

Effects of the Cognitive Load-Managed Handwriting Program (CLM-Handwriting) on Handwriting Legibility among Students with Learning Disabilities

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Introduction & Aim

Handwriting in the Digital Age

Despite growing digitization, handwriting remains critical across educational systems.

Why This Study?

This study developed and evaluated Cognitive Load Managed Handwriting Program (CLM-Handwriting) — a Cognitive Load Theory-informed handwriting intervention for students with learning disabilities

The Challenge for Students with LDs

Students with learning disabilities face persistent deficits in fine motor control, visual-motor integration, working memory, and processing speed.

Cognitive Load & Handwriting

When automaticity is absent, working memory is consumed by letter mechanics, leaving little capacity for ideas, spelling, or composition.

Study Objective

To evaluate effects of CLM-Handwriting on handwriting legibility of students with LDs.

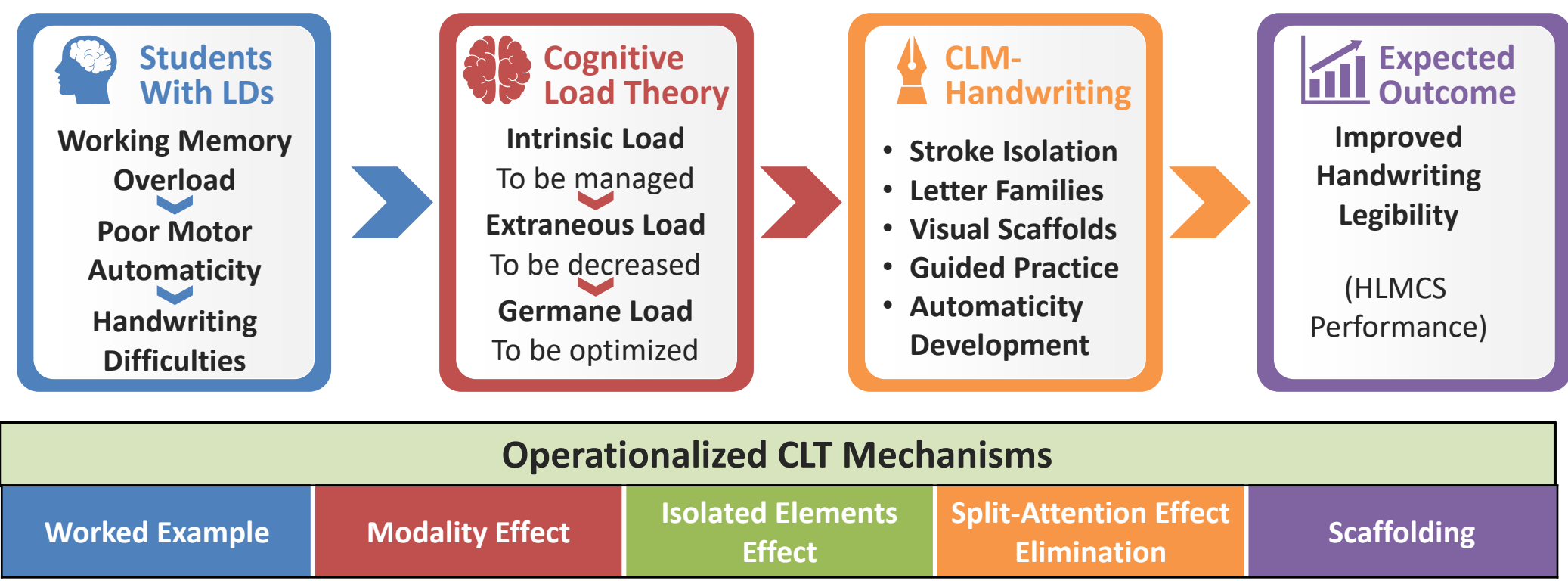
Null Hypothesis

CLM-Handwriting does not improve handwriting legibility of students with LDs.

