KENT STATE
U N I V E R S I T Y

IMSE Orton-Gillingham Teacher Professional Development Program: Evaluation Findings Report

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Introduction

        The Institute for Multi-sensory Education (IMSE) contracted with the Research and Evaluation Bureau at Kent State University to assess the impact of the Orton-Gillingham (OG) multi-sensory teaching method, as taught by IMSE, on early elementary school students. As such, a quasi-experimental research study was conducted that adhered to the established evidence standards and procedures of the Every Student Succeeds Act (ESSA), conforming to ESSA's standards for moderate evidence.[1] The research findings suggest that IMSE's OG teacher professional development program contributed to improved student reading achievement in grades 1-3 based on 2021-2022 academic year data. Specifically, statistically significant differences in adjusted oral reading fluency scores between treatment and control student groups were identified at each grade.

        The goal of the research was to develop and implement a research model in accordance with ESSA standards which could be replicated in multiple diverse settings and conditions to identify the effectiveness of IMSE OG teacher training in improving student learning. The overarching research question was, "Do students taught by IMSE OG-trained teachers experience differential growth in reading from fall (baseline) to spring?" This report describes the IMSE OG study, including research background, methodology, findings, assumptions, and limitations.

Background

        The IMSE OG study utilized a quasi-experimental research design to compare treatment and control group students in first, second, and third grades on fall and spring oral reading fluency (ORF). Oral reading fluency is a common and reliable indicator of student reading ability.[2] Research has indicated that ORF is a strong predictor of student reading comprehension and other literacy skills. Oral reading fluency, this study's dependent variable, was measured by the AIMSweb® reading benchmark assessment. The study duration, from the fall of 2021 testing administration to the spring of 2022 testing administration, exceeded 30 weeks, thereby surpassing ESSA's inclusion criterion of a minimum of 12 weeks.

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[1] U.S. Department of Education. (2016). Every Student Succeeds Act: Using evidence to strengthen education investments. Retrieved from https://www2.ed.gov/policy/elsec/leg/essa/guidanceuseseinvestment.pdf

[2] Hasbrouck, J. & Tindal, G. (2017). An update to compiled ORF norms (Technical Report No. 1702). Eugene, OR, Behavioral Research and Teaching, University of Oregon. Retrieved from https://files.eric.ed.gov/fulltext/ED594994.pdf

Participating students were enrolled in elementary schools from two school districts in Michigan. These school districts were identified by the IMSE administrative team, herein referred to as the treatment district and the control district. After training all elementary teachers in the treatment district, IMSE collaborated with the research team to identify an appropriate control group. The treatment district consisted of students who were taught during the 2021-2022 academic year by teachers trained in IMSE OG methods. The control district consisted of students who were taught during the 2021-2022 academic year by teachers who were not trained in IMSE OG methods. The treatment district contained two elementary schools and included seven first grade, six second grade, and six third grade classroom teachers. The control district was composed of three elementary schools and included thirteen first grade, twelve second grade, and twelve third grade teachers. Both school districts used their customary grade level and school district practice and policy prior to the start of the study to assign students to classrooms. There was no knowledge of, nor consideration given to, creating a priori treatment or control group classrooms in either district. Table 1 provides a summary of the study sample at baseline prior to attrition, disaggregated by district and grade.

Table 1. *Study Sample at Baseline*

Grade	Number of Students		
	Treatment District (across 2 schools)	Control District (across 3 schools)	Total by Grade
1	168	237	405
2	148	233	381
3	146	251	397
Total by District	462	721	1,183

Methodology

The IMSE administrative team identified school districts that were potentially comparable to the treatment district. These districts contained teachers who were not trained in IMSE OG and which had administered the same benchmarking assessment as the treatment district, namely AIMSweb. The research team, in collaboration with IMSE, reviewed potential districts to include

in the study as a control. The control district was ultimately selected based on its comparability with the treatment district regarding the following characteristics:

- Percentage of students classified by the State of Michigan as economically disadvantaged (Treatment=22.3%; Control=21.3%)[3]
- Percentage of students on Individualized Education Plans (Treatment=11.7%; Control=12.2%)[4]
- Percentage of students identified as English Learners (Treatment=<1%; Control=<2%)[5]
- District typology (Treatment=Rural: fringe; Control=Suburb: large)[6]

AIMSweb ORF baseline data from both districts were then compared disaggregated by grade level. Initial equivalency of the district data was confirmed with an independent samples t-test as well as meeting the ESSA guideline that the group differences on average baseline ORF scores did not exceed 25% of a standard deviation for any grade level. Table 2 presents an overview of these findings.

