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Using Computer Adaptive Curriculum to Improve Istation Reading Outcomes in Special Education Students

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Executive Summary

Istation is an integrated learning system that provides assessments, supplemental curriculum, and detailed reports that can be used for progress monitoring or benchmarking. It provides a computer adaptive test for universal screening, and students are routed into the curriculum based on assessment performance.

Istation recommends that students use the supplemental curriculum 30–40 minutes per week to increase their performance in reading. Previous research with the Istation Reading curriculum demonstrated that Istation usage increased reading performance. This research evaluates if usage of Istation Reading curriculum leads to Istation Reading growth specifically in special education students.

Using data from Idaho, New Mexico, and Arkansas in the 2022–23 school year, a hierarchical linear model was used to control for socioeconomic status at the school level. Usage was divided into quintiles with quintile 1 indicating the lowest amount of usage and quintile 5 indicating the highest amount of usage. Results indicated that Istation curriculum usage led to Istation Reading growth in every grade.

- Kindergarten special education students in usage quintiles 3–5 had scores that were 16–28 points higher on Istation Reading than those in lower usage quintiles.
- First grade special education students in usage quintiles 2–5 had scores that were 11–15 points higher than those in usage quintile 1.
- Second grade special education students in usage quintile 5 had scores that were 9 points higher than those in lower usage quintiles.

These results demonstrate that using Istation curriculum helps student performance in reading as measured by the Istation Reading formative assessment. Furthermore, Istation Reading growth was observed in special education students who did not meet the usage recommendations, suggesting that the supplemental curriculum for this particular population may be beneficial at any level.

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Introduction

As the education landscape continues to evolve, including students with disabilities in general education classrooms has become a focal point of educational reform in the United States. With the rise of inclusion, adopting High-Leverage Practices (HLPs) has become increasingly crucial for delivering effective specialized instruction (NCES, 2023; USDOE, 2010; Nelson et al., 2022). These HLPs are integral for educators to meet diverse learning needs in the regular classroom setting.

Advancements in educational technology offer promising avenues for supporting these practices through adaptive digital systems that facilitate personalized instruction and timely feedback (Riccomini et al. 2017; Branham & Branham 2020). Integrating such technologies is particularly significant in special education, where tailored educational strategies can dramatically influence learning outcomes.

Emerging research indicates that digital learning platforms, such as Istation, can benefit the academic achievement of students with disabilities, especially within inclusive educational models (Oh-Young & Filler 2015; Hehir et al. 2016). These technologies may offer the dual advantage of enhancing learning while promoting greater student engagement and motivation (Szumski et al. 2017). For example, special education students using Istation's curriculum had gains on the Idaho State ELA assessment that were over 13 points more than their peers in comparison schools that did not use the curriculum (Cook & Ross, 2022). These findings emphasize the potential of Istation to bridge academic gaps faced by special education students and enhance their learning outcomes. Despite the recognized potential of digital instructional tools, research is scarce exploring their effectiveness across different grade levels and student demographics, particularly when comparing special education students to their non-special education peers (Ciampa 2017; Baglama & Yucesoy 2018).

Therefore, this study aims to evaluate the impact of Istation curriculum usage on Istation Reading outcomes of special education students across kindergarten through second grade in Idaho, New Mexico, and Arkansas. Specifically, the study aims to address the following questions:

- Does using the Istation Reading curriculum improve scores on the Istation Reading formative assessment in special education students?
- Are Istation Reading scores different based on Istation curriculum usage and socioeconomic status?

Methodology

Analytical Sample

The data are from students across Idaho, New Mexico, and Arkansas. This study focused on kindergarten through second grade special education students (n=2,896). Of those that had demographic data (n=2,498), the largest racial/ethnic group was White (48.5%), followed by Hispanic (39.4%), American Indian/Alaska Native (4.4%), two or more races (3.9%), and Black/African American (2.6%).

Measures

This study used the Istation Reading formative assessment gain score as the outcome measure. Istation Reading is a computer-adaptive universal screener. Istation is an integrated learning system that provides assessments, supplemental curriculum, and detailed reports that can be used for progress monitoring or benchmarking. Students are routed into the curriculum based on assessment performance.

