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## Using Computer-Adaptive Curriculum to Improve Outcomes on STAAR Reading Assessment

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# Executive Summary

Istation is an integrated learning system that is used in school districts across the country by millions of students. It provides a computer adaptive test 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 Istation usage led to increased achievement in reading. This research evaluates if usage of Istation leads to academic growth on the State of Texas Assessments of Academic Readiness (STAAR) Reading.

Using data from five school districts in the 2021-22 school year, a hierarchical linear model was used to control for socioeconomic status at the school level. In every grade, results indicated that usage of Istation led to growth on the STAAR.

- Students in grade 3 who met or exceeded usage guidelines had scores that were 29–39 higher on the STAAR than those that did not meet usage guidelines.
- Students in grade 4 who met or exceeded usage guidelines had scores that were 23 points higher than those who had less usage.
- Students in grade 5 who approached usage guidelines had scores that were approximately 31 points higher on the STAAR than those that had less usage.
- Students in grade 6 who approached or met usage guidelines had increases of 84–86 points on the STAAR, as compared to students who did not meet usage guidelines.
- Students in grade 7 who used Istation more than 44 minutes per month had STAAR scores that were 77 points higher than those that used Istation less than that, and those that used it an hour a month had STAAR scores that were 125 points higher.
- Students in grade 8 who used Istation between 24 to 44 minutes per month had increased scores of 95–98 points.

These results demonstrate that using Istation close to the recommended usage guidelines helps student achievement in reading as measured by the STAAR assessment.

# Introduction

Istation's Indicators of Progress (ISIP™) Reading assessment measures a student's ability to read in English (Mathes et al., 2022). The assessment measures the skills based on the science of reading that lead to literacy: phonemic awareness, alphabetic knowledge and skills, vocabulary, fluency, and comprehension. After students complete ISIP Reading, the Istation system routes them into Istation's adaptive curriculum program. The reading curriculum in English provides students with authentic and engaging intervention lessons aimed at increasing student success in the classroom. The curriculum is cyclical, as one cycle is completed the student then proceeds to the next cycle. The first cycle starts instruction with foundational skills for the alphabet, alphabetic principle, print awareness, and other basic skills supported by the science of reading.

Evidence for the efficacy of the Istation Reading curriculum comes from research that demonstrates Istation usage led to increased achievement across several assessments. Cook and Ross (2020) found a relationship with Istation usage and gains on the Partnership for Assessment of Readiness for College and Careers (PARCC) and the North West Education Association Measures of Academic Progress (NWEA MAP®) (Cook & Ross, 2021). Other studies show gains on the Renaissance Star Assessment® (Luo et al., 2017), the Developmental Reading Assessment (2nd edition) (DRA2) (Putman, 2017), and the Idaho state assessment (Cook & Ross, 2022).

This research examines the findings from the quantitative analyses comparing students' Istation Reading curriculum usage time and performance on the State of Texas

Assessments of Academic Readiness (STAAR) Reading, 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 STAAR scores?
2. Does Istation usage vary among schools?
3. Are there differences in STAAR scores based on Istation usage and socioeconomic status (SES)?

## Methodology

### Analytical Sample

All data came from students in five school districts in Texas in the 2021-22 school year. There was a total of 22,927 students. Table 1 shows the demographic characteristics of the sample.

**Table 1.** *Demographic Composition of Sample by District and Grade*

District	Grade	N	Gender (M/F)	Black	Hispanic	White	All other Races Combined
A	3	96	49%/51%	73%	24%	1%	2%
	4	71	69%/31%	56%	39%	1%	4%
	5	62	37%/63%	61%	29%	7%	3%
B	4	636	49%/51%	14%	33%	33%	20%
	5	427	51%/49%	15%	32%	32%	21%
	6	398	50%/50%	18%	38%	25%	19%
	7	443	52%/48%	20%	35%	26%	19%
C	8	360	53%/47%	17%	38%	24%	21%
	3	611	53%/47%	8%	84%	5%	3%
	4	641	57%/43%	10%	82%	4%	4%
	5	597	52%/48%	8%	80%	6%	6%
D	3	2,559	51%/49%	3%	81%	14%	2%
	4	2,498	50%/50%	4%	80%	14%	2%
	5	2,246	51%/49%	4%	80%	14%	3%
	6	1,724	52%/48%	4%	77%	15%	4%
	7	1,904	51%/49%	5%	77%	15%	3%

	8	1,792	50%/50%	4%	76%	17%	3%
E	3	2,000	51%/49%	11%	47%	33%	9%
	4	1,925	52%/48%	10%	47%	35%	8%
	5	1,937	50%/50%	10%	47%	34%	9%

**Measures**

**STAAR Reading Assessments**

The Texas Education Agency (TEA), in collaboration with the Texas Higher Education Coordinating Board (THECB) and Texas educators, developed the STAAR program in response to requirements set forth by the 80th and 81st Texas legislatures. STAAR is an assessment program designed to measure what students have learned and how well they can apply the knowledge and skills defined in the state-mandated curriculum standards (<http://tea.texas.gov>).

