch, C. (2013). *Leiter international performance scale-third edition*. Wood Dale, IL: Stoelting.

Roid, G. H. & Koch C. (2017). *Leiter-3: nonverbal cognitive and neuropsychological assessment.* In R. S. McCallum (Ed.), *Handbook of Nonverbal Assessment* (127-150). Springer International.

Russell, J. (1996). *Agency: Its role in mental development*. Hove, UK: Erlbaum.

Talland, G. A. (Ed.). (1965). *Deranged memory*. New York, NY: Academic Press.

Teuber, H. L. (1972). Unity and diversity of frontal lobe functions. *Acta neurobiologiae experimentalis*, *32*(2), 615–656.

Vygotsky, L. S. (1962). Thought and word. In E. Hanfmann & G. Vakar (Eds.), *Thought and language* (pp. 119–153). Cambridge, MA: MIT Press. doi:10.1037/11193-007

Whitehouse, A. J. O., Maybery, M. T., & Durkin, K. (2006). Inner speech impairments in autism. *Journal of Child Psychology and Psychiatry, 47*, 857–865.

Appendix A

Curriculum Vitae

S. HANS STOLTZFUS

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Newberg, OR
97132

EDUCATION

PsyD Graduate School of Clinical Psychology, April 2021
George Fox University
Dissertation: "ADHD and Deaf/Hard of Hearing Performance on Nonverbal Measures of Set Shifting, Working Memory, and Inhibition"
Committee: Rodger Bufford, PhD (chair), Gale Roid, Ph.D., Ken Logan, PsyD

MA Graduate School of Clinical Psychology May 2017
George Fox University

BA Cedarville University, Psychology May 2015
Minored in Biblical Studies

PROFESSIONAL EXPERIENCE

Post-Doctoral Work September 2021-Present

- PsychNW testing services

Doctoral Internship August 2020-July 2021

- University of Rochester Counseling Center

- Brief individual therapy, group therapy, and on-call crisis intervention
- Consultation, outreach, and supervision of practicum students

Pre-Internship June 2019-June 2020

- Location: Willamette Family Medical Center
- Long term therapy, short term behavioral health consultation, warm handoffs
- Low income, underserved population
- Interdisciplinary team

Supplemental Practicum August 2019-June 2020

- Rural Child and Adolescent Psychological Services, Yamhill Carlton School District
- Supervisor for Practicum I students, including theoretical conceptualization, assessment interpretation and report writing

Practicum II August 2018-May 2019

- University Counseling Center at George Fox University
- Short term therapy, long term therapy
- Traditional college undergraduate students
- Psychoeducational Assessment

Practicum I August 2017-June 2018

- Rural Child and Adolescent Psychological Services, Yamhill-Carlton School District
- Individual, group, and milieu therapy
- Comprehensive psychoeducational reports with feedback in IEP meetings, system wide behavioral education

RESEARCH EXPERIENCE

Dissertation, George Fox University, Newberg, Oregon February 2021

Advisor: Rodger Bufford, PsyD

Western Psychological Association April 2021

Presentation of Dissertation

George Fox University, Newberg, Oregon 2017

Assessment Technician, Nancy Thurston PsyD, ABPP/CL

Thurston Craddock Test of Shame, Spromberg Dissertation

TEACHER'S ASSISTANT

Integrative Approaches to Psychology Spring-Fall 2019

- Mark McMinn, PhD
- In class dialogue and discussion with Professor and colleagues
- Group facilitator for discussion of required readings for Pre-Practicum Students

Psychodynamic Psychotherapy Spring 2020

- Nancy Thurston, PsyD, ABPP(CL)
- Led case conceptualization group for Practicum I students

RELATED EDUCATION

Developmental Model for Intercultural Sensitivity October 16, 2019

Dr. Cheryl Forester

Promoting Forgiveness September 25, 2019

Everett Worthington Jr., PhD

Foundations of Relationships Therapy-The Gottman Model March 20, 2019

Douglas Marlow, PhD

Opportunities in Forensic Psychology February 13, 2019

Diomaris Safi, PsyD and Alex Millkey, PsyD

Old Pain in New Brains October 10, 2018

Scott Pengelly, PhD

Spiritual Formation and the Life of a Psychologist: September 26, 2018

Looking Closer at Soul-Care

Lisa Graham McMinn, PhD and Mark McMinn, PhD

Integration and Ekklesia March 14, 2018

Mike Vogel, PsyD

History and Application of Interpersonal Psychotherapy February 14, 2018

Carlos Taloyo

Telehealth November 8, 2017

Jeff Sordal, PsyD

Using Community Based Participatory Research (CBPR) October 11, 2017

to Promote Mental Health in American Indian/Alaska Native

(AI/AN) Children, Youth and Families

Eleanor Gil Kashiwabara, PsyD

Domestic Violence: A Coordinated Community Response March 1, 2017

Patricia Warford, PsyD and Sgt. Todd Baltzell

Native Self Actualization: February 8, 2017

It's assessment and application in therapy

Sydney Brown, PsyD

When Divorce Hits the Family: November 9, 2016

Helping Parents and Children Navigate

Wendy Bourg, PhD

Sacredness, Naming and Healing: Lanterns Along the Way October 12, 2016

Brooke Kuhnhausen, PhD

UNDERGRAD CLINICAL EXPERIENCE

Oesterlen Services for Youth Spring 2015

- Community Counseling Center Undergraduate Intern
- Observed therapy in community counseling clinic, elementary schools, and youth residential facility

- Assisted with greenhouse and woodshop projects with residents, and aided supervisors in afterhours sports groups for community and residential clients
- Organized and prepared client files for transition to electronic platform

Chehalem Youth and Family Services Summer 2013/2014

- Youth Behavior Specialist for Residential Youth
- Medication Management, supported clients with ADLs, facilitated family visits, provided 1:1 support, responded to crises

COMMUNITY VOLUNTEER

Newberg Boys Rugby Team Spring 2018/2019

- Assistant/Graduate Coach
- Participated in drills and practice, supported team during away games

Twin Rocks Friends Camp Summer 2014

- Youth Leader/Camp Counselor
- Led a "cabin" of students through the events of the week, provided 1:1 encouragement and support, assisted the camp with activities and exercises