Evaluating Intervention Programs across Multiple Outcomes: Multivariate Latent Growth Modeling Approaches

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Research Purpose

The current study evaluated five reading programs versus Business As Usual (BAU) for adolescent struggling readers (ASRs) using two multivariate latent growth modelling approaches.

- **Most intervention studies include multiple measures, but use univariate approaches to evaluate the treatment effects.**
  - It is unknown how the general literacy ability is influenced by the intervention.
  - It is also unknown the extent to which the intervention effects might be general versus specific.

Design of five program versions

Version	Monday	Tuesday	Wednesday	Thursday	Friday
Alternating	Comp-only	PD-only	PD-only	Comp-only	PD-only
Integrated	Comp-only	PD+Flu+Sp	PD+Flu+Sp	Comp-only	PD+Flu+Sp
PD-emphasis	PD-only	PD-only	Comp+Sp+Flu	PD-only	PD-only
Comp-emphasis	Comp-only	Comp-only	PD+Sp+Flu	Comp-only	Comp-only
	1st – 7 weeks	**2nd – 7 weeks**	**3rd – 7 weeks**	**4th – 7 weeks**	
Additive	PD-only	PD+Sp	PD+Flu+Sp	Comp+Flu+Sp	

Method

Participants

665 6th students were randomly assigned to one condition and received one year intensive reading instruction. 422 children were male. The mean age was 11.90 years old (SD = .66). They were tested three times per semester.

Measures

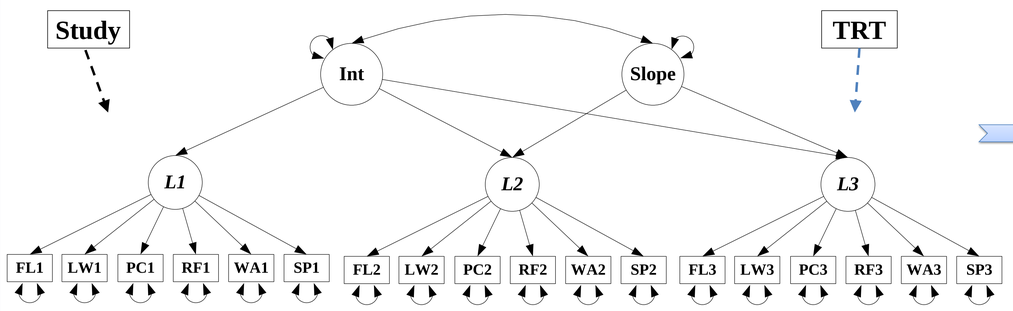
- **AIMSweb progress monitoring Oral Reading Fluency passages (FL)**
- **Five WJ-III measures:**
  - WJ-3 Letter-Word Identification (LW)
  - WJ-3 Reading Fluency (RF)
  - WJ-3 Spelling (SP)
  - WJ-3 Passage Comprehension (PC)
  - WJ-3 Word Attack (WA)

Study design

Study	Cohort	N	BAU	Additive	Alternating	Integrated	Comp-emphasis	PD-emphasis
1	1	38	20		18			
2	1	90		30	29	31		
3	1	47		23		24		
4	1	123	38				43	42
	2	120	34				37	49
5	1	98	24				38	36
	2	149	42				56	51
	Total	665	158	53	47	55	174	178

Results and Discussion

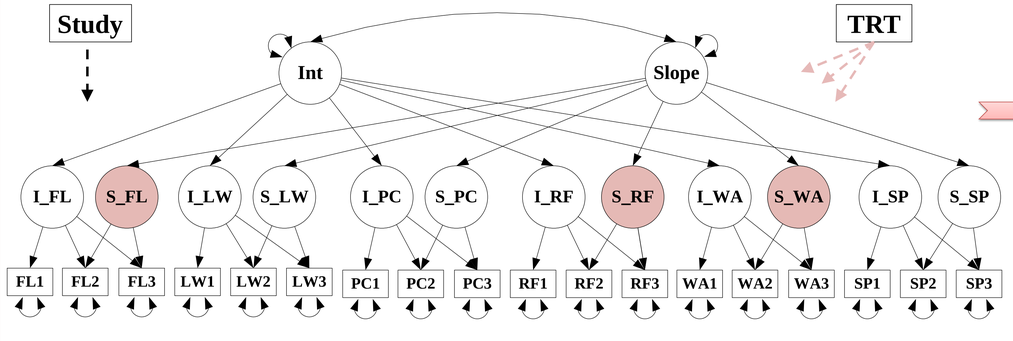
Curve of Factor Model (one factor that changes)



- ASRs had an integrated literacy system measured by these six tests.
- There was significant growth in the literacy ability, but little variability in the amount of change across students (see table below). Thus, it is not possible to fit an overall slope factor.

Est.	L1	L2	L3
L1	1		
L2	.99	1	
L3	.98	.99	1

Factor of Curve Model (several related processes)



- The second-order common slope factor failed to estimate due to little variation in slopes (zero in slopes of LW, PC & SP), as well as low and heterogeneous correlations among the other three slope factors.

Est.	S_FL	S_LW	S_PC	S_RF	S_WA	S_SP
S_FL	1					
S_LW	-	-				
S_PC	-	-	-			
S_RF	.23	-	-	1		
S_WA	.13	-	-	.43	1	
S_SP	-	-	-	-	-	-

Model fit indices

Model	χ^2	*df*	*CFI*	*TLI*	*RMSEA*	*BIC*
Unconditional CUFFS	997.59	138	.92	.91	.10	65940
Conditional CUFFS	1561.03	282	.89	.88	.08	65764
Unconditional FOCUS	424.41	114	.97	.96	.06	65523
Conditional FOCUS	756.84	207	.95	.93	.06	65447

Treatment effects

Both models show that the **PD-emphasis** and **Comp-emphasis** versions did not have any treatment effects.

Curve of Factor Model

The **Additive**, **Integrated**, and **Alternating** versions showed significant treatment effects on the literacy ability, with greater effect for the Additive version.

Factor of Curve Model

The treatment effects were only shown in **work attack** and two **fluency** measures, with greater effect in work attack.

Version	Literacy 3	Slope: FL: AIMSweb	Slope: RF: WJ Fluency	Slope: Word Attack
	Curve of Factor Model	Factor of Curve Model		
Additive	**.15***	**.16***	**.18***	**.69***
Integrated	**.13***	**.19***	**.17***	**.48***
Alternating	**.11***	.06	.08	**.39***
Comp-emphasis	-.01	.04	.09	.16
PD-emphasis	-.01	-.04	.07	.13