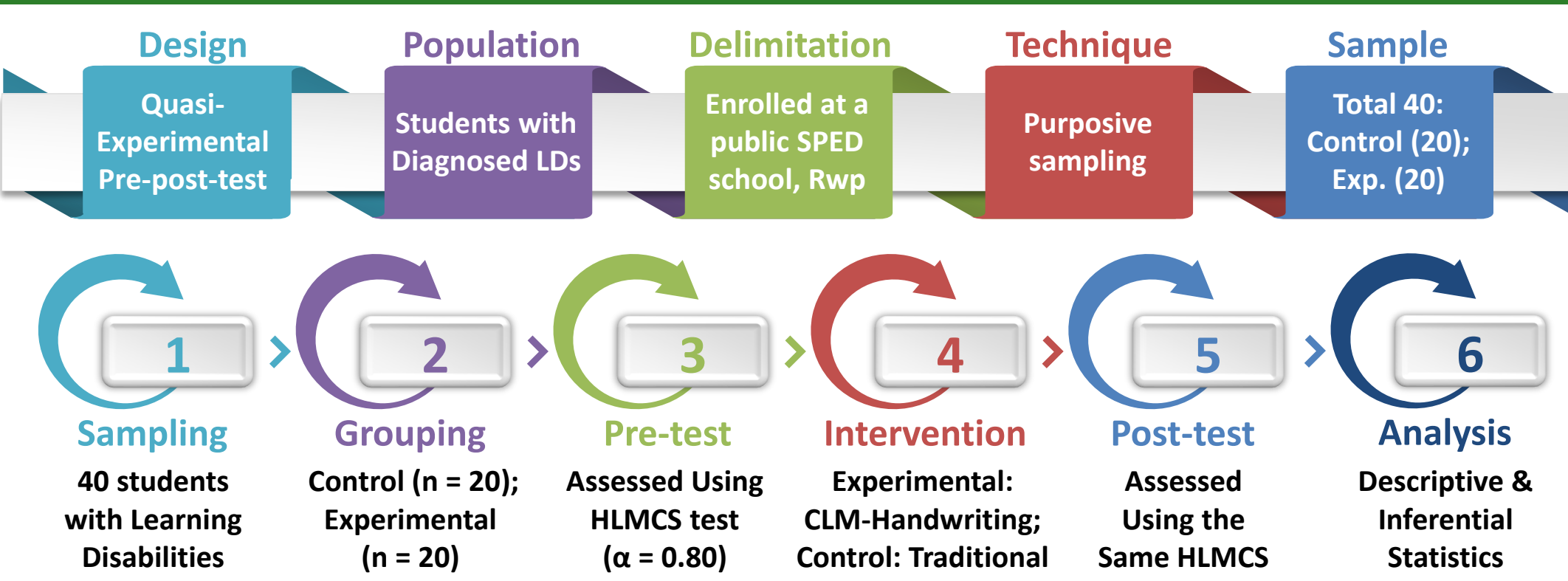
Alt. Hypothesis

CLM-Handwriting significantly improves handwriting legibility of students with LDs.

