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Title: What Works in Gifted Education-Documenting the Model-based Curriculum for Gifted Students

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Abstract Body

Background / Context:

Description of prior research and its intellectual context.

The heart of effective programming for gifted services lies in the development of curricula that will challenge and enhance learning outcomes for gifted students (Hertberg-Davis & Callahan, in press). While the field abounds with models that provide frameworks for curricular modification (e.g., Maker, 2001; Renzulli, 1977; Renzulli & Reis, 1997; Tomlinson, 2001; VanTassel-Baska, 1986), empirical evidence related to the effectiveness of these models is still developing (Van Tassel-Baska, 2002; Van Tassel-Baska, Bass, Reis, Poland & Avery, 1998), and large scale studies of curricular interventions in multiple settings are limited. Challenges to documenting curricular effectiveness include: (a) difficulty with establishing effective outcome measures (Callahan, 1992; Hunsaker, Nielsen, & Bartlett, 2010); (b) determining the extent to which these models are responsible for observable and measurable outcomes using experimental paradigms (Sanchez et al., 2007); and (c) lack of data on fidelity of implementation (O'Donnell, 2008).

Educators have voiced concerns about the lack of differentiated curricula and instruction in gifted classrooms and the paucity of empirical evidence to support their effectiveness for gifted learners (Callahan, Tomlinson, Moon, Tomchin, & Plucker, 1995; Callahan, 1996; Passow, 1986; VanTassel-Baska et al., 1998; VanTassel-Baska, Zuo, Avery, & Little, 2002). In response to such concerns, guiding principles for differentiated curriculum and instruction for gifted students have been provided by national organizations (National Association for Gifted Children, 2010; Purcell, Burns, Tomlinson, Imbeau, & Martin, 2002) and have been continuously echoed by experts in gifted education (e.g., Kaplan, 1986; Reis & Purcell, 1993; Renzulli & Reis, 1994). These principles articulate standards for curriculum planning and instruction and specify elements that should be included to ensure optimal learning for gifted students. While some studies utilize these guiding principles in developing and evaluating curricular units (e.g., Gavin, Casa, Adelson, Carroll, & Sheffield, 2009; Little, Feng, & VanTassel-Baska, 2007; VanTassel-Baska & Brown, 2007), further study of how to translate these guiding principles effectively into practice with diverse learners in various contexts is still needed.

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

Concerning the need to gather further data on the effectiveness of model-based curricula on student learning in gifted classrooms, critical components of three highly regarded curricular models in gifted education were integrated into a single curriculum model and two language arts units for third grade gifted students were developed. Using key compatible elements from Tomlinson's Differentiated Instruction Model (2001), Renzulli and Reis' Schoolwide Enrichment Model (SEM) (1985), and Kaplan's Depth and Complexity Model (2005), an integrated curricular model called the CLEAR curriculum, which stands for Challenge Leading to Engagement, Achievement and Results, served as a framework for two language arts unit for third grade students in gifted classrooms.

The review of the related literature illustrates the need for a study investigating the extent to which model-based curricular units are accountable for observable and measurable outcomes

in gifted classrooms using an experimental paradigm. The current study investigated effectiveness of the integrated curricular model through assessing student outcomes from two language arts units. The purpose of the study was to determine the effectiveness of the CLEAR curriculum, specifically: Do gifted learners exposed to an integrated model-based curriculum outperform equally able learners not exposed to the integrated model-based curriculum in the comparison group on standards-referenced post-tests after controlling for their prior achievement?

Setting:
Description of the research location.

The data were collected from more than 200 classrooms in 23 states over three years.

Population / Participants / Subjects:
Description of the participants in the study: who, how many, key features, or characteristics.

Teachers and students in third grade classrooms, pull-out or self-contained classrooms specifically designated for gifted students, were recruited through national advertisement at the state and district level. A total of 1,215 students from 76 classrooms in 11 states participated in the first year of the study (Y1, 2009-2010 school year), 1,007 students from 82 classrooms in 14 states took part in the second year of the study (Y2, 2010-2011school year), and 683 students from 56 classrooms in 19 states in the third year of the study (Y3, 2011-2012 school year).

