EQUIPPING MINDS INCREASES VERBAL AND NONVERBAL ABILITIES, IQ, AND ACADEMIC SKILLS

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Research Design Overview

This research design was a true quantitative experimental study of the effects on working memory when applying the Equipping Minds Cognitive Development Curriculum (*EMCDC*) among learners diagnosed with specific learning disorder (SLD).[1] A school who serves learners with a specific learning disorder (SLD) initiated contact with Equipping Minds, which allowed access to the population sample. Thirty-two participants in 4th through 8th grade were randomly allocated into an Active Control and a Training Group.

Administer the Pre-Test

Qualified professionals administered a working memory pre-test, the *Automated Working Memory Assessment* 2nd ed. (*AWMA*-2). The *Kaufman Brief Intelligence Test,* 2nd ed. (*KBIT*-2), a brief intelligence test which yields three scores: verbal, non-verbal, and an IQ composite, was administered. The *TerraNova* is a standardized academic assessment for 2nd-12th grade students in reading, mathematics, language, science, social studies, and spelling. All participants had completed the *TerraNova* in 2015 which was administered by the school.

The Intervention Program

The *Equipping Minds Cognitive Development Curriculum*[2] (*EMCDC*) is based on the theory of Structural Cognitive Modifiability (SCM), Mediated Learning Experience (MLE), and a biblical worldview. *EMCDC* is designed to strengthen existing neural connections and, more importantly, to create missing neural pathways that may inhibit one's ability to learn. *EMCDC* employs a holistic approach to cognitive development training through primitive reflex exercises, sensory-motor development exercises, and cognitive developmental exercises.

The participants in the training group received cognitive developmental training for 60 minutes, 5 days a week for 7 weeks in a small group of two participants with a trained mediator using *EMCDC*. The *Maintaining Brains Everyday* DVD for the primitive reflex exercises[3] and the fear paralysis exercises[4] were done by the participants at home or at school for 15 minutes a day. The sensory-motor development exercises included the use of sound therapy[5]

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[1] Paul D. Leedy and Jeanne Ellis Ormrod, *Practical Research: Planning and Design* (Upper Saddle River, NJ: Pearson, 2013), 234. Experimental designs offer a greater degree of control and, as a result, greater internal validity.

[2] Brown developed *EMCDC*; it includes a teacher workbook, student workbook, and instructional DVDs for use in the regular or special education classroom, church, or home environment by teachers, therapist, and parents.

[3] Kathy Johnson, *Maintaining Brains Every Day*, DVD, http: www.pyramidofpotential.com.

[4] Harald Bloomberg and Moira Dempsey, *Movements That Heal*: Rhythmic Movement (Sunnybank Hills, Australia: Book Pals, 2011), 195.

[5] Sound therapy is therapeutic classical music designed to increase auditory processing.

which the participants wore during the one-hour intervention sessions while doing the cognitive developmental exercises. The mediators follow an abbreviated format of the *EMCDC* full program as the intervention was limited to 30 hours. Brown observed the training groups on a weekly basis to assure fidelity to the *EMCDC* research protocol, answer questions from the mediators, and observe the participants' progression. The participants in the active control group received academic support with a teacher for 60 minutes, 5 days a week for 7 weeks in a small group. All participating learners continued to receive standard special educational support services as a result of their learning difficulties.

Administer the Post-Test

The *KBIT*-2 and *AWMA*-2 were administered by Brown, along with five testers who met the qualifications. The *TerraNova* was administered by the school administration and faculty.

Statistical Analysis

The results of all three tests were compiled on Excel spreadsheets. A statistician then conducted a statistical analysis of the data collected on the *AWMA-2*, the *KBIT*-2, and the *TerraNova* to examine the gains as a function of cognitive developmental training. A series of paired *t*-tests was used to determine the statistical significance between the pre-test and post-test scores in both the active control and training group. A multiple linear regression was conducted on the difference of the pre and post-test scores as a function of their training group, age, and gender.

