Modeling Nested Data Using Two Different Estimators and Score Metrics

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ELLM Author

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Introduction

Purposes of this study are to:

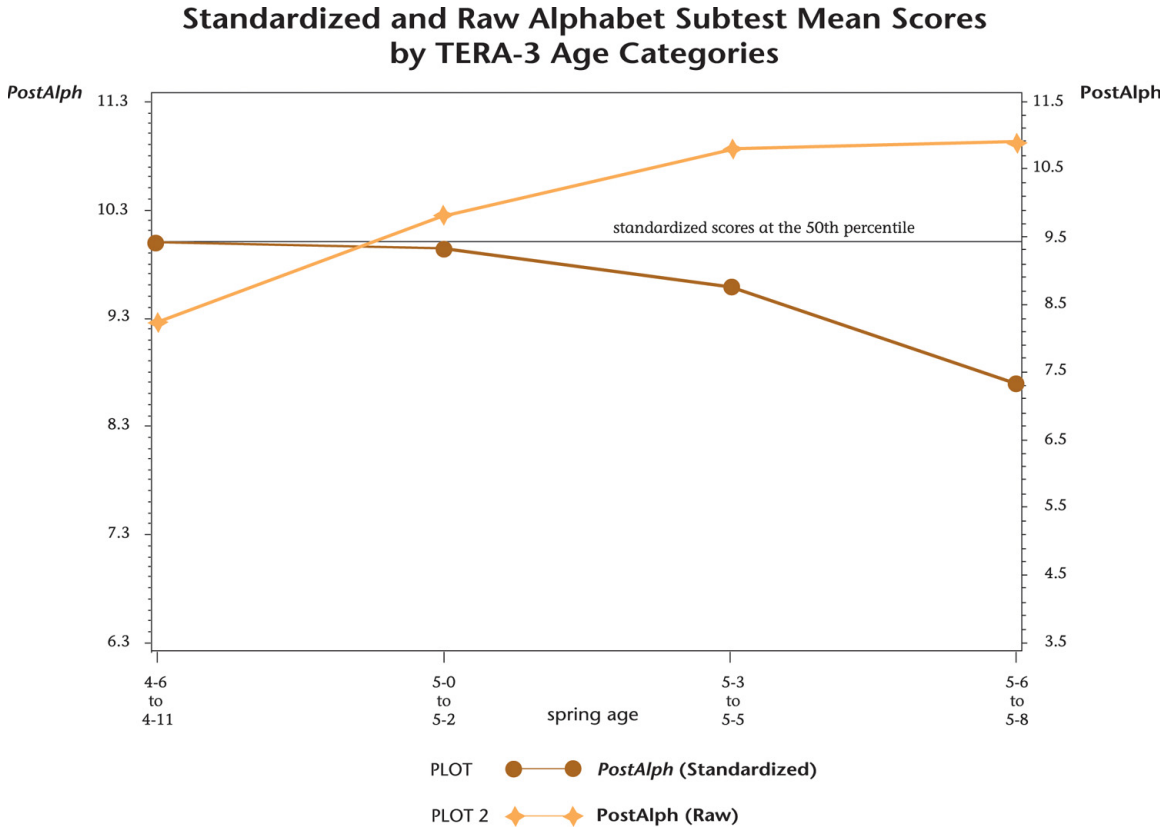
- To investigate the effect of using ML and MLR estimators (Cluster Analysis) in SEMs when scores are nested.
- To determine the direct and indirect effects of age and intervention on raw and standardized posttest scores.

Introduction 2

Age Coefficients and Intraclass Correlations (HLM Studies)

TERA-3 Test	Age Effect	Intraclass Correlation
Alphabet	-0.0826	.15
Conventions of Print	-0.1906	.06
Meaning	-0.1539	.14

Introduction 3



The age category, 4-6 to 4-11, means 4 years, 6 months to 4 years, 11 months. Other categories follow the same pattern.

Introduction 4

Methodological Issues in the Investigation of Age and the Effectiveness of ELLM

- Early literacy constructs are multivariate in nature.
- Need to model direct and indirect effects of age and intervention on posttest scores.
- The scores are from children nested in classes.
- Use of standardized or raw scores.