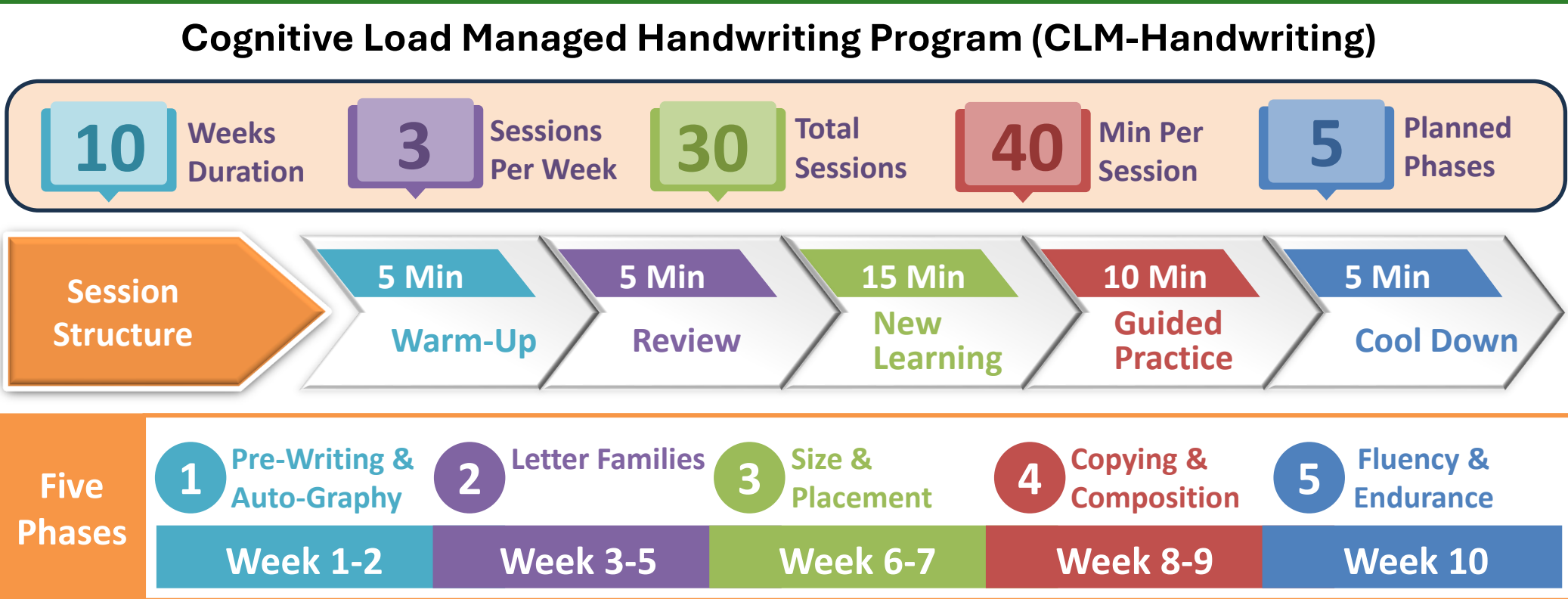
Theoretical Framework



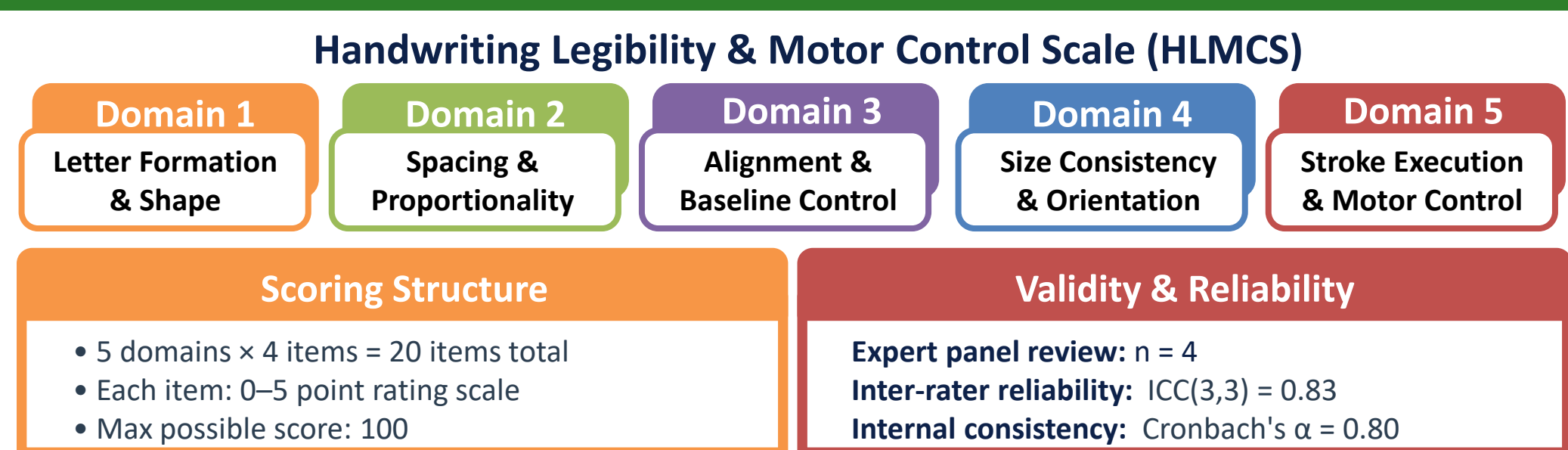
Methodology



Intervention



Instrumentation



Data Analysis

Descriptive Statistics					
Variable	n	M	Med	SD	Var
Control – Pretest	20	38.45	39.50	4.24	17.94
Control – Posttest	20	38.55	39.50	3.82	14.57
Experimental – Pretest	20	38.50	39.00	3.62	13.10
Experimental – Posttest	20	41.75	41.50	2.93	8.62