Intervention / Program / Practice:
Description of the intervention, program, or practice, including details of administration and duration.

At the beginning of each school year, teachers in the treatment condition were given two language arts units to implement. Teachers were allowed to decide the order and scheduling of implementation of the units to be completed by the end of the school year. In the third year of the study, teachers in treatment condition received the poetry unit only due to time constraints for the study. Along with all the necessary materials and resources to implement the units, the research team also provided webinars through which teachers in treatment condition were informed about the purpose of the study, the program model, the layout of the curriculum manual, and the use of materials. In addition, teachers were provided continuous access to instructional support via phone calls and emails, and the password protected online resource center.

While the inclusion of fidelity of implementation in effectiveness studies is a relatively nascent concept (Mowbray, Holder, Teague & Bybee, 2003; O'Donnell, 2008) and is receiving increased attention (U. S. Department of Education, 2003; 2006), the degree to which the interventions are implemented with fidelity is often overlooked and virtually nothing is known in gifted education context. As fidelity assessments provide an evaluative systematic link between program implementation and outcomes attributable to the program's effectiveness (Sanchez et al., 2007), the research team utilized on-site observations and interviews in order to monitor teachers' unit implementation. Teachers were also asked to report their implementation process and fidelity to the unit design through a teacher log developed by the research team. The teacher log, given to teachers to report how they perceived their implementation of each lesson, mirrored the observation guide. The log entailed a checklist format with the assumption that a teacher would be more likely to fill out the log and return it at the end of the unit. Additionally, there was

an area to provide descriptions of any modifications, omissions, or additions and the rationale behind the adaptation as well.

While teachers in the treatment condition implement the unit, teachers in the comparison site proceeded with their own curriculum. Teachers in comparison sites were also observed and interviewed in order to identify the presence or absence of the critical components that distinguish the intervention from the curriculum used in the comparison classrooms.

Research Design:
Description of the research design.

The current study employed a cluster-randomized experimental design in which classrooms were randomly assigned to treatment or comparison conditions. Interested sites were informed that participation was contingent on compliance with random assignment. After recruitment, settings were randomly assigned to experimental or comparison conditions with students nested within classrooms. In cases where teachers taught at multiple sites or there were multiple teachers in a school, those teachers were assigned to the same condition in order to avoid possible contamination of treatment effect from a teacher inadvertently using the curriculum in comparison classrooms.

Data Collection and Analysis:
Description of the methods for collecting and analyzing data.

Data sources for the study include Iowa Test of Basic Skills (ITBS) Survey Battery Reading subtest, Level 9, Form A (Hoover et al., 2003) and two standards-referenced post-tests specifically developed for the study. The ITBS scores were used to control students' achievement level prior to the intervention. With a clustered-randomized design where students are nested in a classroom, the study employed multilevel analyses of the data using maximum likelihood estimator. Multilevel analyses allowed the nested nature of the data set to be taken into account and prevent issues with aggregation bias, the misinterpretation of standard errors, and heterogeneity of regression (Maas & Hox, 2004; Raudenbush & Bryk, 2002; Scherbaum & Ferreter, 2009). In order to examine achievement differences between the treatment and comparison groups, multilevel models were generated. The level 1 model contained students' ITBS scores. The ITBS scores were entered after grand-mean centering, in which the grand mean for the ITBS scores was subtracted from each student's ITBS score ($ITBS_{ij} - \overline{ITBS}_{..}$), as a proxy for previous unaccounted influences. At level 2 treatment condition was coded as 1= *treatment group* and 0 = *comparison group*.

Findings / Results:
Description of the main findings with specific details.