Introduction 5

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Method

Variables Used in the Study

Variable Label	Variable Description
Gender	Coded 1 for boys and 0 for girls.
Age	Age of the children in months on September 1 of the school year.
Status	Coded 1 for ELLM and 0 for W-L Control.
Fabc (Sabc)	Fall (Spring) ALRI score (number of letters recognized).
Alph	TERA-3 Alphabet subtest.
Conv	TERA-3 Convention of Print subtest.
Mg	TERA-3 Meaning subtest.
Ak	Alphabet knowledge fall latent variable measured by Fabc and PreAlph.
PostAk	Alphabet knowledge spring latent variable measured by Sabc and PostAlph.

Note: Italicized font indicates standardized scores, regular font indicates raw scores.
Prefix: Pre- indicates a fall score, Post- indicates a spring score.
Bold indicates a latent variable.

Results

Model Fit Statistics

Metric	Estimator	CFI	TLI	RMSEA	SRMR
Standardized	ML	0.999	0.993	0.024	0.018
Standardized	MLR	1.000	1.002	0.000	0.018
Raw	ML	0.980	0.961	0.057	0.025
Raw	MLR	0.983	0.965	0.051	0.025

- The fit statistics are comparable across metrics.
- All statistics indicate good fit.

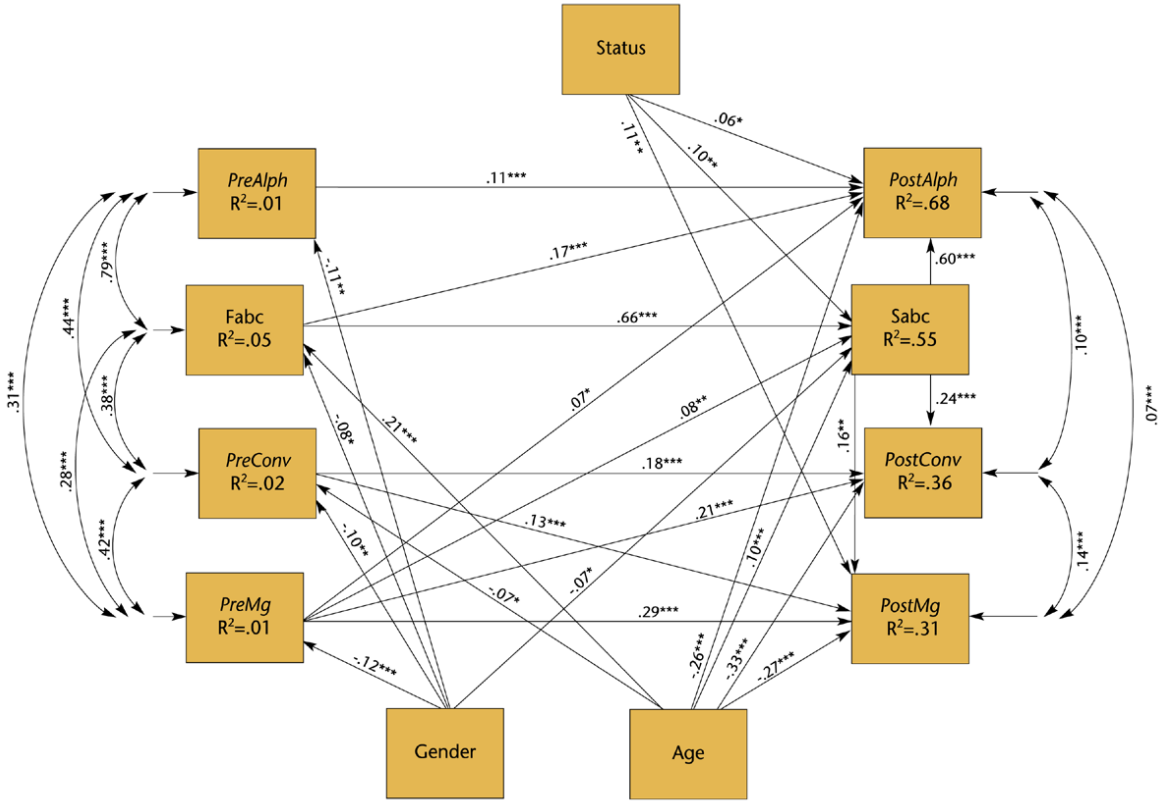
Results 2

Comparison of ML and MLR Estimators on the Effects of ELLM Using Standardized and Raw Posttest Scores

