Using Computer-Adaptive Curriculum to Improve Outcomes on the New Mexico MSSA ELA Assessment

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Executive Summary

Istation is an integrated learning system that is used by millions of students in school districts throughout the United States. It provides computerized adaptive testing used for universal screening or progress monitoring, reports for teachers and parents that are used to inform instruction, and an adaptive supplemental curriculum.

Istation recommends that students use the program 30–40 minutes per week to increase their achievement in reading. Previous research with the Istation Reading curriculum demonstrated that students' Istation usage led to increased achievement in reading. This research evaluates whether Istation usage leads to academic growth on the New Mexico Measures of Student Success and Achievement (NM-MSSA) English Language Arts (ELA) assessment.

Using data from six school districts in the 2021–2022 school year, a hierarchical linear model was used to control for socioeconomic status at the school level and for ISIP level and usage at the student level. In fourth and fifth grades, results indicated that using Istation led to growth on the NM-MSSA ELA, as detailed below. The results for grade 3 were statistically not significant.

- Students in grade 3 who were in the third usage quintile (253–539 minutes per year) and students who were in ISIP level 3, 4, or 5 saw increases of approximately 4–6 points on the NM-MSSA ELA.
- Students in grade 4 who approached, met, or exceeded usage guidelines had scores 3–4 points higher on the NM-MSSA ELA than those who had less usage.
- Students in grade 5 who approached, met, or exceeded usage guidelines had scores that were approximately 4–6 points higher on the NM-MSSA ELA than those who had less usage.

These results demonstrate that using Istation based on the recommended usage guidelines helps student achievement in reading as measured by the NM-MSSA ELA assessment.

Introduction

Istation's Indicators of Progress (ISIP™) Reading assessment measures a student's ability to read in English (Mathes et al., 2023). The assessment measures the essential skills that lead to literacy: phonemic awareness, alphabetic knowledge and skills, vocabulary, fluency, and comprehension. After students complete ISIP Reading, the system places them into Istation's interactive program. The adaptive reading curriculum in English provides students with engaging intervention lessons aimed at increasing student success in the classroom. The curriculum is cyclical and starts instruction with foundational skills for the alphabet, alphabetic principle, print awareness, and other basic skills supported by the science of reading. As students progress through the cycles of instruction, they encounter more difficult instructional materials.

Previous research with the Istation Reading curriculum demonstrated that Istation usage leads to increased achievement across several assessments including the Partnership for Assessment of Readiness for College and Careers (PARCC) (Cook & Ross, 2020), the North West Education Association Measures of Academic Progress (NWEA MAP®) (Cook & Ross, 2021), the Renaissance Star Assessment® (Luo et al., 2017), the Developmental Reading Assessment (2nd edition) (DRA2) (Putman, 2017), and the Idaho state assessment (The Idaho Standards Achievement Test (ISAT))(Cook & Ross, 2022).

To determine whether these results can be replicated for other state assessments, this research examines the findings from the quantitative analyses comparing students' Istation Reading curriculum usage time and performance on the New Mexico Measures of Student Success and Achievement (NM-MSSA) English Language Arts (ELA) assessment, which is the state testing program for students in grades 3 through 8.

These were the main research questions investigated:

1. Can using the Istation Reading curriculum improve NM-MSSA ELA scores?
2. Does Istation usage vary among schools?
3. Are there differences in NM-MSSA ELA scores based on Istation usage and socioeconomic status (SES)?

4. Are there differences in NM-MSSA ELA scores based on Istation usage and socioeconomic status (SES) after controlling for performance at the beginning of the year?

Methodology

Analytical Sample

The data for this analysis was obtained from six districts in New Mexico. This study focuses on grades 3 through 5. There was a total of 11,041 students. Tabel 1 shows the sample size by grade, whereas Table 2 shows the demographic characteristics of the sample.