Conclusions and Implications of the Research

1.   Students with SLD have low working memory scores which impact academic performance.
2.   Working memory training does not seem to have a causative effect in relationship to verbal, nonverbal, and academic abilities when using *EMCDC* for 30 hours of intervention.
3.   In the context of this study, 30 hours of intervention using the *EMCDC* did not impact verbal and visuospatial working memory to the extent seen in the clinical setting when 60 hours of intervention are used.
4.   Thirty hours of intervention with *EMCDC* significantly improves science scores demonstrating far transfer effects in learners with a SLD.
5.   *EMCDC* increases cognitive abilities of verbal, nonverbal, and IQ composite despite insignificant measurable changes in working memory.
6.   Human-mediated learning using a cognitive development curriculum, *EMCDC*, increases cognitive abilities of verbal, nonverbal, and IQ composite scores in learners with a SLD.
7.   Gender is not a significant factor in a student's response to the training provided by *EMCDC* in verbal and visuospatial working memory, verbal and non-verbal abilities, and IQ Composite.
8.   *EMCDC* impacts males more significantly than females in reading and science.
9.   Older students are more likely to exhibit significant improvement in test scores on the Verbal Working Memory test.

Contribution of Research to
the Precedent Literature

Over the last twenty years there has been an increased interest in the relationship between working memory, cognitive skills, and academic abilities. To the author's knowledge, no previous study has demonstrated significant changes in verbal abilities, nonverbal abilities, IQ composite, and academic abilities in 30 hours of intervention; this is despite insignificant measurable changes in working memory. The current research seeks to engage theologians, educators, and psychologist in a discussion on the cognitive modifiability of individuals with neurodevelopmental disorders. This study provides a format which reaches an international, multi-disciplinary audience with a holistic approach to strengthen cognitive abilities, and acknowledges the importance of spiritual, academic, and cognitive formation. These findings contribute to the precedent literature discussion in four areas: naturalistic or biblical worldview of human development, fixed or modifiable intelligence, computer training or human mediator, and working memory or cognitive functions.

The evidence for cognitive modifiability in learners with SLD based on Feuerstein's theories of SCM and MLE should be embraced by Christian educators. We should no longer accept a naturalistic worldview based on biological determinism, which discounts spirituality and which views learners with neurodevelopmental leaning disorders as having a fixed limit to their cognitive abilities. However, we should align with the theistic perspective of Feuerstein which sees all individuals as created as the *imago Dei* and in need of a human mediator. These theories direct and inform our religious and academic curricula, the learners we admit to our institutions, and our views of the cognitive abilities and potential of these learners.

This research demonstrates that cognitive abilities in verbal and nonverbal abilities and IQ composite can be increased and generalized to academics using *EMCDC*. Educational settings which view cognitive development as a goal in itself and view the teacher as a mediator who invites the learner to identify a problem, to analyze it, to use inductive thinking processes to develop a strategy for its solution—and connect it to other knowledge networks—can use *EMCDC* in their classrooms. The implications for the church, Christian school practitioners, Christian higher education practitioners, Christian academicians and professionals, homeschool parents, adoption and foster care parents, and missionaries are substantial since intelligence can be developed when a mediator teaches and trains a learner.

Group profiles and means for pre and post training assessments

Measures	Active Control Group			Training Group			Training Group Results
	Pre-Test M (S.E.)	Post-Test M (S.E.)	Pre-To-Post P	Pre-Test M (S.E.)	Post-Test M (S.E.)	Pre-To-Post p	
Verbal WM	93.88 (8.55)	96.00 (10.30)	.2671	88.31 (11.94)	92.19 (11.50)	.0265	**Significant**
Visuospatial WM	101.31 (15.12)	100.25 (15.73)	.7480	93.69 (15.81)	98.00 (15.99)	.1495	Higher than Control Group
Verbal Short Term Memory	94.31 (11.25)	96.75 (11.43)	.4342	89.31 (11.31)	92.50 (14.76)	.1188	Higher than Control Group
Visuospatial Short Term Memory	104.50 (19.17)	101.25 (17.81)	.3542	103.13 (14.60)	104.25 (13.14)	.7224	Higher than Control Group