Significant differences between classroom variance in both years were observed. The intraclass coefficient which measures the proportion of variance across the clusters ranged from .18 to .43 indicating that about 18-43% of student achievement variance occurred across classrooms. The multilevel analyses result showed a significant difference ($p<.01$) favoring treatment group over comparison group on the outcome measure after controlling for students ITBS scores for both units. This difference was over one standard deviation for one unit and

nearly one standard deviation for the other unit. Model fit tests corroborate the significance of the treatment effect on student achievement for both units as well. As effect size indices for treatment, proportion of variance reduction (PVR) between classrooms for both units was calculated. Results indicated that a significant amount of the variation ranged from 30% to 58% in student achievement scores decreased by adding treatment condition in the analyses.

Conclusions:

Description of conclusions, recommendations, and limitations based on findings.

The significant differences between treatment and control groups on the outcome measure from two different units of study based on the CLEAR curriculum model are promising indicators of the potential of this integrated model to develop units that positively affect learning for gifted students. The results suggest that the CLEAR curriculum model which establishes the context of rich curriculum and responsive instruction driven by key components of three existing curricular models in gifted education is a viable option to enhance student learning. The effect of the CLEAR curriculum units were also supported through rigorous methodologies such as a cluster-randomized experimental design and multilevel analyses of student outcome data over two years. The current study also collected data with regards to the fidelity of implementation and found that teachers implemented the lessons with moderate to high fidelity (Foster, Oh, Azano, & Callahan, 2012). Further discussion on fidelity of implementation in the study can be found in Azano et al. (2011) and Foster et al. (2012).

Appendices

Appendix A. References

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Appendix B. Tables and Figures

Table 1

Participants by Treatment Condition and Years

Year	Group	Number of Classrooms	Number of Students*
Y1	Treatment group	49	711
	Comparison group	36	504
Y2	Treatment group	61	712
	Comparison group	21	295
Y3	Treatment group	30	335
	Comparison group	26	348

*Number of student here reported reflect those who completed post-tests.

Table 2

Teacher Demographic Characteristics from Y1 Cohort (N=85)

Characteristics	Treatment	Control	Total	% of Group
Gender				
Female	48	36	84	98.8
Male	1	0	1	.2
Race/Ethnicity				
Asian/Pacific Islander	0	0	0	0
American Indian/Alaskan Native	0	0	0	0
African American	1	1	2	2.3
Hispanic/Latino(a)	0	0	0	0
White	48	35	83	97.6
Multiple Ethnicities/Other	0	0	0	0
Ethnicity not indicated	0	0	0	0
Total Number of Years Teaching				
Less than 5 years	2	5	7	8.2
5-9 years	6	7	13	15.3
10-14 years	11	4	15	17.6
More than 15 years	24	18	42	49.4

Not indicated	6	2	8	9.4
Total Number of Years Teaching 3rd Grade				
Less than 5 years	21	20	41	48.2
5-9 years	7	6	13	15.3
10-14 years	10	5	15	17.6
More than 15 years	5	3	8	9.4
Not indicated	6	2	8	9.4
Total Number of Years Teaching Gifted				
Less than 5 years	15	10	25	29.4
5-9 years	6	11	17	20.0
10-14 years	7	1	8	9.4
More than 15 years	5	4	9	10.6
Not indicated	16	10	26	30.6
Highest Degree Earned				
Bachelors	18	16	34	40.0
Masters	30	20	50	51.4
Doctorate	1	0	1	.01

Table 3

Teacher Demographic Characteristics from Y2 Cohort (N=73)

Characteristics	Treatment	Control	Total	% of Group
Gender				
Female	51	21	72	98.6
Male	1	0	1	1.4
Race/Ethnicity				
Asian/Pacific Islander	0	0	0	0
American Indian/Alaskan Native	1	0	1	1.4
African American	0	0	0	0
Hispanic/Latino(a)	2	0	2	2.7
White	49	21	70	95.9
Multiple Ethnicities/Other	0	0	0	0
Ethnicity not indicated	0	0	0	0
Total Number of Years Teaching				