Table 1

Sample Size by District and Grade

Grade	District A	District B	District C	District D	District E	District F	Combined
3	1,784	233	539	660	989	510	4,715
4	1,304	204	506	737	95	369	3,215
5	1,393	223	545	856	94		3,111

Table 2

Demographic Composition of Sample by District and Grade

District	N	Gender (M/F)	Black	Hispanic	White	All Other Races Combined
A	4,481	52%/48%	2%	50%	38%	9%
B	823	52%/48%	1%	64%	32%	3%
C	1,590	50%/50%	5%	44%	45%	6%
D	3,070	50%/50%	1%	90%	8%	3%
E	1,178	53%/47%	3%	44%	47%	5%
F	879	50%/50%	1%	51%	44%	5%

Measures

New Mexico MSSA ELA Assessment

The NM-MSSA ELA is a statewide computer-based summative assessment for English language arts administered at the end of grades 3 through 8. Items are aligned to the Common Core State Standards and are based on passages composed of literary and informational texts. Because they are a single measure taken at the conclusion of a

grade, NM-MSSA ELA scores should be interpreted and utilized alongside additional measures. Classroom summative and formative assessments in English language arts and interim assessments can provide important supplementary information.

The NM-MSSA ELA is designed to provide evidence that determines grade-level proficiency and progress toward college and/or career readiness.

ISIP Reading

ISIP Reading is a formative assessment and reading screener used by millions of students. It was authored by reading specialists Patricia Mathes, Joseph Torgesen, and Jeannine Herron as a way of providing teachers with assessment results that can be used to inform instruction. Based on the science of reading, it measures phonemic awareness, reading comprehension, listening comprehension, letter knowledge, alphabetic decoding, fluency, and spelling. ISIP Reading is computer adaptive and uses a two-parameter model to determine student scores (Mathes et al., 2022).

Curriculum Usage

Istation typically recommends that students who are at or below the 40th percentile of the normative sample on ISIP use the Istation curriculum for 40 minutes per week and that students who score above the 40th percentile use the curriculum for 30 minutes per week. For this study, usage quintiles were calculated by grade based on the actual usage within the sample. Quintile 1 represents the lowest usage, and quintile 5 represents the highest usage. A dummy variable was also created that placed students in quintiles 1 and 2 into the “Not Meeting Usage” category.

ISIP Level

Istation uses instructional levels to identify students potentially at risk of not meeting grade-level expectations in reading. Levels are determined by percentile ranks:

- Level 1: Students who score at or below the 20th percentile
- Level 2: Students at or above the 21st percentile but below the 41st percentile

- Level 3: Students at or above the 41st percentile but below the 61st percentile
- Level 4: Students at or above the 61st percentile but below the 81st percentile
- Level 5: Students at or above the 81st percentile

We included the ISIP level at the student level to control for performance at the beginning of the school year.

Socioeconomic Status

We defined socioeconomic status at the school level (level 2) by determining the percentage of students who were eligible for the free or reduced priced lunch (FRPL) program via data and categorizations from the National Center for Education Statistics (NCES). NCES divides the percentages into quartiles:

- SES 1 are high-poverty schools with 75% or more of the student body eligible for FRPL.
- SES 2 are mid-high poverty schools with 50% to 74.9% of students eligible for FRPL.
- SES 3 schools are mid- to low-poverty schools with 25% to 49.9% of students eligible for FRPL.
- SES 4 schools are low-poverty schools with less than 25% of students eligible for FRPL.

Analytic Approach

Given that the sample consisted of students who were nested in schools, we used a two-level hierarchical linear model (HLM) to explore the aforementioned research questions. HLM models are used to control for effects at the student level (Level 1) and clustering at the school level (Level 2). Within this framework, five nested models were tested. Model 1 is the baseline model that has no predictors, just the random effect for the intercept. Model 2 is an extension of Model 1 that includes fixed effects at Level 1 (usage). Model 3 is an extension of Model 2 that includes random slopes for Level 1.

Model 4 extends Model 3 by including the Level 2 fixed effects (SES). Lastly, Model 5 extends Model 4 by including the ISIP level at the student level to control for performance at the beginning of the school year.