Reading	6.156 (2.489)	6.406 (2.641)	.7508	4.131 (0.980)	5.200 (1.904)	.0399	**Significant**
Vocabulary	6.988 (2.496)	7.138 (2.253)	.8411	5.044 (1.663)	5.850 (2.132)	.2336	Higher than Control Group
Language	6.494 (2.760)	7.575 (2.460)	.1148	4.525 (1.055)	5.694 (2.575)	.1055	Higher than Control Group
Mechanics	6.038 (3.096)	5.444 (1.982)	.4624	4.500 (2.260)	5.631 (3.091)	.1549	Higher than Control Group
Math	5.094 (1.912)	5.913 (2.198)	.1256	4.275 (0.904)	4.775 (2.050)	.2521	
Computation	5.581 (1.843)	6.356 (2.716)	.1679	4.556 (1.301)	4.444 (1.352)	.8181	
Science	6.444 (2.179)	6.463 (1.810)	.9745	4.700 (1.726)	6.138 (1.810)	.00105	**Significant**
Social Studies	6.081 (2.196)	6.925 (2.349)	.2268	4.763 (2.852)	5.713 (2.378)	.2345	Higher than Control Group
Spelling	5.175 (2.037)	5.831 (2.178)	.1935	4.038 (1.527)	5.913 (2.459)	.00199	**Significant**
Verbal	101.25 (10.38)	104.19 (13.49)	.00937	94.56 (10.51)	108.00 (15.99)	.000112	**Significant**
Non-Verbal	104.69 (10.62)	104.19 (13.76)	.7620	100.81 (10.17)	116.00 (10.77)	.000237	**Significant**
IQ Composite	103.69 (8.55)	105.06 (12.35)	.5706	97.13 (9.84)	113.94 (14.08)	.00000288	**Significant**

Table 6. Working memory scores for SLD

	Active Control			Training Group			
Measures	M	$t_{(15)}$	Pre-to-Post (p)	M	$t_{(15)}$	Pre-to-Post (p)	
Verbal WM	2.125	1.152	.2671	3.875	2.459	.0265 *	Significant
Visuo-Spatial WM	-1.063	-0.327	.7480	4.313	1.519	.1495	

NOTE: M = Mean of the post- minus pre-test scores; p = p-value for the two-mean t-tests for the difference in pre- and post-test scores; * = significant at the 5% level

Table 7. Regression analysis: effect of training
on working memory scores for SLD

Measures	Training B (S.E.)	p	r^2
Verbal WM	1.750 (2.425)	.4761	.0171
Visuospatial WM	5.375 (4.313)	.2223	.0492

NOTE: B = regression coefficient of the training effect on the difference in post- minus pre-test scores; SE = standard error of the regression coefficient; p = p-value for the significance of the training on the difference in test scores; * = significant at the 5% level

Table 8. Grade equivalent academic scores for SLD

Measures	Active Control			Training Group		
	M	$t_{(15)}$	Pre-to-Post (p)	M	$t_{(15)}$	Pre-to-Post (p)
Reading	0.250	0.324	.7508	1.069	2.249	.0399 *
Vocabulary	0.150	0.204	.8411	0.806	1.241	.2336
Language	1.081	1.674	.1148	1.169	1.722	.1055
Mechanics	-0.594	-0.754	.4624	1.131	1.498	.1549
Math	0.819	1.622	.1256	0.500	1.191	.2521
Computation	0.775	1.449	.1679	-0.113	-0.234	.8181
Science	0.019	0.032	.9745	1.438	4.050	.00105 **
Social Studies	0.844	1.260	.2268	0.950	1.239	.2345

Spelling	0.656	1.361	.1935	1.875	3.735	.00199 **

NOTE: M = Mean of the difference in the grade equivalencies of the pre- and post-test scores; *p* = *p*-value for the two mean t-tests for pre- and post-test scores; * = significant at the 5% level; ** = significant at the 1% level