Table 2. *Baseline Equivalence Prior to Attrition*

Grade	t-test Results	Treatment	Control
1	$t(385.71) = 1.69$, $p = .093$	N=164 Mean=20.41 SD=22.56	N=229 Mean=24.72 SD=28.05
2	$t(367) = -0.62$, $p = .536$	N=145 Mean=61.25 SD=34.27	N=224 Mean=58.91 SD=36.09
3	$t(379) = .320$, $p = .749$	N=143 Mean=77.28 SD=38.54	N=238 Mean=78.64 SD=41.09

[3] Michigan Department of Education https://www.mischooldata.org/dashboard/

[4] Bridge Michigan News https://www.bridgemi.com/talent-education/special-education-searchable-list

[5] National Center for Educational Statistics https://nces.ed.gov/

[6] National Center for Educational Statistics https://nces.ed.gov/

Baseline equivalence remained within the threshold at the conclusion of the study after attrition. Attrition was minimal, and there was no attrition in second grade. These findings are illustrated in Table 3.

Table 3. *Baseline Equivalence Following Attrition*

Grade	t-test Results	Treatment	Control
1	$t(385.17) = 1.72$, $p = .086$	N=164 Mean=20.41 SD=22.56	N=228 Mean=24.82 SD=28.07
2		No attrition	
3	$t(376) = .299$, $p = .765$	N=142 Mean=77.80 SD=38.16	N=236 Mean=79.07 SD=40.96

Program Delivery Method

The treatment group utilized IMSE's Orton-Gillingham Plus (OG+) program. IMSE OG+ provides teachers with an early literacy curriculum with a scope and sequence, 30 hours of structured literacy professional development, a teacher guide and student workbooks, plus extensive additional classroom resources. Teachers are taught during the professional development about the science of reading, the Orton-Gillingham approach, and how to incorporate a structured literacy program in their classrooms. The key components of OG+ include curricula, instructional strategies, teacher professional development, teacher coaching, teacher advising and mentoring, specialized courses, and other activities or strategies as needed.

The treatment group received no additional coaching, advising, mentoring, or specialized courses beyond what is included routinely in the IMSE OG+ professional development course. The control district was not exposed to the IMSE OG+ process; reading was taught across the district according to the district's typical methods. The treatment was implemented by means of whole class delivery of the IMSE OG+ curriculum for the duration of the 2021-2022 school year. The intended and actual dosage of the intervention was the same – specifically, a minimum of 30 minutes a day, five times a week.

The resources needed to implement the intervention include the IMSE OG+ Teacher Guides, which general education classroom teachers receive during their IMSE OG+ professional development. IMSE OG+ Professional Development costs $1500 and includes the following materials for teachers to use with implementation of the curriculum:

- Training and Assessment Manual by the Institute for Multi-Sensory Education
- IMSE's Comprehensive OG Plus Teacher's Guides (K-2)
- IMSE's Comprehensive OG Plus Spelling Teacher's Guide (3rd Grade Plus)
- Interventions for All: Phonological Awareness by Yvette Zgonc
- Syllable Division Word Book by the Institute for Multi-Sensory Education
- Phoneme/Grapheme Card Pack by the Institute for Multi-Sensory Education
- Syllable Division Posters by the Institute for Multi-Sensory Education
- Comprehensive OG Plus Practice Packet
- Decodable Readers Sets 1-3 (PDF)
- Asynchronous Fluency, Vocabulary, Comprehension webinar with digital practice packet
- IMSE Blending Board
- Procedural Routine Flip Chart
- Access to IMSE's Interactive OG 2.0
- Access to IMSE's Resource Portal

The use of IMSE's lesson planning app, Interactive OG 2.0, is not required to implement the program; however, it is a helpful tool for teachers to use to make lessons. Interactive OG 2.0 requires access to a computer.