Results

We first ran correlations with ISIP Reading and NM-MSSA ELA scores at the middle of the year (MOY) and end of the year (EOY) to determine if there was a significant relationship. Correlation coefficients ranged from .71 in grade 5 to .77 in grade 3, indicating a strong relationship between ISIP Reading and NM-MSSA ELA Reading measures.

Table 3

Pearson Product-Moment Correlations of ISIP Reading and MSSA ELA

Grade	ISIP MOY	ISIP EOY
3	0.76*	0.77*
4	0.73*	0.75*
5	0.71*	0.72*

*$p < .001$

Table 4 shows the total minutes by quintiles and grades.

Table 4

Usage Quintiles and Total Time (Minutes) across School Year by Grade

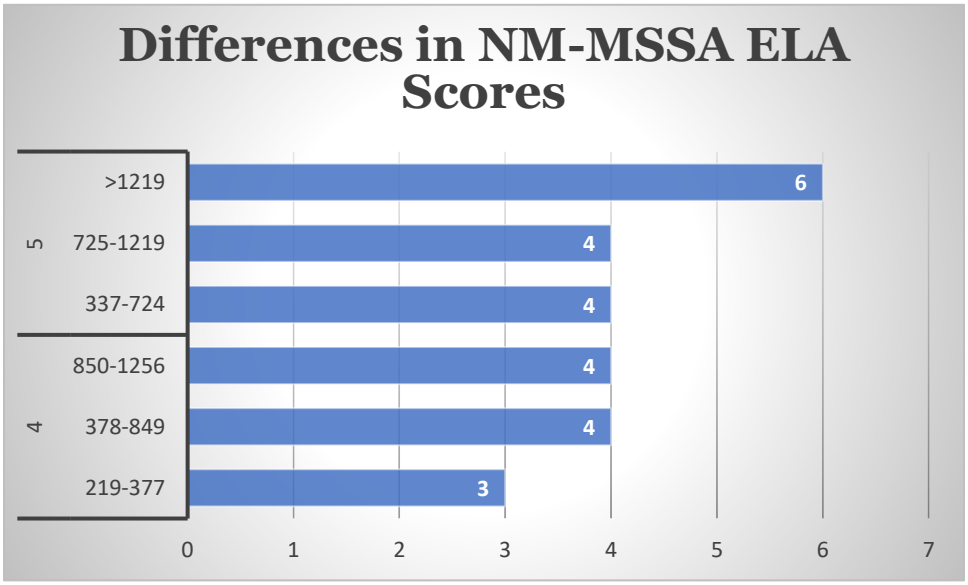
Usage Quintile	Grade 3	Grade 4	Grade 5
1	<148	<219	<210
2	148–252	219–377	210–336
3	253–539	378–849	337–724
4	540–1049	850–1256	725–1219
5	>1049	>1256	>1219

Next, we ran the nested models specified above to evaluate the relationship between NM-MSSA ELA scores and the time spent in the Istation Reading curriculum. In general students with a higher Istation usage quintile scored higher on the NM-MSSA ELA measure in grades 4 and 5. Istation usage varied significantly among schools.

Figure 1 shows the graphical representation of statistically significant increases in NM-MSSA ELA scores by Istation total minutes of usage per school year.

Figure 1

Differences in NM-MSSA ELA Scores for Grades 4 and 5 by Istation Total Usage



Grade 3

Given the best model fit based on AIC and BIC, Model 5 will be interpreted (see Table 5). Usage by itself had no statistically significant differences for students in grade 3. However, students in the highest SES category had an average increase of 6 points on MSSA ELA. Students in ISIP levels 4 and 5 saw the largest increases on the MSSA ELA (29 points in Level 4 and 41 points in Level 5). There was also a significant interaction between ISIP usage and ISIP level. Students who were using ISIP instruction for 253–539 minutes per year and who were in ISIP levels 3–5 saw increases between 5 and 6 points on the NM-MSSA ELA. Students who were in ISIP level 2 and who were using ISIP 540–1049 minutes per year saw an increase on NM-MSSA ELA of about 4 points.