Less than 5 years	3	1	4	5.5
5-9 years	12	4	16	21.9
10-14 years	8	6	14	19.2
More than 15 years	29	9	38	52.1
Not indicated	0	1	1	1.4
Total Number of Years Teaching 3rd Grade				
Less than 5 years	22	8	30	41.1
5-9 years	16	8	24	32.9
10-14 years	7	4	11	15.1
More than 15 years	7	1	8	11.1
Not indicated	0	1	1	1.4
Total Number of Years Teaching Gifted				
Less than 5 years	22	9	31	42.5
5-9 years	17	7	24	32.9
10-14 years	4	3	7	9.6
More than 15 years	8	1	9	12.3
Not indicated	1	1	2	2.7
Highest Degree Earned				
Bachelors	11	4	15	20.5
Masters	40	17	57	78.1
Doctorate	1	0	1	1.4

Table 4

Teacher Demographic Characteristics from Y3 Cohort (N=54)

Characteristics	Treatment	Control	Total	% of Group
Gender				
Female	27	24	51	94.4
Male	1	2	3	5.6
Race/Ethnicity				
Asian/Pacific Islander	0	0	0	0
American Indian/Alaskan Native	0	1	1	1.8
African American	0	2	2	3.7
Hispanic/Latino(a)	0	0	0	0
White	25	23	48	88.8
Multiple Ethnicities/Other	0	0	0	0
Ethnicity not indicated	3	0	3	5.5

Total Number of Years Teaching				
Less than 5 years	2	1	3	5.6
5-9 years	4	6	10	18.5
10-14 years	8	6	14	25.9
More than 15 years	13	11	24	44.4
Not indicated	1	2	3	5.6
Total Number of Years Teaching 3rd Grade				
Less than 5 years	11	9	20	37.0
5-9 years	14	9	23	42.6
10-14 years	1	3	4	7.4
More than 15 years	1	3	4	7.4
Not indicated	1	2	3	5.6
Total Number of Years Teaching Gifted				
Less than 5 years	4	8	12	22.2
5-9 years	8	6	14	25.9
10-14 years	10	4	14	25.9
More than 15 years	5	6	11	20.4
Not indicated	1	2	3	5.6
Highest Degree Earned				
Bachelors	5	0	5	9.2
Masters	23	26	49	90.7
Doctorate	0	0	0	0

Table 5

*Student Demographic Characteristics from Y1 Cohort (N=944)**

Characteristics	Treatment	Control	Total	% of Group
Gender				
Female	184	154	338	35.8
Male	158	125	283	29.9
Gender not indicated	236	87	323	34.1
Race/Ethnicity				
Asian/Pacific Islander	5	13	18	1.9
American Indian/Alaskan Native	4	4	8	.8
African American	10	31	41	4.3
Hispanic/Latino(a)	5	15	20	2.1
White	190	184	374	39.6

Multiple Ethnicities/Other	16	18	34	3.6
Ethnicity not indicated	348	101	449	47.5

*Number of student here reported reflect those who completed the ITBS.

Table 6

*Student Demographic Characteristics from Y2 Cohort (N=1007)**

Characteristics	Treatment	Control	Total	% of Group
Gender				
Female	321	137	458	45.5
Male	318	141	459	45.6
Gender not indicated	74	16	90	8.9
Race/Ethnicity				
Asian/Pacific Islander	28	18	46	4.6
American Indian/Alaskan Native	10	2	12	1.2
African American	34	5	39	3.9
Hispanic/Latino(a)	38	8	46	4.6
White	473	223	696	69.1
Multiple Ethnicities/Other	45	22	67	6.7
Ethnicity not indicated	85	16	101	10.0

*Number of student here reported reflect those who completed the ITBS.

Table 7

*Student Demographic Characteristics from Y3 Cohort (N=694)**

Characteristics	Treatment	Control	Total	% of Group
Gender				
Female	161	173	334	48.1
Male	179	149	328	47.3
Gender not indicated	6	26	32	4.6
Race/Ethnicity				
Asian/Pacific Islander	9	21	30	4.3
American Indian/Alaskan Native	5	10	15	2.2
African American	22	27	49	7.1

Hispanic/Latino(a)	11	12	23	3.3
White	275	181	456	65.6
Multiple Ethnicities/Other	3	30	33	4.8
Ethnicity not indicated	21	67	88	12.7

*Number of student here reported reflect those who completed the ITBS.