Findings

Analyses of covariance (ANCOVA) were conducted separately at each grade level to identify evidence of the impact of IMSE OG teacher professional development training on student achievement by comparing the relative growth of students of IMSE OG-trained teachers (treatment group) with those of non-IMSE OG-trained teachers (control group). Growth was defined as achievement on the spring ORF scores (dependent variable) after controlling for differences in the fall ORF scores (baseline). To account for clustering of students nested within teacher classroom, the proposed analysis included teacher experience, as defined by number of years teaching, as a

covariate. In addition, to account for potential dosage issues and to assure that students received sufficient reading instruction throughout the school year, student attendance (i.e., number of absences) was also proposed to be included as a covariate. Tables 4-6 (one for each grade level) present the descriptive statistics for all variables proposed in the study disaggregated at the teacher level, including the student sample post-attrition. Tables 7-9 present the intercorrelations between the proposed study variables.

Table 4. *Descriptive Statistics for Grade 1*

Group	School	Teacher: Years Experience	Number of Students	Absences M (SD)	ORF Fall M (SD)	ORF Spring M (SD)
Control		1: 3 years exp	2	28.50 (15.556)	0.00 (.000)	0.00 (.000)
		2: 2 years exp	21	17.50 (9.831)	25.86 (27.211)	51.29 (35.445)
		3: 2 years exp	21	12.29 (6.976)	29.19 (30.354)	57.29 (41.419)
	A	4: 6 years exp	22	17.50 (17.018)	24.14 (26.950)	49.14 (41.372)
		5: 1 year exp	1	9.00 (-)	75.00 (-)	106.00 (-)
		SCHOOL TOTAL Mean = 2.80 years exp (SD = 1.924)	67	16.07 (12.295)	26.30 (28.211)	51.76 (39.768)
		1: 10 years exp	22	17.16 (16.243)	23.00 (20.104)	64.95 (32.205)
		2: 2 years exp	22	10.18 (5.666)	24.05 (23.728)	65.18 (34.630)
		3: 1 year exp	6	8.75 (4.132)	13.83 (7.910)	42.17 (17.543)
	B	4: 18 years exp	22	18.89 (10.438)	39.45 (39.913)	77.09 (44.766)
		SCHOOL TOTAL Mean = 7.75 years exp (SD = 7.932)	72	14.85 (11.728)	27.58 (28.839)	66.83 (36.903)
		1: 20 years exp	20	14.10 (13.738)	20.20 (23.797)	41.60 (34.411)
		2: 10 years exp	23	18.41 (10.763)	25.57 (31.367)	56.65 (39.976)
		3: 20 years exp	23	18.52 (11.165)	17.39 (18.138)	42.30 (27.299)
	C	4: 15 years exp	23	18.65 (12.243)	22.52 (33.777)	48.35 (39.153)
		SCHOOL TOTAL Mean = 16.25 years exp (SD = 4.787)	89	17.53 (11.908)	21.46 (27.296)	47.42 (35.521)
		GROUP TOTAL Mean = 8.46 years exp (SD = 7.512)	228	16.26 (11.968)	24.82 (28.069)	54.82 (38.012)

Group	School	Teacher: Years Experience	Number of Students	Absences M (SD)	ORF Fall M (SD)	ORF Spring M (SD)
Treatment	A	1: 26 years exp	27	15.37 (7.525)	12.67 (11.066)	62.22 (27.247)
		2: 22 years exp	26	14.08 (8.953)	21.42 (21.964)	59.23 (33.259)
		3: 27 years exp	28	16.61 (7.862)	17.75 (20.538)	61.18 (27.058)
		SCHOOL TOTAL Mean = 25.00 years exp (SD = 2.646)	81	15.38 (8.086)	17.23 (18.595)	60.90 (28.907)
	B	1: 15 years exp	25	13.72 (7.602)	25.44 (28.049)	67.08 (43.064)
		2: 15 years exp	24	17.42 (7.575)	23.17 (26.542)	65.96 (33.146)
		3: 30 years exp	23	14.87 (7.689)	26.30 (26.981)	66.96 (32.602)
		4: 1 year exp	11	13.18 (7.360)	14.00 (11.498)	34.82 (24.677)
		SCHOOL TOTAL Mean = 15.25 years exp (SD = 11.843)	83	15.04 (7.625)	23.51 (25.589)	62.45 (36.450)
		GROUP TOTAL Mean = 19.43 years exp (SD = 9.981)	164	15.21 (7.834)	20.41 (22.561)	61.68 (32.849)