Metric	Path	ML Estimator Wald	MLR Estimator Wald	Percent Difference in S.E.
Standardized	Sabc on Status	3.071***	2.079**	32.5
Standardized	PostAlph on Status	2.174**	1.810*	16.7
Standardized	PostConv on Status	0.862	0.841	2.7
Standardized	PostMg on Status	2.885***	2.457**	14.4
Raw	**PostAk** on Status	3.991***	3.071***	23.1
Raw	PostConv on Status	0.352	0.349	1.0
Raw	PostMg on Status	2.462***	2.085**	15.4

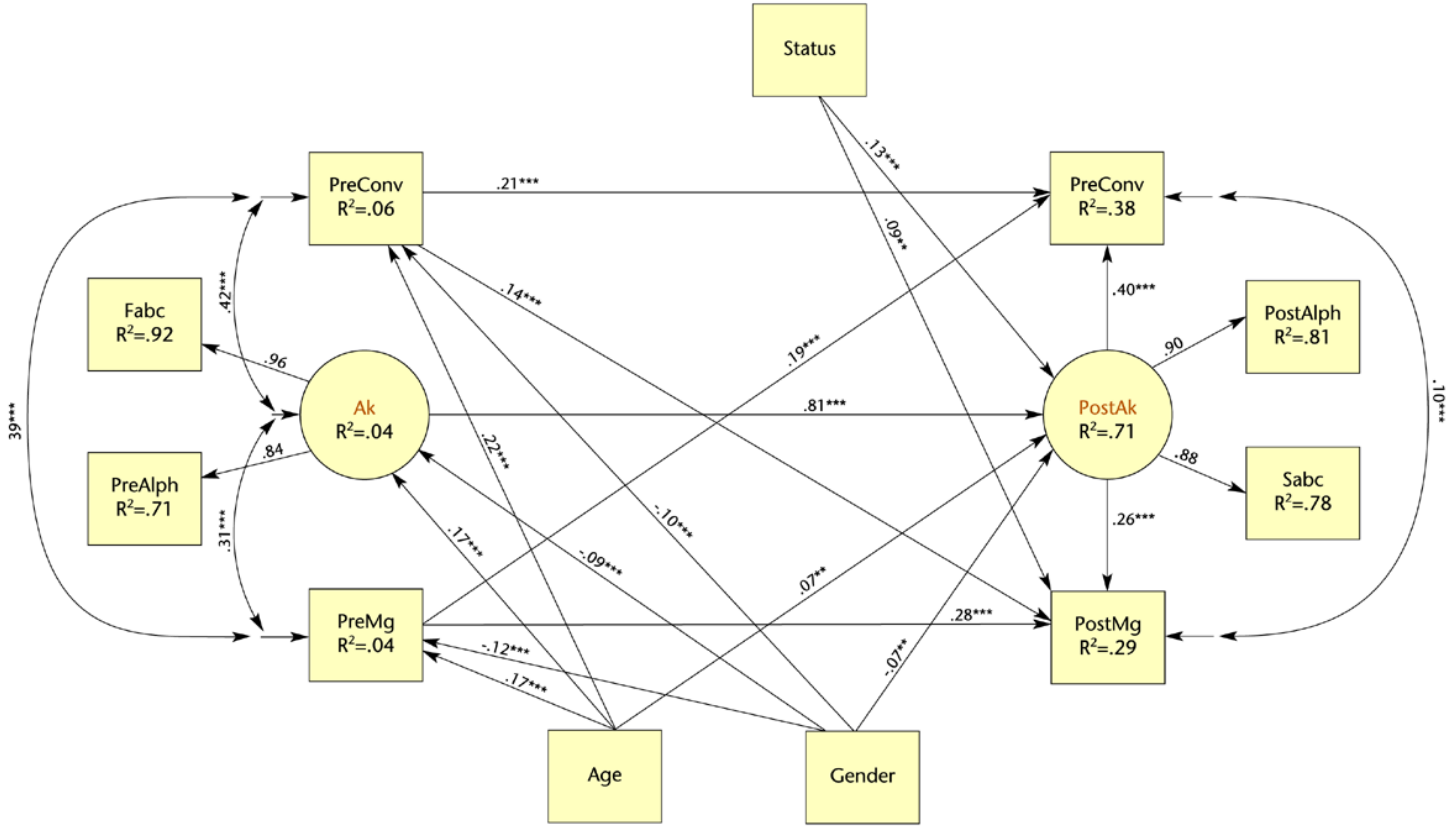
Note: *on* means regressed on. All path weight significances are indicated by * for a=.10, ** for a=.05, and *** for a=.01. Estimates are in metric of the posttest scores.