This study focused on students who took the Istation Reading assessment during the 2022-23 academic year. Istation Reading assesses the critical domains of alphabet knowledge, phonemic awareness, nonsense word decoding, vocabulary, comprehension, spelling, and fluency subtests, and the foundational subtests may be added if their score dips below a preset threshold. This way, the Istation Reading score can assess students on a broad spectrum of reading skills, from pre-kindergarten through middle school (Mathes et al., 2023).

Istation usage guidelines recommend that students who score at or below the 40th percentile of the normative sample on Istation assessments 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 implementation fidelity. Usage quintiles were calculated for special education students by grade level based

on the total usage (minutes), with quintile 1 representing the lowest amount of usage and quintile 5 representing the highest usage.

Socioeconomic status categorizations were developed at the school level using the National Center for Education Statistics and U.S. Census Bureau data. Tertiles were created for school socioeconomic status, with tertile 1 consisting of schools with the lowest socioeconomic status and tertile 3 with the highest socioeconomic status.

Analytical Approach

Due to the sample having students nested in schools, a hierarchical linear model (HLM) was used to examine the efficacy of Istation curriculum usage on Istation assessment gain scores, which were calculated as the difference between beginning-of-year (BOY) and end-of-year (EOY) scores. Furthermore, socioeconomic status was calculated at the school level to account for shared school characteristics and contextual effects. Three nested models were tested. Model 1 is the baseline model that consists of only the random effect for the intercept. Model 2 is an extension of model 1 that includes fixed effects at Level 1, which included BOY score and usage quintiles. Model 3 is an extension of model 2 that includes Level 2 fixed effects (school socioeconomic status). Models that included random slopes for Level 1 (usage) resulted in insignificant improvement of model fit. Therefore, model 3 was interpreted for each grade, except for second grade, where model 2 was interpreted due to insignificant improvement observed in model 3.

Results

Table 1 shows the total minutes by usage quintiles and grades for special education students using the supplemental curriculum for Istation Reading.

Table 1. *Istation Reading Usage Quintiles and Total Time across School Year by Grade*

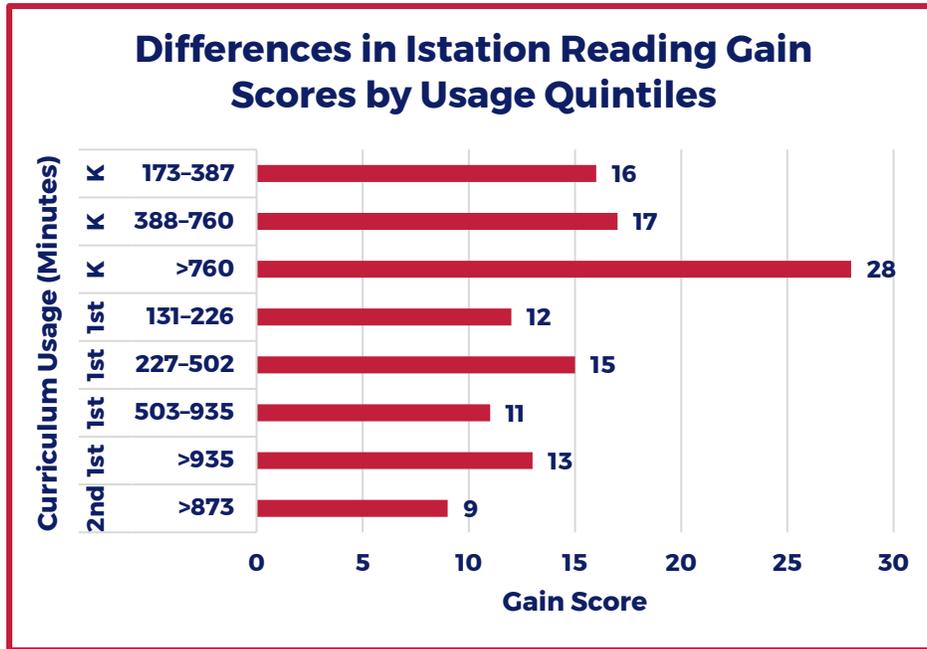
Usage Quintile	Usage Percentile Rank	Kindergarten	1st Grade	2nd Grade
1	≤20	≤95	≤130	≤136
2	21-40	96-172	131-226	137-255
3	41-60	173-387	227-502	256-499
4	61-80	388-760	503-935	500-873
5	>80	>760	>935	>873

Next, the relationship between Istation Reading scores and time spent in the curriculum was examined. Students in higher Istation usage quintiles generally scored higher on Istation Reading across kindergarten through second grade. The tables below show the results for each regression model.