After students take the STAAR, their results are reported in two primary ways: scaled scores and achievement levels. This study focuses on STAAR scaled scores.

**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 amount of 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.

### **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 four 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, and SES 4 schools are low poverty 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 the school level (Level 2). Within this framework four 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 by including fixed effects at Level 1 (usage). Model 3 is an extension of model 2 by including random slopes for Level 1. Lastly, model 4 extends model 3 by including the Level 2 fixed effects (SES).

## Results

We first ran correlations with ISIP Reading and STAAR Reading 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 .68 in grade 8 to .74 in grade 4, indicating a strong relationship between ISIP Reading and STAAR Reading measures.

**Table 2.** *Pearson Product-Moment Correlations of ISIP Reading and STAAR Reading*

Grade	ISIP MOY	ISIP EOY
3	0.72	0.72
4	0.72	0.74
5	0.72	0.72
6	0.72	0.71
7	0.72	0.70
8	0.68	0.68

Table 3 shows the total minutes by quintiles and grades. Typically grades 3 through 5 have much higher usage compared to students in middle school.

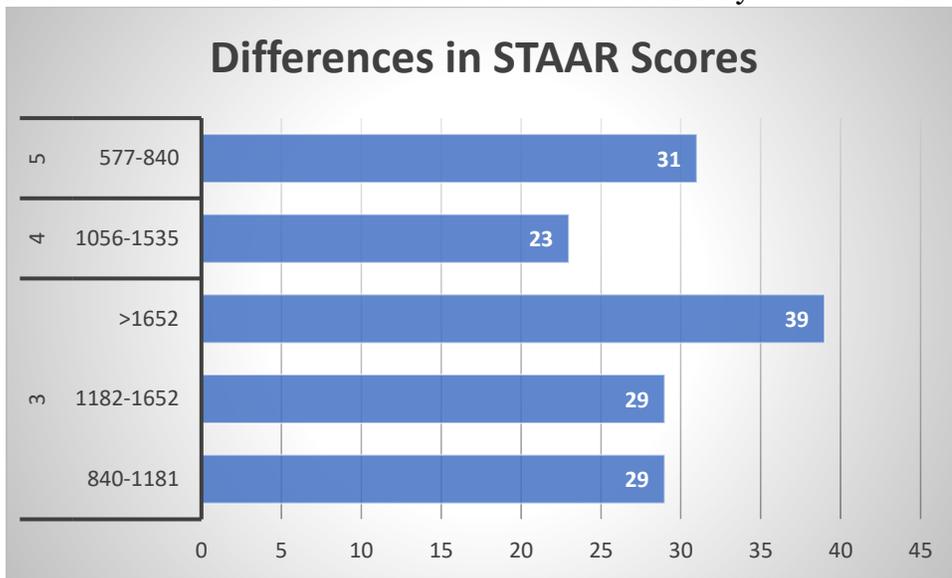
**Table 3.** *Usage Quintiles and Total Time (Minutes) across School Year by Grade*

Usage Quintile	Percentile rank for usage	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
1	≤20	<501	<467	<384	<353	<227	<166
2	21-40	501-839	467-734	384-576	353-542	227-310	166-219
3	41-60	840-1181	735-1055	577-840	543-717	311-396	220-281
4	60-80	1182-1652	1056-1535	841-1239	718-1002	397-563	282-395
5	>80	>1652	>1535	>1239	>1002	>563	>395