These results are after controlling for the SES at the school level and ISIP level at the student level. There appears to be an interaction between usage quintile and student

level, affirming the Istation recommendations that students in levels 1 and 2 benefit from increased usage. Fourteen (14%) of the variability in scores was due to schools, leaving 86% of the variability due to students. The significance of the error variance suggests that schools influence the variability in students' scores even after accounting for usage, ISIP level, and SES. There was also variability in Istation curriculum usage across schools.

Table 5

2-Level HLM for Grade 3

Fixed Effects	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Intercept	345.71*(.84)	349.06*(1.11)	348.28*(1.24)	343.94*(1.09)	329.98*(.99)
Usage 2		−3.64*(.97)	−3.36*(1.35)	−2.86*(1.22)	−1.09 (1.17)
Usage 3		−7.39*(1.15)	−7.97*(1.50)	−6.61*(1.22)	−3.55*(1.20)
Usage 4		−3.98*(1.33)	−2.60 (1.67)	−0.34 (1.45)	−0.87 (1.33)
Usage 5		−4.11*(1.49)	−1.91 (1.88)	1.71 (1.62)	0.41 (1.40)
SES 2				6.10*(2.06)	1.93 (1.35)
SES 3				13.22*(1.53)	3.73*(.99)
SES 4				19.30*(2.71)	6.20*(1.72)
Level 2					14.07*(1.26)
Level 3					21.98*(1.37)
Level 4					29.16*(1.40)
Level 5					40.52*(1.35)
Usage 2*Level 4					4.04*(1.96)
Usage 3*Level 3					5.41*(1.93)
Usage 3*Level 4					6.15*(2.03)
Usage 3*Level 5					5.15*(1.91)
Usage 4*Level 2					3.80*(1.85)
Error Variance					
Level-1	407.23*(8.53)	402.87*(8.45)	391.63 (8.39)	394.43*(8.52)	187.97*(4.08)
Level-2 Intercept	65.68*(11.26)	70.62*(12.19)	59.67*(12.27)	6.75 (15.32)	10.05*(2.72)
Usage			23.39*(6.49)	15.34*(5.62)	2.04 (1.84)
Model Fit					
AIC	41638.9	41604.3	41572.5	41060.2	36904.8
BIC	41648.0	41624.4	41595.5	41094.8	36993.9

Note: *Statistically significant, $p<.05$; ICC = .14
Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom

Grade 4

Table 6 shows the results for grade 4. Again, we ran a series of nested models to determine the best fit of variables that explains the relationship between Istation usage and NM-MSSA ELA scores. Due to model fit statistics, the results from Model 5 will be interpreted. In grade 4, students who were in the second through fourth quintile of

usage (219–1256 total minutes per school year) saw an increase of 3 to 4 points on average in NM-MSSA ELA scores, which is statistically significant. Twelve percent of the variability was because of schools. Similar to grade 3, students in the higher SES category had much higher gains compared to those in the lowest SES category (reference group). Students who were in ISIP levels 4 and 5 on average saw increases of 29–43 points on the NM-MSSA ELA. Students who were in ISIP level 2 and who were in usage quintiles 4 and 5 (850 and above minutes per year) saw average increases of 6 to 7 points on the NM-MSSA ELA, after controlling for SES and student level at the beginning of the year. Based on the significant error variance, there is variability in scores across schools after accounting for usage, ISIP levels, and SES. There is also variability in Istation curriculum usage across schools.