Table 5. *Descriptive Statistics for Grade 2*

Group	School	Teacher: Years Experience	Number of Students	Absences M (SD)	ORF Fall M (SD)	ORF Spring M (SD)
Control		1: 24 years exp	21	11.69 (6.282)	58.86 (30.446)	96.81 (34.635)
		2: 16 years exp	21	10.91 (6.266)	52.62 (39.210)	104.10 (45.768)
	A	3: 2 years exp	22	14.75 (13.581)	62.23 (33.058)	100.91 (37.795)
		SCHOOL TOTAL Mean = 14.00 years exp (SD = 11.136)	64	12.48 (9.450)	57.97 (34.099)	100.61 (39.126)
		1: 2 years exp	10	3.40 (2.757)	72.00 (29.143)	106.70 (28.570)
		2: 2 years exp	21	15.62 (12.088)	52.14 (35.095)	90.00 (35.713)
		3: 2 years exp	20	12.80 (7.070)	67.80 (29.661)	111.30 (33.252)
	B	4: 23 years exp	23	14.17 (8.110)	54.48 (35.796)	88.74 (36.178)
		SCHOOL TOTAL Mean = 7.25 years exp (SD = 10.500)	74	12.76 (9.422)	59.78 (33.481)	97.62 (35.163)
		1: 5 years exp	20	15.70 (9.990)	59.30 (40.558)	89.55 (46.143)
		2: 4 years exp	2	18.75 (12.374)	3.50 (3.536)	5.00 (4.243)
		3: 10 years exp	23	15.59 (9.005)	67.35 (44.973)	99.04 (57.713)
	C	4: 9 years exp	22	14.00 (8.906)	63.09 (36.443)	102.91 (41.542)
		5: 2 years exp	19	15.97 (14.279)	49.05 (34.687)	84.42 (35.747)
		SCHOOL TOTAL Mean = 6.00 years exp (SD = 3.391)	86	15.37 (10.428)	58.86 (39.900)	92.41 (47.661)
		GROUP TOTAL Mean = 8.42 years exp (SD = 8.273)	224	13.68 (10.562)	58.91 (36.094)	96.47 (41.410)

Group	School	Teacher: Years Experience	Number of Students	Absences M (SD)	ORF Fall M (SD)	ORF Spring M (SD)
Treatment		1: 4 years exp	26	13.77 (9.518)	52.35 (29.155)	90.65 (29.694)
		2: 11 years exp	27	11.11 (6.818)	45.48 (27.157)	86.70 (33.212)
	A	3: 22 years exp	9	10.22 (6.833)	89.67 (33.952)	128.89 (24.441)
		SCHOOL TOTAL Mean = 12.33 years exp (SD = 9.074)	62	12.10 (8.075)	54.77 (32.160)	94.48 (33.430)
		1: 24 years exp	27	13.59 (13.098)	67.00 (42.091)	112.74 (45.721)
		2: 20 years exp	28	13.00 (8.219)	64.93 (34.324)	122.82 (49.200)
	B	3: 23 years exp	28	16.68 (14.129)	66.36 (29.560)	122.93 (31.595)
		SCHOOL TOTAL Mean = 22.33 years exp (SD = 2.082)	83	14.43 (12.043)	66.08 (35.187)	119.58 (42.560
		GROUP TOTAL Mean = 17.33 years exp (SD = 8.042)	145	13.43 (10.562)	61.25 (34.274)	108.85 (40.744)