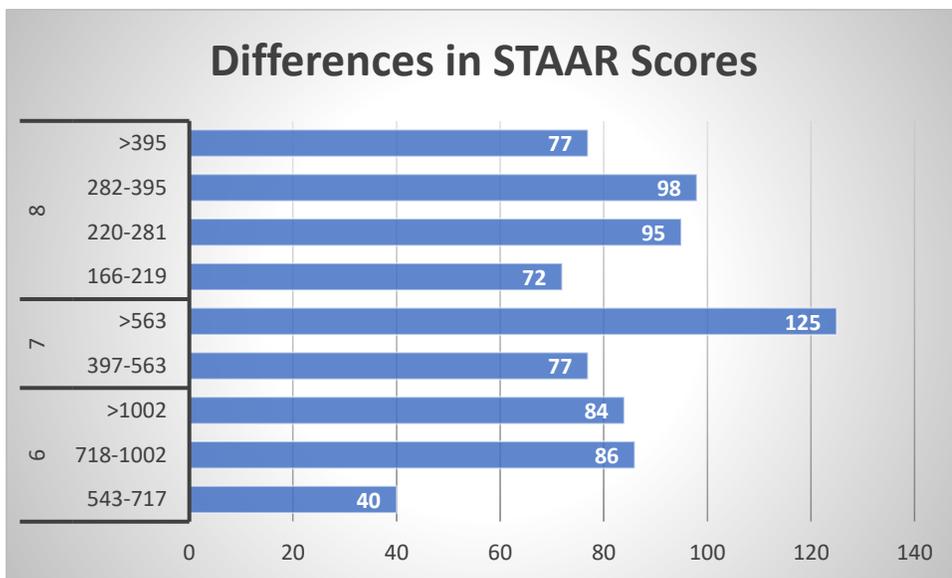
After establishing that there was a correlation between ISIP and STAAR, we ran a series of nested models specified above to evaluate the relationship between STAAR Reading scores and the time spent in the Istation English curriculum. The results show that overall, students with a higher Istation usage quintile scored higher on the STAAR Reading measure across all grades. Istation usage varied significantly among schools.

Figures 1 and 2 show the graphical representation of increases in STAAR scores by Istation total minutes of usage per school year. In the sections below, we explain the results from the model with the best fit according to the Akaike information criterion (AIC) and Bayesian information criterion (BIC) values. Lower values on AIC and BIC indicate a better model fit.

**Figure 1.** Differences in STAAR Scores for Grades 3 to 5 by Istation Total Usage



**Figure 2.** Differences in STAAR Scores for Grades 6 to 8 by Istation Total Usage



## Grade 3

Given the best model fit based on AIC and BIC, model 3 is interpreted (see Table 4). Students who were in or above the 3rd ISIP usage quintile (>840 total minutes/school year, or 23 minutes or more per week) saw an increase of 29–39 points on EOY STAAR Reading scores over students in the referent group, which was the lowest quintile of usage. Thirteen percent (13%) of the variability in scores was due to schools, leaving 87% of the variability due to students. Looking at the SES variable in model 4, we see what one would expect as STAAR scores increase significantly based on a higher SES category compared to the referent group (lowest SES category). The significance of the error variance suggests that schools influence the variability in students' scores even after accounting for usage and SES. There was also variability in Istation curriculum usage across schools.

**Table 4.** Two-Level HLM for Grade 3, Coefficients and Standard Errors (SE)

Fixed Effects	Model 1	Model 2	Model 3	Model 4
Intercept	1438.08* (9.24)	1422.50* (10.82)	1409.18* (12.73)	1404.61*(11.83)
Usage 2 (21-40)		10.70 (7.36)	17.41 (12.92)	18.63 (13.24)
Usage 3 (41-60)		19.70* (7.53)	28.72* (13.11)	31.11*(13.37)
Usage 4 (61-80)		17.44* (7.52)	29.02* (13.31)	35.67*(13.62)
Usage 5 (>80)		31.18* (7.48)	38.58* (13.46)	42.12*(13.75)
SES 2				-48.78*(6.80)
SES 3				30.97*(10.59)
SES 4				156.64*(27.49)
<i>Error Variance</i>				
Level-1	21893* (441.13)	21796* (439.19)	20780* (424.49)	20360*(413.61)
Level-2 Intercept	3259* (780.82)	3550.64* (847.05)	2788.42* (839.59)	1022.67*(449.18)
Usage			1631.86* (340.10)	1799.86*(360.95)
Model Fit: AIC	63869.9	63859.3	63758.3	64268.0
Model Fit: BIC	63875.1	63871.3	63772.0	64286.6

Note: \*Statistically significant,  $p < .05$ ; ICC = .13

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 5 shows the results for grade 4. In grade 4, students who were in the fourth quintile of usage (1056–1535 total minutes per school year, or 29–42 minutes per week) saw an increase of 23 points on average in STAAR Reading scores which was statistically significant. Nine percent (9%) 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). Based on the significant error variance, there is variability in scores across schools after accounting for usage and SES. There is also variability in Istation curriculum usage across schools.