Table 9. Regression analysis: effect of training
on the grade equivalent academic scores for SLD

Measures	*Training B (S.E.)*	*P*	r^2
Reading	0.819 (0.907)	.3740	.0264
Vocabulary	0.656 (0.981)	.5088	.0147
Language	0.0875 (0.937)	.9262	.00029
Mechanics	1.725 (1.091)	.1244	.0769
Math	-0.319 (0.656)	.6308	.0078
Computation	-0.888 (0.719)	.2267	.0483
Science	1.419 (0.678)	.0450*	.1273
Social Studies	.1063 (1.018)	.9176	.00036
Spelling	1.219 (.6960)	.0901	.0927

NOTE: B = regression coefficient of the training effect on the difference in post- minus pre-test scores; SE = standard error of the regression coefficient; *p* = *p*-value for the significance of the training on the difference in test scores; * = significant at the 5% level

Table 10. Verbal and non-verbal scores for SLD

Measures	*Active Control*			*Training Group*		
	M	$t_{(15)}$	Pre-to-Post (p)	M	$t_{(15)}$	Pre-to-Post (p)
Verbal	5.313	2.979	.00937 **	13.438	5.179	.000112 ***

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| Non-Verbal | 1.125 | 0.308 | .7620 | 15.813 | 6.015 | .0000237 *** |
| IQ Composite | 1.500 | 0.580 | .5706 | 16.813 | 7.239 | .00000288 *** |

NOTE: M = Mean of the post- minus pre-test scores; *p* = *p*-value for the two-mean *t*-tests for the difference in pre- and post-test scores; * = significant at the 5% level; ** = significant at the 1% level; *** = significant at the .1% level

Table 11. Regression analysis: effect of training
on verbal and non-verbal scores for SLD

Measures	Training B (S.E.)	P		r²
Verbal	8.125 (3.149)	.0150 *	**Significant**	.1816
Non-Verbal	14.688 (4.495)	.00272 **	**Significant**	.2624
IQ Composite	15.313 (3.476)	.000124 ***	**Significant**	.3927

NOTE: B = regression coefficient of the training effect on the difference in post- minus pre-test scores; SE = standard error of the regression coefficient; *p* = *p*-value for the significance of the training on the difference in test scores; * = significant at the 5% level; ** = significant at the 1% level; *** = significant at the .1% level

Table 12. Regression output: significance of training interacting
with gender and age on scores

Measures	Training: Age B (S.E.)	P	Training: Gender(M) B (S.E.)	p	r²
Verbal WM	5.714 (2.396)	.0247 *	-0.0973 (5.200)	.9852	.1941
Visuospatial WM	-6.604 (4.311)	.1377	8.748 (9.358)	.3585	.2020
Reading	-0.127 (0.903)	.8893	4.345 (1.959)	.0355 *	.1901
Vocabulary	0.805 (1.049)	.4496	-1.613 (2.276)	.4849	.0547

Language	0.206 (0.941)	.8282	3.815 (2.043)	.0731 #	.1526
Mechanics	0.366 (1.117)	.7456	-0.517 (2.424)	.8326	.1877
Math	-0.056 (0.653)	.9318	2.319 (1.418)	.1141	.1744
Computation	-0.281 (0.770)	.7186	0.161 (1.671)	.9240	.0835
Science	-0.552 (0.651)	.4047	2.886 (1.413)	.0514 #	.3242
Social Studies	0.030 (1.056)	.9777	0.787 (2.291)	.7338	.0974

Spelling	0.484 (0.715)	.5046	-2.230 (1.552)	.1626	.1957
Verbal	-3.364 (3.110)	.2893	8.560 (6.322)	.1874	.3660
Non-Verbal	1.229 (4.199)	.7721	-6.607 (8.536)	.4459	.4890
IQ Composite	-4.006 (3.506)	.2636	5.485 (7.128)	.4486	.5094

NOTE: B = regression coefficient for the interaction of term of Training with Age or with Gender; SE = Standard Error of regression coefficient; p = p-value for the significance of the interaction term; * = significant at the 5% level

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