Table 6. *Descriptive Statistics for Grade 3*

Group	School	Teacher: Years Experience	Number of Students	Absences M (SD)	ORF Fall M (SD)	ORF Spring M (SD)
Control		1: 23 years exp	24	13.02 (6.114)	70.62 (42.216)	109.83 (48.488)
		2: 18 years exp	25	13.92 (8.479)	69.84 (39.368)	104.52 (33.148)
	A	3: 10 years exp	23	14.11 (12.456)	72.13 (37.776)	120.00 (36.289)
		SCHOOL TOTAL Mean = 17.00 years exp (SD = 6.557)	72	13.68 (9.204)	70.83 (39.389)	111.24 (39.781)
		1: 15 years exp	19	16.58 (22.919)	110.05 (50.758)	141.05 (36.691)
		2: 3 years exp	23	9.87 (6.742)	80.39 (35.540)	111.26 (35.122)
		3: 22 years exp	19	12.87 (7.808)	77.05 (31.106)	115.58 (29.880)
	B	4: 4 years exp	21	11.41 (6.559)	89.86 (42.267)	115.10 (36.832)
		5: 2 years exp	8	6.50 (4.276)	96.13 (26.454)	121.75 (18.858)
		SCHOOL TOTAL Mean = 9.20 years exp (SD = 8.871)	90	11.98 (12.228)	89.56 (40.425)	120.29 (35.515)
		1: 17 years exp	23	12.70 (6.552)	75.17 (39.060)	104.65 (34.584)
		2: 4 years exp	2	13.50 (8.485)	49.00 (69.296)	56.50 (79.903)
		3: 1 year exp	24	17.08 (8.201)	71.92 (45.582)	106.92 (40.691)
	C	4: 5 years exp	25	12.70 (8.809)	77.92 (37.777)	103.40 (35.568)
		SCHOOL TOTAL Mean = 6.75 years exp (SD = 7.042)	74	14.14 (8.053)	74.34 (40.909)	103.66 (38.082)
		GROUP TOTAL Mean = 10.33 years exp (SD = 8.206)	236	13.18 (10.163)	79.07 (40.957)	112.31 (38.139)

Group	School	Teacher: Years of Experience	Number of Students	Absences M (SD)	ORF Fall M (SD)	ORF Spring M (SD)
Treatment		1: 16 years exp	25	17.88 (8.507)	84.00 (38.820)	115.08 (29.442)
		2: 2 years exp	25	16.60 (6.696)	78.84 (39.062)	115.60 (42.783)
	A	3: 22 years exp	17	9.65 (6.623)	83.35 (25.325)	120.41 (20.171)
		SCHOOL TOTAL Mean = 13.33 years exp (SD = 10.263)	67	15.31 (8.040)	81.91 (35.554)	116.63 (32.931)
		1: 30 years exp	28	13.00 (5.913)	77.79 (43.854)	113.04 (42.691)
		2: 28 years exp	24	13.13 (6.543)	78.04 (43.212)	130.71 (44.035)
	B	3: 20 years exp	23	12.87 (7.143)	65.61 (31.970)	106.30 (32.896)
		SCHOOL TOTAL Mean = 26.00 years exp (SD = 5.292)	75	13.00 (6.422)	74.13 (40.231)	116.63 (41.130)
		GROUP TOTAL Mean = 19.67 years exp (SD = 10.073)	142	14.09 (7.297)	77.80 (38.162)	116.63 (37.356)

Table 7. *Pearson Correlations among Proposed Study Variables for Grade 1 (n = 392)*

	Spring ORF	Fall ORF	Teacher Experience (years)	Student Absences
Spring ORF	-			
Fall ORF	.808***	-		
Teacher Experience (years)	.079	-.055	-	
Student Absences	-.084	-.051	.053	-

***p < .001

Table 8. *Pearson Correlations among Proposed Study Variables for Grade 2 (n = 369)*

	Spring ORF	Fall ORF	Teacher Experience (years)	Student Absences
Spring ORF	-			
Fall ORF	.888***	-		
Teacher Experience (years)	.168**	.076	-	
Student Absences	-.035	-.021	-.014	-

**p < .01
***p < .001

Table 9. *Pearson Correlations among Proposed Study Variables for Grade 3 (n = 378)*

	Spring ORF	Fall ORF	Teacher Experience (years)	Student Absences
Spring ORF	-			
Fall ORF	.895***	-		
Teacher Experience (years)	.057	-.035	-	
Student Absences	-.092	-.105*	-.024	-

*p < .05
***p < .0

Of greatest concern to the research question was that fall ORF was a significant covariate in the model. It is the growth from fall scores to spring scores which is of primary concern to this study, particularly the differential growth of the two instructional groups. Testing confirmed that using fall ORF as a covariate met all assumptions for every grade level.