**Table 5.** *Two-Level HLM for Grade 4 Coefficients and Standard Errors (SE)*

Fixed Effects	Model 1	Model 2	Model 3	Model 4
Intercept	1525.08*(7.05)	1518.25*(8.14)	1507.54*(10.26)	1497.87*(10.38)
Usage 2 (21-40)		6.64 (6.14)	12.21 (10.80)	12.27 (10.31)
Usage 3 (41-60)		9.07 (6.36)	15.78 (10.87)	14.40 (10.38)
Usage 4 (61-80)		12.41 (6.48)	22.55* (11.24)	22.44*(10.74)
Usage 5 (>80)		7.14 (6.49)	15.61 (11.60)	18.50 (10.98)
SES 2				-27.70*(60.08)
SES 3				52.56*(8.74)
SES 4				111.01*(26.75)
Error Variance				
Level-1	18429*(354.01)	18414*(353.73)	17654*(343.46)	17584*(339.49)
Level-2 Intercept	1853.44*(453.56)	1879.85*(463.31)	1810.79*(529.06)	1459.18*(463.38)
Usage			1200.21*(250.52)	998.32*(220.03)
Model Fit : AIC	69256.2	69260.4	69167.1	70138.5
Model Fit : BIC	69261.4	69272.4	69180.8	70157.0

Note: \*Statistically significant,  $p < .05$ ; ICC = .09

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 ISIP usage quintile (577–840 total minutes per school year, or 16–23 minutes per week) saw a statistically significant improvement in STAAR Reading scores (see Table 6). On average these students had gains of 31 points. Students who were in the second SES category saw a decrease of about 40 points compared to the reference group. Students in the highest SES category had a STAAR score increase of 116 points. There is variability in usage across schools.

**Table 6.** *Two-Level HLM for Grade 5, Coefficients and Standard Errors (SE)*

Fixed Effects	Model 1	Model 2	Model 3	Model 4
Intercept	1592.09*(8.25)	1586.95*(9.49)	1569.44*(12.78)	1574.49*(12.08)
Usage 2 (21-40)		17.46*(7.02)	18.14 (15.49)	20.79 (14.77)
Usage 3 (41-60)		21.21*(7.32)	29.29 (15.50)	30.95*(14.83)
Usage 4 (61-80)		-8.93(7.54)	11.54 (15.76)	14.58 (15.17)
Usage 5 (>80)		-4.18(7.51)	12.31 (16.08)	13.23 (15.49)
SES 2				-40.43*(7.74)
SES 3				8.17 (9.84)
SES 4				116.37*(29.00)
Error Variance				
Level-1	21634*(431.38)	21511*(428.93)	20112*(404.80)	20027*(405.98)
Level-2 Intercept	2558.65*(629.21)	2525.24 (622.66)	1310.62*(565.22)	569.41 (398.55)
Usage			2720.54*(529.14)	2368.74*(478.12)
Model Fit: AIC	65148.9	65127.7	64933.5	64576.9
Model Fit: BIC	65154.1	65139.7	64947.2	64595.5

Note: \*Statistically significant,  $p < .05$ ; ICC = .11

Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom

## Grade 6

Students in grade 6 and above typically don't use the product as much compared to those in the lower grades. Interestingly, students in grade 6 who were in the 3rd usage quintile or above (>543 minutes/school year, or 15 or more minutes per week) had statistically significant improvements in STAAR Reading scores (see Table 7). The gains ranged from 40 to 86 points respectively. Both usage quintile 4 (20–28 minutes per week) and quintile 5 (>28 minutes per week) saw the largest gains, which were similar in magnitude.

**Table 7.** *Two-Level HLM for Grade 6, Coefficients and Standard Errors (SE)*

Fixed Effects	Model 1	Model 2	Model 3	Model 4
Intercept	1550.36*(9.18)	1495.93*(11.98)	1498.34*(14.05)	1488.10*(14.58)
Usage 2 (21-40)		38.38*(9.51)	33.79 (16.32)	33.14 (16.42)
Usage 3 (41-60)		45.65*(9.69)	39.78* (16.13)	38.26*(16.20)
Usage 4(61-80)		89.40*(9.79)	86.31* (15.93)	84.23*(15.94)
Usage 5 (>80)		92.34*(10.62)	84.35* (16.54)	82.14*(16.44)
SES 3				24.62 (15.13)
<i>Error Variance</i>				
Level-1	17094*(545.66)	16191*(517.30)	15963*(513.40)	15960*(512.90)
Level-2 Intercept	531.10 (338.68)	687.29 (435.41)	459.09 (386.27)	247.65 (265.36)
Usage			403.73 (246.04)	418.54*(248.49)
Model Fit: AIC	24824.9	24690.3	24682.9	24707.2
Model Fit: BIC	24825.2	24690.8	24683.5	24708.0

Note: \*Statistically significant,  $p < .05$ ; ICC = .03

Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom (Only had SES 2 and 3)

## Grade 7

A similar trend was observed for students in grade 7 (see Table 8) in that students in ISIP usage quintiles 4 and 5 (>397 total minutes/school year or 44 minutes or more per month) saw statistically significant improvements in STAAR Reading scores. On average the gains ranged from 77 to 125 points. Furthermore, students in the third SES category saw gains of about 62 points on STAAR Reading scores.

