What Works When Teaching Young Children to Read: Lessons Learned from the Early Literacy and Learning Model

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Introduction

In 2002, the U. S. DOE awarded the Florida Institute of Education $3.1 million over four years to expand and evaluate the *Early Literacy and Learning Model* (ELLM) through the *Preschool Curriculum Evaluation Research* (PCER) program. ELLM researchers are longitudinally following children, their teachers, and their families for three years. This year-one study using complementary data is designed to determine whether or not participation in the ELLM classes resulted in higher posttest emergent literacy achievement scores for 4-year-old at-risk children than participation in the locally used curricula without the ELLM intervention.

Methodology

Design of Study

This evaluation of ELLM used an experimental design based on the random assignment of elementary schools and childcare centers to ELLM or wait-list control status (W-L Control). Experimental designs provide the greatest validity for causal conclusions based on statistical inferences.

Methodology 2

The Sample and Randomization

Three locations with differing degrees of urbanicity participated in the study. Low-performing elementary schools housing at least one early intervention prekindergarten class were identified in each of the three locations and randomly assigned to either ELLM or W-L Control status. Additionally, two Head Start and two subsidized sites were randomly selected in the neighborhood of each elementary school. One class from each site was randomly selected to participate. Within the classes, children who were four years old on September 1 of the school year participated in the study.

Methodology 3

Classes

Most of the 48 classes in the study were regular education classes serving 3- and 4-year-old children. The ELLM literacy curriculum was used in combination with the existing comprehensive curricula. The prevalent locally used curricula in ELLM and W-L Control classes were *Creative Curriculum, High Scope*, and *High Reach*.

Methodology 4

Teachers

The average age of the teachers was about 45 years; 63% of the teachers were Black; and the typical teacher reported about 14 years' experience working with young children.

Methodology 5

Participants

Participants	ELLM	W-L Control
Number of Classes	24	24
Number of 4-Year Degreed Teachers	8	11
Number of Children	222	243
Percent Boys	50	50
Percent of Children in Classes Taught by 4-Year Degreed Teachers	41	46

Methodology 6

Measurement

The children's emergent literacy abilities were assessed in the fall and spring of the school year using the nationally standardized *Test of Early Reading Ability–Version 3* (TERA-3) and the locally developed Alphabet Letter Recognition Inventory (ALRI). The TERA-3 is composed of three subtests – Alphabet, Conventions of Print, and Meaning – measuring children's ability to recognize letters and their sounds, familiarity with book handling and proper orientation of print, and ability to comprehend meaning from printed material. The Reading Quotient, a composite of the three subtests, is an overall measure of children's emergent literacy abilities. The ALRI measures children's ability to recognize the upper- and lowercase letters when presented in non-alphabetic order.

Methodology 7

Analyses: Hierarchical Linear Modeling (HLM)

The use of HLM is indicated because children experienced the ELLM instructional model together in classes rather than in one-on-one settings. HLM allows this shared learning to be modeled in data analyses. Modeling was done using SAS Release 9.1 and the Proc Mixed procedure.

Methodology 8

HLM Variables

Label	Name	Description
X_1	TERA-3 Pretest	The TERA-3 pretest standardized score – grand mean centered
X_2	ALRI Pretest	The number of upper- and lowercase letters the child recognized at pretest – grand mean centered
X_3	Age	The age (in months) of the child on September 1 of the school year – grand mean centered
X_4	Gender	Gender of the child, boys coded 0 and girls coded 1
W_1	Status	Wail-List Control coded 0 and ELLM coded 1
W_2	Area	3 geographic regions
W_3	Education	Coded 1 if teacher has at least a 4-year degree, and coded 0 otherwise

Methodology 9

HLM Equations

These variables were used to fit a general HLM equation for the TERA-3 Reading Quotient and subtest scores.

Child-Level Model: $Y_{ij} = \beta_{0j}+\beta_{1j}(X_{1ij})+. . .+\beta_{4j}(X4_{ij})+ r_{ij}$

Class-Level Model: $\beta_{0j} = \gamma_{00}+\gamma_{01}(W_{1j})+. . .+\gamma_{03}(W_{3j})+u_{0j}$

$\beta_{1j} = \gamma_{10}+\gamma_{11}(W_{1j})+. . .+\gamma_{13}(W_{3j})+u_{1j}$

$\beta_{4j} = \gamma_{40}+\gamma_{41}(W_{1j})+. . .+\gamma_{43}(W_{3j})+u_{4j}$

Where

Y_{ij} is the TERA-3 posttest score of the i^{th} child in the j^{th} class

i =1,. . .,465 children and *j*=1,. . .,48 classes.

β_{nj} is the fixed or random slope of the n^{th} child-level effect, n =1,. . . ,4.