Conversely, although teacher experience and student absences were proposed as potential covariates, initial analyses revealed that a number of ANCOVA assumptions were violated for both of these covariates at each grade level. In grade 1, using teacher experience as a covariate violated the assumptions of 1) a linear relationship between teacher experience and spring ORF scores and 2) independence of teacher experience and treatment group. Also, in grade 1, using student absences as a covariate violated the assumptions of 1) a linear relationship between student absences and spring ORF scores and 2) homogeneity of regression slopes. In grade 2, using teacher experience as a covariate violated the assumptions of 1) homogeneity of regression slopes and 2) independence of teacher experience and treatment group. Also, in grade 2, using student absences as a covariate violated the assumption of a linear relationship between student absences and spring ORF scores. In grade 3, using teacher experience as a covariate violated the assumptions of 1) a linear relationship between teacher experience and spring ORF scores and 2) independence of teacher experience and treatment group. Lastly, in grade 3, using student absences as a covariate violated the assumption of a linear relationship between student absences and spring ORF scores. Appendix A presents a detailed summary of the assumption testing.

The assumption violations supported the removal of student absences as a covariate from all grade-level analyses and the removal of teacher experience as a covariate in the analyses for grades 1 and 3. If these covariates were retained in the ANCOVA, interpreting results would be unreliable for grades 1 and 3. However, teacher experience was retained as a covariate in the analysis for grade 2 based on the significant relationship between teacher experience and spring ORF scores. Given that the assumption of homogeneity of regression slopes was still violated, the interpretation of these results is limited at this grade level.

The analyses for the final models consisted of a series of one-way ANCOVAs, one for each grade level. Fall ORF was the single covariate in grades 1 and 3, while fall ORF and teacher experience were the two covariates for grade 2. The independent variable in all analyses was instructional group: treatment vs. control. The dependent variable was the spring ORF.

The findings for the analyses in grades 1 and 3 suggest that IMSE OG teacher-training contributes to student growth on oral reading fluency. For grade 1, Table 10 presents the descriptive statistics for both instructional groups on ORF scores, and Table 11 presents the results of the ANCOVA. For grade 3, Table 12 presents the descriptive statistics for both instructional groups on ORF scores, and Table 13 presents the results of the ANCOVA. These results indicate that the treatment group scored significantly higher on spring ORF while controlling for fall ORF, demonstrating that the treatment group for both grades 1 and 3 grew at a significantly higher rate.

The findings for grade 2 further support the interpretation that IMSE OG training for teachers contributed to differential student growth over the school year in a two-covariate model, when also controlling for teacher experience. Table 14 presents the descriptive statistics and Table 15 presents the results of this ANCOVA. These combined results support the hypothesis that students of IMSE OG-trained teachers perform better in reading, and that IMSE OG training does, indeed, positively impact student reading learning.

Table 10. *Unadjusted and Covariate-Adjusted Descriptive Statistics for Grade 1*

Instructional Groups	Fall ORF scores		Unadjusted Spring ORF Scores		Covariate-Adjusted Spring ORF Estimates*	
	Mean	SD	Mean	SD	Mean	Standard Error
Treatment (n=164)	20.41	22.56	61.68	32.85	64.61	1.60
Control (n=228)	24.82	28.07	54.82	38.01	52.72	1.36

* Covariates appearing in the model are evaluated at the following value: ORF Fall = 22.97

Table 11. *Between-Subjects Effects on Oral Reading Fluency Spring Scores for Grade 1*

Source	Df	Mean Square	F	Sig	Partial Eta Squared
Covariate					
Fall ORF	1	340669.15	811.91	<.001	0.68
Factor					
Instructional Group	1	13380.81	31.89	<.001	0.08
Error	389	419.59			

*R Squared = .679 (Adjusted R Squared = .677)

Table 12. *Unadjusted and Covariate-Adjusted Descriptive Statistics for Grade 3*

Instructional Groups	Fall ORF scores		Unadjusted Spring ORF Scores		Covariate-Adjusted Spring ORF Estimates*	
	Mean	SD	Mean	SD	Mean	Standard Error
Treatment (n=142)	77.80	38.16	116.63	37.36	117.30	1.41
Control (n=236)	79.07	40.96	112.31	38.14	111.91	1.09

* Covariates appearing in the model are evaluated at the following value: ORF Fall = 78.33

Table 13. *Between-Subjects Effects on Oral Reading Fluency Spring Scores for Grade 3*

Source	df	Mean Square	F	Sig	Partial Eta Squared
Covariate					
Fall ORF	1	433511.31	1547.10	<.001	.81
Factor					
Instructional Group	1	2577.39	9.20	.003	.02
Error	375	280.21			