Istation Reading

Figure 1 shows the graphical representation of increases in Istation Reading gain scores by total minutes of usage per school year.

Figure 1. Differences in Istation Reading Gain Scores for Grades K to 2 by Istation Total Usage



Kindergarten

Table 2 shows the results for the HLM model for kindergarten special education students (n=803). Students who were in the 3rd Istation Reading usage quintile or above (>173 total minutes/school year) had an increase of 16 to 28 points in EOY Istation Reading scores over students in the lowest quintile of usage, with the most gains for students in the highest usage quintile. Ten percent (10%) of the variability in scores was due to schools (ICC = .10), leaving 90% of the variability due to students. A significant positive relationship was observed for the 2nd and 3rd tertiles of school socioeconomic status ($\beta = 11.68$ and $\beta = 13.17$, $p < 0.05$). This suggests that schools with higher socioeconomic status also tend to have special education students in kindergarten who exhibit greater individual improvement on Istation Reading. The significance of the error variance suggests that there was variability in scores across schools after accounting for school-level socioeconomic status.

Table 2. *Istation Reading Two-Level HLM for Kindergarten, Coefficients and Standard Errors (SE)*

Fixed Effects	Model 1	Model 2	Model 3
Intercept	73.97* (2.03)	80.67* (8.95)	76.22* (9.03)
Baseline Score		-0.09* (0.04)	-0.10* (0.04)
Usage 2 (21-40)		2.67 (4.95)	2.28 (4.92)
Usage 3 (41-60)		15.82* (5.03)	15.66* (4.97)
Usage 4 (61-80)		17.23* (5.24)	16.51* (5.17)
Usage 5 (>80)		27.45* (5.31)	27.64* (5.27)
School SES 2			11.68* (4.15)
School SES 3			13.17* (6.24)
<i>Error Variance</i>			
Level-1	1578.28* (86.79)	1522.67* (83.93)	1524.49* (83.87)
Level-2 Intercept	218.48* (72.52)	200.05* (68.81)	169.51* (64.25)
Model Fit: AIC	8267.5	8226.8	8211.7
Model Fit: BIC	8281.6	8264.3	8258.6

Note. * $p < 0.05$; ICC = .10

Values based on Stata 18.0 Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = REML; Satterthwaite degrees of freedom.

First Grade

Table 3 shows the results for the HLM model for first grade special education students (n=1014). Students in the 2nd Istation Reading usage quintile or above (>131 total minutes/school year) had an increase of 11 to 15 points in EOY Istation Reading scores over students in the lowest usage quintile, the referent group. Fourteen percent (14%) of the variability in scores was due to schools (ICC = .14), leaving 86% of the variability due to students. There were no relationships with school socioeconomic status, but the significance of the error variance suggests that there was variability in scores across schools after accounting for school-level socioeconomic status.

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

Fixed Effects	Model 1	Model 2	Model 3
Intercept	53.28* (1.73)	35.14* (7.25)	33.43* (7.41)
Baseline Score		0.03 (0.02)	0.02 (0.02)
Usage 2 (21-40)		11.64* (4.07)	11.67* (4.08)
Usage 3 (41-60)		15.38* (4.03)	15.35* (4.03)
Usage 4 (61-80)		11.52* (4.17)	11.22* (4.17)
Usage 5 (>80)		14.04* (4.37)	13.48* (4.39)
School SES 2			3.00 (3.65)
School SES 3			10.40 (5.33)
<i>Error Variance</i>			
Level-1	1192.34* (57.24)	1186.12* (57.06)	1183.61* (56.90)
Level-2 Intercept	212.80* (52.32)	188.32* (49.33)	188.79* (49.45)
Model Fit: AIC	10169.1	10149.2	10139.9
Model Fit: BIC	10183.9	10188.5	10189.1

Note. * $p < 0.05$; ICC = .14

Values based on Stata 18.0 Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = REML; Satterthwaite degrees of freedom.

Second Grade

Table 4 shows the results for the HLM model for second grade special education students ($n=1079$). Students in the 5th Istation Reading usage quintile or above (>873 total minutes/school year) had an increase of 9 points in EOY Istation Reading scores over students in the lowest usage quintile. Thirteen percent (13%) of the variability in scores was due to schools (ICC = .13), leaving 87% of the variability due to students.