Results

TERA-3 and ALRI Mean Scores

Test	Time	ELLM (n=222) Mean Scores	W-L Control (n=243) Mean Scores
TERA-3 Reading Quotient	Pretest	84.62	84.73
TERA-3 Reading Quotient	Posttest	91.81	88.76
TERA-3 Alphabet	Pretest	7.80	7.98
TERA-3 Alphabet	Posttest	9.92	9.29
TERA-3 Conventions of Print	Pretest	7.16	7.33
TERA-3 Conventions of Print	Posttest	7.72	7.48
TERA-3 Meaning	Pretest	7.86	7.57
TERA-3 Meaning	Posttest	8.55	7.98
ALRI	Pretest	15.55	17.97
ALRI	Posttest	33.58	31.64

Results 2

TERA-3 Reading Quotient HLM Model

Child-Level Model: $(\text{RQ Posttest})_{ij} = \beta_{0j} + \beta_{1j}(\text{RQ Pretest})_{ij} + \beta_{2j}(\text{ALRI Pretest})_{ij} + \beta_{3j}(\text{Age})_{ij} + \beta_{4j}(\text{Gender})_{ij} + r_{ij}$

Class-Level Model: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Status})_j + u_{0j}$

TERA-3 Reading Quotient Results

Level	Variable	Coefficient Estimated	Effects	Estimate	F value	P value
Child	X_1	β_{1j}	RQ Pretest	0.44	76.45	<.0001
Child	X_2	β_{2j}	ALRI Pretest	0.27	54.94	<.0001
Child	X_3	β_{3j}	Age	-1.02	73.65	<.0001
Child	X_4	β_{4j}	Gender	2.09	6.04	.0144
Class	No variable	γ_{00}	Intercept	90.97	9085.90	<.0001
Class	W_1	γ_{01}	Status W-L Control	0.00	No F-value	No p-value
Class	W_1	γ_{01}	ELLM	3.52	8.67	.0061
Model	No variable	No Coefficient	Effect Size for Status	0.23	No F-value	No p-value
Model	No variable	No Coefficient	ICC	.15	No F-value	No p-value

Results 3

TERA-3 Reading Quotient

Children in ELLM classes had higher adjusted mean TERA-3 Reading Quotient posttest scores than children in W-L Control classes. The adjusted mean posttest score of the ELLM children, 92.02, ranks at the 30th percentile, while the adjusted mean posttest score of the W-L Control children, 88.50, ranks at the 22nd percentile. This represents a difference of about one fourth of a standard deviation in achievement over the six months between the pre- and posttesting.

Results 4

TERA-3 Alphabet Subtest HLM Model

Child-Level Model: $(\text{Alphabet Posttest})_{ij} = \beta_{0j} + \beta_{1j}(\text{Alphabet Pretest})_{ij} + \beta_{3j}(\text{Age})_{ij} + \beta_{4j}(\text{Gender})_{ij} + r_{ij}$

Class-Level Model: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Status})_j + u_{0j}$

TERA-3 Alphabet Subtest Results

Level	Variable	Coefficient Estimated	Effects	Estimate	F value	P value
Child	X_2	β_{2j}	Alphabet Pretest	0.69	254.67	<.0001
Child	X_3	β_{3j}	Age	-0.08	6.08	.0141
Child	X_4	β_{4j}	Gender	0.51	4.15	.0423
Class	No variable	γ_{00}	Intercept	90.97	1270.92	<.0001
Class	W_1	γ_{01}	Status W-L Control	0.00	No F-value	No p-value
Class	W_1	γ_{01}	ELLM	0.78	5.31	.0272
Model	No variable	No Coefficient	Effect Size for Status	0.26	No F-value	No p-value
Model	No variable	No Coefficient	ICC	.15	No F-value	No p-value

Results 5

TERA-3 Alphabet Subtest

Children in ELLM classes had higher adjusted mean Alphabet subtest posttest scores than children in W-L Control classes. The adjusted mean posttest score of the ELLM children, 10.00, ranks at the 50th percentile, while the adjusted mean posttest score of the W-L Control children, 9.22, ranks at the 40th percentile. This represents a difference of about one fourth of a standard deviation in achievement over the six months between pre- and posttesting.

Results 6

TERA-3 Conventions of Print Subtest HLM Model

Child-Level Model: $(\text{Conventions Posttest})_{ij} = \beta_{0j} + \beta_{1j}(\text{Conventions Pretest})_{ij} + \beta_{2j}(\text{ALRI Pretest})_{ij} + \beta_{3j}(\text{Age})_{ij} + \beta_{4j}(\text{Gender})_{ij} + r_{ij}$

Class-Level Model: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Status})_j + \gamma_{02}(\text{Area})_j + \gamma_{03}(\text{Education})_j + u_{0j}$