**Table 8.** Two-Level HLM for Grade 7, Coefficients and Standard Errors (SE)

Fixed Effects	Model 1	Model 2	Model 3	Model 4
Intercept	1637.21*(13.65)	1582.26*(21.46)	1581.18*(20.43)	1551.43*(20.18)
Usage 2 (21-40)		17.77 (9.47)	10.66 (20.91)	10.15 (21.13)
Usage 3 (41-60)		47.32*(9.55)	31.60 (20.99)	31.10 (21.21)
Usage 4 (61-80)		87.80*(9.70)	78.43* (20.93)	77.34*(21.15)
Usage 5 (>80)		150.52*(10.14)	127.08* (22.53)	125.44*(22.71)
SES 3				62.42*(20.60)
Error Variance				
Level-1	20563*(614.32)	18313* (547.09)	17864*(536.87)	17825*(535.78)
Level-2 Intercept	1054.40 (650.16)	2498.89*(1490.88)	1227.99 (889.75)	546.47 (493.48)
Usage			994.02*(443.57)	1023.89*(446.41)
Model Fit: AIC	28715.9	28469.1	28446.3	28440.4
Model Fit: BIC	28715.3	28467.7	28444.7	28438.6

Note: \*Statistically significant,  $p < .05$ ; ICC = .05

Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom. Only had SES categories 2 and 3.

## Grade 8

Students in grade 8 saw statistically significant increases in STAAR Reading scores for usage quintiles 2–5 (>166 total minutes/school year, or 18 minutes per month). The gains in STAAR Reading scores ranged from 72 to 98 points (see Table 9). This finding shows that even with minimal time spent in the Istation curriculum, students can benefit from it to increase their state assessment scores.

**Table 9.** Two-Level HLM for Grade 8, Coefficients and Standard Errors (SE)

Fixed Effects	Model 1	Model 2	Model 3	Model 4
Intercept	1671.52*(13.76)	1609.25*(21.05)	1605.72*(22.59)	1587.44*(21.78)
Usage 2 (21-40)		76.54*(10.40)	72.12* (19.01)	69.32*(18.90)

Usage 3 (41-60)		89.70*(10.40)	94.66* (18.76)	92.09*(18.65)
Usage 4 (61-80)		103.18*(10.72)	97.87* (19.08)	94.72*(18.99)
Usage 5 (>80)		78.71*(10.49)	76.99* (19.12)	74.01*(18.98)
SES 3				39.00 (25.31)
<i>Error Variance</i>				
Level-1	19257*(604.30)	18253*(572.84)	17847*(563.02)	17872*(564.46)
Level-2 Intercept	1060.85 (651.88)	2356.02 (1451.01)	2085.72 (1533.78)	934.14 (1010.34)
Usage			601.07*(281.45)	602.73*(286.37)
Model Fit: AIC	25900.3	25804.1	25783.9	25784.7
Model Fit: BIC	25899.7	25802.6	25782.2	25782.9

Note: \*Statistically significant,  $p < .05$ ; ICC = .05

Values based on SAS Proc Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = ML; Satterthwaite degrees of freedom. Only had SES categories 2 and 3.

## Conclusion

This research shows that it is important for grades 3–5 to meet the recommended usage criteria since students who fell into this category saw larger gains on the EOY STAAR Reading assessment, even when controlling for SES at the school level. 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 attain greater achievement.

Although students in middle school (grades 6–8) may not be meeting the recommended usage criterion, this study finds that students benefit significantly from using the Istation curriculum. Students in grades 6 through 8 saw large improvement in EOY STAAR Reading scores, and the usage was less than an hour per month.

Usage of technology for remediation or supplemental curriculum may be more challenging in middle school due to students changing instructors for subjects and other potential scheduling hurdles, including increased extracurricular activities such as band, orchestra, and school sports. However, this study demonstrates that finding a regular time that students can access ISIP and the instructional content, perhaps in study hall

or after school, may help them improve their achievement as measured by the STAAR assessment.

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