Shapiro-Wilk Normality Test

Variable	W	p	Interpretation
Control – Pretest	0.92	0.10	Normally distributed
Control – Posttest	0.93	0.17	Normally distributed
Experimental – Pretest	0.98	0.91	Normally distributed
Experimental – Posttest	0.96	0.55	Normally distributed

Levene's Test (Homogeneity of Variance)

Comparison	F	p	Interpretation
Pretest (Con vs Exp)	0.43	0.52	Equal variances
Posttest (Con vs Exp)	0.74	0.39	Equal variances

Hypothesis Testing (t-Tests)

Group	Test Statistic	p-value	Interpretation
Baseline (Pretest)	$t(38) = -0.04$	$p = .97$	No Significant differences.
Control Group	$t(19) = -0.28$	$p = .79$	Negligible improvement.
Experimental Group	$t(19) = -4.33$	$p < .001$	Significant improvement.
Posttest Comparison	$t(38) = -2.97$	$p < .001$	Significant Posttest Difference.

Effect Sizes (Cohen's d)

- $d = 0.97$ Within-Group (Experimental) - Large Effect
- $d = 0.94$ Between-Group (Posttest) - Large Effect

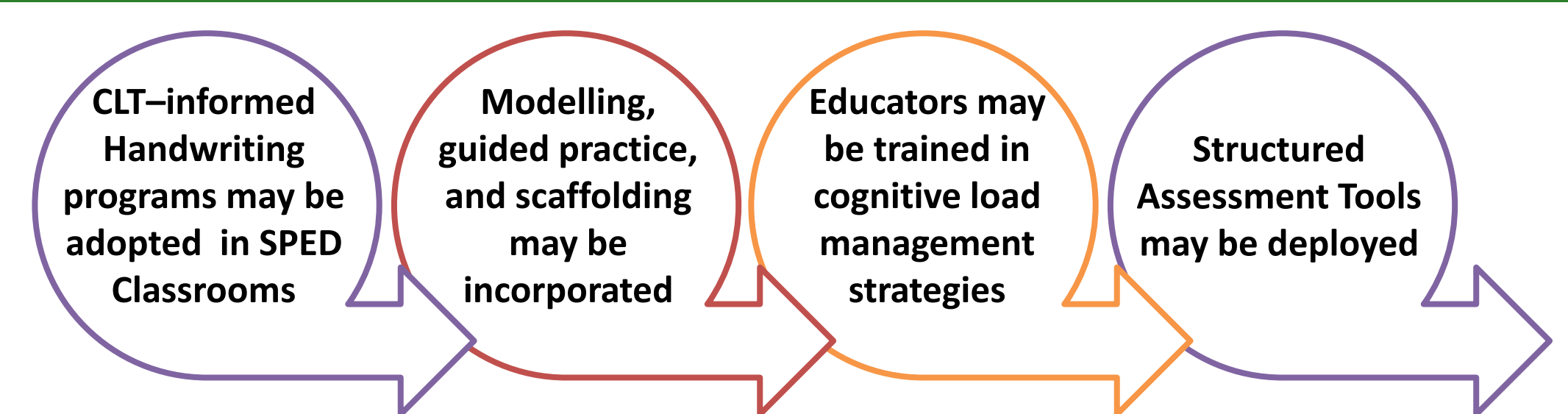
ANCOVA Results

Source	df	F	p	η ²
Group	1	19.40	< .001	0.34
Pretest (Covariate)	1	48.22	< .001	0.56
Error	37	—	—	—

Results & Discussion

- H₀ Rejected:** Significant between-group difference at posttest. CLM-Handwriting group outperformed control.
- CLT Mechanism:** Structured phases, guided practice, and scaffolding; reduced cognitive overload and promoted automaticity.
- Literature Consistency:** Results align with studies on structured handwriting interventions, explicit modelling, and scaffolding.
- Practical Value:** Large effect sizes confirm educationally meaningful, not just statistically significant, improvement.

Implications & Recommendations



Limitations & Future Research

Limitations:

- Small sample size (n = 40)
- Single school site
- Short intervention duration
- Researcher as instructor

Future Research:

- Larger, multi-site samples
- Diverse educational settings
- Extended intervention durations
- Multiple independent instructors