$\beta_{1j} = \gamma_{10} + u_{1j}$

TERA-3 Conventions of Print Subtest Results

Level	Variable	Coefficient Estimated	Effects	Estimate	F value	P value
Child	X_1	β_{1j}	Random	No Estimate	No F-value	No p-value
Child	X_2	β_{2j}	ALRI Pretest	0.04	43.03	<.0001
Child	X_3	β_{3j}	Age	-0.19	59.10	<.0001
Child	X_4	β_{4j}	Gender	0.41	5.12	.0241
Class	No variable	γ_{00}	Intercept	7.65	1264.51	<.0001
Class	W_1	γ_{01}	Status W-L Control	0.00	No F-value	No p-value
Class	W_1	γ_{02}	Status ELLM	0.39	3.77	.0598
Class	W_2	γ_{03}	Area	No Estimate	3.38	.0432
Class	W_3	γ_{10}	Education	0.49	5.11	.0294
Slope	No variable	γ_{10}	Mean Conventions of Print Pretest Slope	0.31	30.53	<.0001
Model	No variable	No Coefficient	Effect Size for Status	0.13	No F-value	No p-value
Model	No variable	No Coefficient	ICC	0.06	No F-value	No p-value

Results 7

TERA-3 Conventions of Print Subtest

Children in ELLM classes had higher adjusted mean Conventions of Print subtest posttest scores than children in W-L Control classes, and the slope of the Conventions of Print pretest score is random. The adjusted mean posttest score of the ELLM children, 7.99, ranks at the 25th percentile, while the adjusted mean posttest score of the W-L Control children, 7.60, ranks at the 21st percentile. This represents a difference of 13% of a standard deviation over the six months between pre- and posttesting.

Results 8

Child-Level Model: $(\text{Meaning Posttest})_{ij} = \beta_{0j} + \beta_{1j}(\text{Meaning Pretest})_{ij} + \beta_{2j}(\text{ALRI Pretest})_{ij} + \beta_{3j}(\text{Age})_{ij} + r_{ij}$

Class-Level Model: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Status})_j + \gamma 0_2(\text{Area})_j + u_{0j}$

$\beta_{1j} = \gamma_{10} + u_{1j}$

TERA-3 Meaning Subtest Results

Level	Variable	Coefficient Estimated	Effects	Estimate	F value	P value
Child	X_1	β_{1j}	Random	No Estimate	No F-value	No p-value
Child	X_2	β_{2j}	ALRI Pretest	0.03	32.31	<.0001
Child	X_3	β_{3j}	Age	-0.15	51.84	<.0001
Class	No variable	γ_{00}	Intercept	8.35	2835.56	<.0001
Class	W_1	γ_{01}	Status W-L Control	0.00	No F-value	No p-value
Class	W_1	γ_{02}	Status ELLM	0.58	9.53	.0049
Class	W_2	γ_{03}	Area	No Estimate	3.78	.0392
Slope	No variable	γ_{10}	Meaning Pretest Slope	0.27	40.25	<.0001
Model	No variable	No Coefficient	Effect Size for Status	0.19	No F-value	No p-value
Model	No variable	No Coefficient	ICC	0.14	No F-value	No p-value

Results 9

TERA-3 Meaning Subtest

Children in ELLM classes had higher adjusted mean Meaning subtest posttest scores than children in W-L Control classes, and the slope of the Meaning pretest score is random. The adjusted mean posttest score of the ELLM children, 8.67, ranks at the 33rd percentile, while the adjusted mean posttest score of the W-L Control children, 8.09, ranks at the 26th percentile. This represents a difference of about one fifth of a standard deviation in achievement over the six months between pre- and posttesting.

Conclusion

The analyses indicated ELLM was more effective than the traditional curricular approaches in raising the emergent literacy achievement of the children. This result was consistent across the TERA-3 Reading Quotient and subtest scores. The effect sizes ranged from a low of .13 on the Conventions of Print subtest to a high of .26 on the Alphabet subtest. The estimated intraclass correlations ranged from a low of .06 on the Conventions of Print subtest to a high of about .15 on the other three measures. Therefore, for these three measures, nearly 15% of the variance in the children's posttest scores is accounted for by the classes in which they learn, and ELLM accounts for a portion of the class-level variance.

Conclusion 2

Secondary findings of the statistical modeling indicated, in a population of at-risk children:

- 4-year-old boys achieve at lower levels than girls.
- Older children achieve at lower levels than younger children.
- Children's ability to recognize the letters of the alphabet at the beginning of their 4-year-old preschool year predicts their year-end literacy-related achievement even when controlling for their initial status on the TERA-3 pretest.

Future Implications of the Study

- Raising the emergent literacy achievement of at-risk preschool children may need more than a one-size-fits-all approach.
- The negative effect of age on children's standardized scores may be the result of several confounding factors, which need to be more fully investigated.
- The impact of children's initial ability to recognize the letters of the alphabet on their TERA-3 outcomes provides areas for future research. The ALRI is the only measure that assesses intentionally taught emergent literacy skills, and the study indicates those skills are important. The ALRI pretest measure reflects the children's opportunity to learn. The predictive ability of the ALRI may indicate at-risk children who engage in explicit learning of alphabet letter knowledge as three year olds more fully learn from experiences and instruction in 4-year-old preschool settings than children who have not experienced this same opportunity to learn.

ELLM

Early Literacy & Learning Model

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