*R Squared = .805 (Adjusted R Squared = .804)

Table 14. *Unadjusted and Covariate-Adjusted Descriptive Statistics for Grade 2*

Instructional Groups	Fall ORF scores		Unadjusted Spring ORF Scores		Covariate-Adjusted Spring ORF Estimates*	
	Mean	SD	Mean	SD	Mean	Standard Error
Treatment (n=145)	61.25	34.27	108.85	40.74	106.01	1.63
Control (n=224)	58.91	36.09	96.47	41.41	98.31	1.28

* Covariates appearing in the model are evaluated at the following values: ORF Fall = 59.83, Teaching Experience = 12.30

Table 15. *Between-Subjects Effects on Oral Reading Fluency Spring Scores for Grade 2*

Source	df	Mean Square	F	Sig	Partial Eta Squared
Covariates					
Fall ORF	1	489246.80	1446.14	<.001	0.80
Teacher Experience	1	2054.66	6.07	.014	0.02
Factor					
Instructional Group	1	4292.20	12.69	<.001	0.03
Error	366	343.00			

*R Squared = .806 (Adjusted R Squared = .804)

Assumptions and Limitations

        The following assumptions are relevant when considering the study findings. First, it was assumed that the AIMSweb assessment process in both school districts and in all participating classrooms, specifically for measuring student oral reading fluency, was implemented as prescribed by the test manufacturer. Second, it was assumed that teachers in the treatment district implemented IMSE OG teaching methods and strategies with fidelity, thereby maximizing program impact on participating elementary school students. Lastly, it was assumed that data provided by both school districts were accurate and complete.

        A limitation of the study is that the study findings are based solely on assessment data for the 2021-2022 academic year. It is possible that the consideration of longitudinal data could contribute to a deeper understanding of the effects of IMSE OG training on student learning. Additionally, in an effort to account for student clustering within classrooms, teacher experience was utilized as the sole measure of teacher characteristics. Inclusion of additional teacher-level characteristics might contribute to the model. Similarly, additional student-level variables could also contribute to the model.

        Another limitation of the study is the removal of the proposed covariates based on assumption violations. Primarily, the findings are limited by the fact that teacher experience was not uniform between student groups. Specifically, teachers from the treatment district possessed significantly more years of teacher experience, on average, than teachers from the control district. However, neither the IMSE administrative team nor the research team intended for the districts to be disparate; this was not a methodological design. Notwithstanding this difference, correlations between teacher experience and spring ORF scores were minimal, accounting for a negligible amount of variance in grades 1 and 3. Even in grade 2, where the Pearson correlation was significant, the relationship was weak at best.

Conclusions

        Findings from the IMSE Orton-Gillingham teacher professional development study suggest that training teachers in IMSE OG methods contributes to positive and improved student reading fluency in early readers in grades 1-3. Specifically, the findings indicated that students taught by teachers trained in IMSE OG demonstrated significantly higher spring oral reading fluency, while controlling for fall oral reading fluency (and teacher experience where relevant),

when compared to students taught by non-IMSE OG teachers. These results support the hypothesis that students of IMSE OG trained teachers perform better in reading than students of teachers not trained in IMSE OG methods, and that IMSE OG training positively impacts student reading learning.

Appendix A. *Summary of Analysis of Covariance (ANCOVA) Assumptions Testing*

Assumption	Covariate	Analysis	Grade		
			1st	2nd	3rd
Dependent variable normally distributed	N/A	Shapiro-Wilk	Violated	Met	Met
Linear relationship between covariate and dependent variables	ORF Fall (baseline)	Linear curve estimate	Met	Met	Met
	Teacher Experience		Violated	Met	Violated
	Student Absences		Violated	Violated	Violated
Homogeneity of regression slopes	ORF Fall (baseline)	One-way ANCOVA interaction design	Met	Met	Met
	Teacher Experience		Met	Violated	Met
	Student Absences		Violated	Met	Met
Independent variable (treatment) and covariant independence	ORF Fall (baseline)	One-way ANOVA	Met	Met	Met
	Teacher Experience		Violated	Violated	Violated
	Student Absences		Met	Met	Met
Homogeneity of variance (dependent variable)	N/A	Levene's test	Met	Met	Met