Model 2 was interpreted for second grade due to insignificant model improvement observed in model 3.

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

Fixed Effects	Model 1	Model 2
Intercept	45.52* (1.89)	38.14* (8.12)
Baseline Score		0.02 (0.02)
Usage 2 (21-40)		-3.99 (4.12)
Usage 3 (41-60)		1.78 (4.39)
Usage 4 (61-80)		0.87 (4.57)
Usage 5 (>80)		9.40* (4.74)
School SES 2		
School SES 3		
<i>Error Variance</i>		
Level-1	1669.60* (77.87)	1665.81* (77.59)
Level-2 Intercept	247.70* (65.54)	240.25* (63.30)
Model Fit: AIC	11171.0	11159.4
Model Fit: BIC	11186.0	11199.3

Note. * $p < 0.05$; ICC = .13

Values based on Stata 18.0 Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = REML; Satterthwaite degrees of freedom.

Discussion

The findings of this study offer evidence supporting the efficacy of the Istation curriculum in bolstering academic performance among special education students. This aligns with the ongoing national trend towards inclusive educational practices and reinforces the Department of Education's focus on high-value practices (HLPs). The integration of technology within these practices, as this study demonstrates, can cater to the diverse learning needs of students.

Regarding reading proficiency, notable performance was observed in kindergarten and first grade students, highlighting the impact of personalized, adaptive learning technologies in early literacy development. This finding resonates with the educational strategies advocated by Riccomini et al. (2017) and aligns with the adaptive learning environment principles outlined by Branham & Branham (2020). The most significant improvements were observed in first grade students who engaged with the curriculum at a moderate level, suggesting an optimal dosage of digital curriculum use maximizes learning outcomes in special education settings.

For kindergarten students, those in the higher usage quintiles (3rd quintile and above, equating to >173 total minutes per school year) showed substantial gains in EOY Istation Reading scores, ranging from 16 to 28 points. This variation underscores the effectiveness of the curriculum in enhancing literacy skills at this critical developmental stage. Additionally, the positive relationship between higher socioeconomic status schools and more significant improvement in Istation Reading scores among kindergarten students suggests that external environmental factors also play a significant role in educational outcomes for this group.

For first grade students, those in the 2nd usage quintile and above (>131 total minutes per school year) demonstrated an improvement of 11 to 15 points in their EOY Istation Reading scores. This finding adds a layer of complexity to our understanding of

engagement with educational technology in special education. While earlier discussion highlighted the potential for an optimal level of digital curriculum engagement, these results suggest that this optimal dosage might not necessarily align with the highest usage levels for first grade students. This deviation invites further examination into how varying degrees of engagement impact learning outcomes differently, emphasizing the need for a nuanced approach in applying digital learning tools in special education settings. Furthermore, the impact of school socioeconomic status on these outcomes was insignificant, indicating that the curriculum's effectiveness is consistent across different socioeconomic environments. This suggests that the curriculum promotes equal learning opportunities for students, regardless of their school's socioeconomic status for this group.

For second grade students, the most substantial gains were seen in the 5th usage quintile (>873 total minutes per school year, or about 24 or more minutes per week), with an average increase of 9 points in EOY scores. This suggests that higher curriculum engagement is particularly beneficial at this grade level. For example, it could be attributed to the alignment of the Istation curriculum with second graders' evolving cognitive and learning styles. The higher engagement levels indicate that the curriculum successfully meets these needs, particularly in special education settings, where students have diverse learning needs. Implementing technology into the curriculum has been found to significantly enhance student engagement and academic success, facilitating collaboration, creativity, higher-order thinking, and inquiry-based learning (Pressbooks, 2018). This is needed for special education students, who benefit from customized and adaptive educational approaches that cater to their unique developmental stages and learning styles.

Conclusion

Utilizing Istation's digital curriculum with special education students underscores the transformative potential of educational technology. This study contributes to a growing body of literature recognizing the importance of personalization and adaptability in educational tools, particularly for students with disabilities. The positive relationship between digital curriculum usage and special education students' academic performance underscores such technologies' value in fostering inclusive educational practices.

Future research must explore how digital tools can be calibrated to maximize their impact across various educational contexts and for students with diverse learning needs. This study provides a foundation for such research, offering a positive perspective on the role of technology in creating more equitable and accessible learning environments for special education students. The insights from this research are valuable in guiding future educational policies and practices.

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