Table 8

Intraclass Correlations and Design Effect by Year and Unit

Year	Unit	ICC	Average Cluster Size	DE
1	Research	.32	14.06	5.18
	Poetry	.44	13.35	6.44
2	Research	.18	11.48	2.89
	Poetry	.39	11.46	5.08
3	Poetry	.42	11.77	5.52

Table 9

Model Summaries for Poetry Unit in Year 1

Parameter	Unconditional One-way ANOVA		ITBS only		Treatment Condition + ITBS	
	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE
Intercept (γ_{00})	21.71**	.45	21.93**	.45	18.95**	.66
ITBS (γ_{10})	-	-	.101**	.01	.102**	.010
Treatment (γ_{01})	-	-	-	-	4.95**	.79
Residual (σ^2)	17.379**	1.00	14.829**	.93	14.911**	.94
Intercept (τ_{00})	13.839**	2.27	12.042**	1.97	5.859**	2.11
Deviance Statistic	6185.714		4536.09		4500.04	
Number of estimated	3		4		5	

parameters						

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 10

Model Summaries for Research Unit in Year1

	Unconditional One-way ANOVA		ITBS only		Treatment Condition + ITBS	
Parameter	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE
Intercept (γ_{00})	24.01**	.34	24.51**	.31	23.12**	.32
ITBS (γ_{10})	-	-	.08**	.01	.08**	.01
Treatment (γ_{01})	-	-	-		2.38**	.53
Residual (σ^2)	15.48**	1.09	12.71**	1.00	12.73**	.99
Intercept (τ_{00})	7.39**	2.10	5.16**	1.45	3.69**	1.33
Deviance Statistic	6265.114		4498.56		4483.50	
Number of estimated parameters	3		4		5	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 11

Model Summaries for Poetry Unit in Year 2

	Unconditional One-way ANOVA		ITBS only		Treatment Condition + ITBS	
Parameter	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE

Intercept (γ_{00})	23.576***	.45	23.782***	2.22	21.947***	.75
ITBS (γ_{10})	-		.092***	.01	.094***	.01
Treatment (γ_{01})	-		-		2.950***	.85
Residual (σ^2)	15.471***	1.55	13.792***	1.68	13.783***	1.676
Intercept (τ_{00})	9.855***	2.01	8.378***	1.78	6.376***	1.502
Deviance Statistic	3884.69		3381.18		3368.46	
Number of estimated parameters	3		4		5	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 12

Model Summaries for Research Unit in Year 2

	Unconditional One-way ANOVA		ITBS only		Treatment Condition + ITBS	
	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE
Intercept (γ_{00})	24.704***	.31	24.902***	.290	23.68***	.40
ITBS (γ_{10})	-		.090***	.01	.094 ***	.01
Treatment (γ_{01})	-		-		2.066***	.54
Residual (σ^2)	15.285***	1.01	13.390***	.93	13.357***	.92
Intercept (τ_{00})	3.390***	.88	2.788**	.98	1.827***	.64
Deviance Statistic	3512.70		3169.96		3155.59	
Number of estimated parameters	3		4		5	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 16

Model Summaries for Poetry Unit in Year 3

Parameter	Unconditional One-way ANOVA		ITBS only		Treatment Condition + ITBS	
	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE
Intercept (γ_{00})	21.43**	.52	21.62**	.47	18.56**	.42
ITBS (γ_{10})	-	-	.12**	.01	.13**	.010
Treatment (γ_{01})	-	-	-	-	5.70**	.54
Residual (σ^2)	18.09**	1.59	13.70**	1.07	13.90**	.1.08
Intercept (τ_{00})	13.17**	2.27	10.99**	1.81	2.50**	.72
Deviance Statistic	3896.652		3463.368		3402.876	
Number of estimated parameters	3		4		5	

* $p < .05$. ** $p < .01$. *** $p < .001$.