Results 3: *Standardized Scores*



Note: Path weight are standardized; significances are indicated by * for a=.10, ** for a=.05, and *** for a=.01; and n=468.

Results 4: *Raw Scores*



Note: Path weight are standardized; significances are indicated by * for a=.10, ** for a=.05, and *** for a=.01; and n=468.

Results 5

Total Effect of Age on Alphabet Posttest Scores

Path PostAlph	Effect PostAlph
Age•*PostAlph*	-0.246
Age•Fabc•*PostAlpha*	0.033
Age•Sabc•*PostAlpha*	0.055
Age•Fabc•Sabc•*PostAlpha*	0.077
Total	-0.080

Effects are in metric of the variables.

Results 6

Total Effect of Age on Conventions of Print Posttest Scores

Path *PostConv*	**Effect *PostConv***
Age•*PostConv*	-0.203
Age•*PreConv*•*PostConv*	-0.007
Age•Fabc•*PostConv*	0.012
Age•Sabc•*PostConv*	0.014
Age•Fabc•Sabc•*PostConv*	0.019
Total	-0.165

Effects are in metric of the variables.

Results 7

Total Effect of Age on on Meaning Posttest Scores

Path *PostMG*	Effect *PostMG*
Age•*PreMg*	-0.146
Age•*PreConv*•*PostMg*	-0.005
Age•Fabc•*PostMg*	0.007
Age•Sabc•*PostMg*	0.009
Age•Fabc•Sabc•*PostMg*	0.012
Total	-0.123

Effects are in metric of the variables.

Results 8

Total Effect on ELLM on Alphabet Posttest Scores

Path *PostAlpha*	**Effect *PostAlpha***
Status•*PostAlpha*	0.421
Status•Sabc•*PostAlpha*	0.403
Total	0.824
Effect Size	0.233

Effects are in metric of the variables.

Results 9

Total Effect on ELLM on Conventions of Print Posttest Scores

Path *PostConv*	**Effect *PostConv***
Status•Sabc•*PostConv*	0.102
Total	0.102
Effect Size	0.044

Effects are in metric of the variables.

Results 10

Total Effect on ELLM on Meaning Posttest Scores

Path *PostMg*	**Effect *PostMg***
Status•*PostMg*	0.460
Status•Sabc•*PostMg*	0.063
Total	0.523
Effect Size	0.255

Effects are in metric of the variables.

Conclusion

ML and MLR Estimators

- As ICC increases so does the MLR estimate of the treatment standard error. Where ICC is minimal, increase in treatment standard error is minimal.
- Use of MLR is recommended for nested data.

Conclusion 2

Score Metrics

- Number of correct items measures a different construct than the standardized number of correct items.
- Standardized scores answer research questions about program effectiveness in terms of improved ranking of raw scores relative to national normative samples. This process adjusts for normal maturation of children overtime.
- Raw scores answer research questions about program effectiveness in terms of increased ability to correctly respond to items on a test. Raw scores do not distinguish between improvement due to maturation and due to intervention.

Conclusion 3

Total Effect of Age

The positive direct and indirect effects of age on the Fabc and Sabc scores mediate the negative direct effect of age:

- 67% on the Alphabet posttest scores.
- 19% on the Conventions of Print posttest scores.
- 16% on the Meaning posttest scores.

Implications of the Study

Standardized Scores and Academically At-Risk Preschool Children

1. In randomized clinical trials studying the effectiveness of interventions, either standardized or raw scores can be used; however, statistical models should control for age.
2. Standardized scores provide useful information to program developers.

Implications of the Study 2

ELLM Theory of Action

Cluster analyses indicate that fall and spring alphabet letter knowledge have positive indirect and direct effects on children's posttest emergent literacy achievement scores.

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