Table 6

2-Level HLM for Grade 4

Fixed Effects	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Intercept	446.65*(.92)	439.18*(1.27)	439.90*(1.42)	437.34*(1.33)	430.21*(1.04)
Usage 2		9.19*(1.21)	7.83*(1.78)	7.63*(1.67)	2.86*(1.41)
Usage 3		9.81*(1.54)	7.85*(1.98)	8.73*(1.81)	4.10*(1.51)
Usage 4		14.33*(1.76)	11.82*(2.19)	13.00*(1.98)	4.47*(1.70)
Usage 5		10.33*(1.82)	8.77*(2.28)	10.46*(2.05)	3.21 (1.66)
SES 2				4.53 (2.77)	.57 (1.78)
SES 3				11.47*(2.30)	2.10 (1.46)
SES 4				20.82*(3.61)	5.48*(2.37)
Level 2					10.27*(1.60)
Level 3					22.64*(1.90)
Level 4					28.72*(1.98)
Level 5					42.59*(2.01)
Usage 2*Level 2					5.01*(2.26)
Usage 4*Level 2					6.91*(2.50)
Usage 5*Level 2					6.03*(2.42)
Error Variance					
Level-1	421.50*(10.82)	409.60*(10.50)	395.58*(10.34)	395.99*(10.35)	227.65*(6.06)
Level-2 Intercept	57.44*(11.77)	58.43*(11.46)	31.20*(12.05)	11.63 (7.95)	4.21 (2.83)
Usage			36.92*(10.63)	30.54*(9.15)	8.48*(3.82)
Model Fit					
AIC	27957.2	27878.7	27846.1	27789.3	25231.4
BIC	27965.0	27896.8	27866.7	27817.8	25311.2

Note: *Statistically significant, $p<.05$; ICC = .12
Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom

Grade 5

In grade 5, students who were in the third through fifth ISIP usage quintiles (337 and above total minutes per school year) saw a statistically significant improvement in NM-MSSA ELA scores (see Table 7). On average these students had gains of 4–6 points, after controlling for school level SES and student level in Istation at the beginning of the year. Students who were in the highest SES category saw an increase of about 6–7 points compared to the reference group. Students in ISIP levels 4 and 5 on average saw increases of 32–42 points on the NM-MSSA ELA assessment. The significant error variance suggests that there is variability in scores across schools after accounting for usage, ISIP levels, and SES. There is also variability in usage across schools.

Table 7

2-Level HLM for Grade 5

Fixed Effects	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	546.71*(.99)	541.83*(1.39)	541.47*(1.58)	538.42*(1.39)	527.73*(1.09)
Usage 2		5.31*(1.30)	5.76*(1.96)	6.18*(1.87)	2.47 (1.49)
Usage 3		6.50*(1.60)	5.95*(2.11)	7.42*(1.88)	4.28*(1.55)
Usage 4		7.91*(1.76)	7.26*(2.24)	8.81*(1.92)	3.60*(1.61)
Usage 5		8.00*(1.99)	6.86*(2.55)	8.08*(2.16)	5.59*(1.69)
SES 2				11.20*(2.60)	2.09 (1.98)
SES 3				15.62*(2.22)	7.14*(1.61)
SES 4				18.55*(3.90)	5.76*(2.62)
Level 2					15.33*(1.72)
Level 3					20.17*(1.76)
Level 4					32.47*(1.83)
Level 5					41.81*(1.80)
Usage 2*Level 4					–5.09*(2.52)
Error Variance					
Level-1	393.71*(10.25)	389.85*(10.14)	376.70*(9.98)	378.17*(10.02)	202.26*(5.43)
Level-2 Intercept	60.89*(13.03)	63.60*(13.21)	37.21*(14.09)	.02 (7.56)	6.00*(3.31)
Usage			36.38*(11.26)	35.77*(10.92)	5.51 (3.35)
Model Fit					
AIC	26910.5	26891.9	26860.8	26798.8	24187.6
BIC	26918.4	26910.3	26881.7	26827.6	24268.6

Note: *Statistically significant, $p<.05$; ICC = .14
Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom

Conclusion

This research shows that it is important for grades 3–5 to meet the recommended Istation usage criteria since students who fell in this category saw larger gains in NM-

MSSA ELA assessment scores, even when controlling for SES at the school level and ISIP level at the beginning of the year. This is important as it provides evidence that using the Istation program, including progress monitoring and Istation Reading curriculum, will help students in all types of schools improve achievement.

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