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Using Computer-Adaptive Curriculum to Increase English Literacy in Emerging Bilingual Students

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5214F Diamond Heights Blvd, #3255, San Francisco, CA 94131
wwww.AmiraLearning.com | 866-883-7323 | info@amiralearning.com

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Victoria Locke, PhD

Sean Lewis, MA

Jean Hampel, EdD

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Executive Summary

Istation partnered with a large urban school district in north Texas to study the impact of a computer-adaptive reading curriculum on bilingual students' English language proficiency. This research brief examines the findings from the quantitative analyses comparing students' English and Spanish curriculum usage time and movement along the Texas English Language Proficiency Assessment System (TELPAS) proficiency continuum levels.

Data from the 2016-2017, 2017-2018, and 2018-2019 school years were provided by a school district in north Texas and included TELPAS composite ratings, TELPAS subscale scores, and demographic data for students in grades two through five. These data were linked to Istation data, including Istation's Indicators of Progress (ISIP™) Reading and ISIP Lectura assessment scores and cumulative time spent in the English and Spanish curricula. A logistic regression mixed effects model was used to analyze student growth on the TELPAS. The following findings were determined through this study:

- Students in grades two and three (2017-2018 and 2018-2019) who used the Istation Spanish curriculum as recommended significantly increased their odds of improving a category on the TELPAS.
- Students in second grade (2017-2018 and 2018-2019) who received some instruction in the English language curriculum but most of their instruction in Spanish increased their odds of improving a category on the TELPAS. Students in third grade benefited from the Spanish curriculum as well.
- Students with lower English language proficiency and high usage of the English curriculum did not increase their likelihood of improving one category on the TELPAS. This finding is consistent with literature indicating that strengthening skills in one's primary language can facilitate acquisition of a second language.
- Advanced bilingual students in second grade (2017-2018 and 2018-2019) and third grade (2017-2018) with higher usage in the English curriculum and lower

usage in the Spanish curriculum increased their odds of improving a category on the TELPAS.

- There were no significant effects found for students in fourth or fifth grades. This finding may be attributable to many factors, including lower curriculum usage, students exiting the bilingual program, and small sample sizes.

Introduction

Istation, an educational technology company based in Dallas, Texas, provides formative assessments, intervention curriculum, and teacher resources focused on building literacy skills in both English and Spanish. The assessment known as Istation's Indicators of Progress (ISIP™) Reading measures a student's ability to read in English (Istation, 2016; Mathes, Torgesen, & Herron, 2016), while ISIP Lectura measures a student's ability to read in Spanish (Istation, 2016). The assessments measure the essential skills that lead to literacy by assessing phonemic awareness, alphabetic knowledge and skills, vocabulary, fluency, and comprehension.

After students complete the ISIP Reading or ISIP Lectura assessment, the system places them into Istation's interactive program. The adaptive reading curriculum in English or Spanish provides students with authentic and 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.

Previous research with the English curriculum demonstrates that Istation usage led 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, Lee, & Molina, 2017), the Developmental Reading Assessment (2nd edition) (DRA2) (Putman, 2017), and the Idaho state assessment (Cook & Ross, 2022). Research with emerging bilingual students indicates that teaching them in their native language helps their English language acquisition ((Goldenberg, 2013), for review). Given the evidence for the efficacy of the English curriculum and the fact that teaching students in their native language may help their reading ability in English, we wanted to know if using the Istation reading

curriculum in Spanish and English helped emerging bilingual students grow in their reading ability in English.

Istation partnered with a large urban school district in north Texas to study the impact of the computer-adaptive reading curriculum on bilingual students' English language proficiency. This research examines the findings from the quantitative analyses comparing students' English and Spanish curriculum usage time and movement along the Texas English Language Proficiency Assessment System (TELPAS) proficiency continuum levels. The TELPAS is a summative assessment used as part of the state accountability system in Texas. It is designed to assess students in reading, writing, listening and speaking. These results are used to determine a school's ability to meet state and federal targets for student proficiency in English (Collier & Huang, 2019). This report addresses the following research questions:

1. Can using the Istation Spanish curriculum increase the likelihood that a student will improve on the TELPAS?
2. Can using both the Istation English and the Istation Spanish curricula improve TELPAS scores?
3. Can using the Istation English curriculum increase the likelihood that a student will improve on the TELPAS?
4. What is the relationship between Istation English and Istation Spanish curriculum usage and the likelihood that an advanced bilingual student will improve on the TELPAS as compared to an emergent bilingual student?

Methods

Research Design

This report explores the quantitative analyses examining students' Istation English and Spanish curriculum usage time and movement along the TELPAS proficiency continuum levels using retrospective data collected from three school years.

A secondary data analysis approach allowed us to evaluate curriculum usage patterns and TELPAS growth and make comparisons across grade levels and student cohorts.

Analytical Sample

The school district shared data for three cohorts of students from the 2016-2017, 2017-2018, and 2018-2019 school years. We limited the sample to students in grades two through five who were identified as English learners (ELs) by the district and who had taken ISIP in English or Spanish at the beginning of the year. Demographics are available in Table 1. The difference in sample sizes is due to the number of students who took an assessment in English or Spanish, and also took the TELPAS. There are fewer students in later grades because some students will exit out of the bilingual program, or no longer take the TELPAS.

Table 1. *Demographic Composition of the Students in the Sample*

Grade	Demographic	2017-2018 N (%)	2018-2019 N (%)
2	Total Students	26,769 (100.0)	28,771 (100.0)
	English Learners	18,618 (69.6)	20,118 (69.9)
	Male	13,125 (49.0)	14,179 (49.3)
	Female	12,759 (47.7)	13,856 (48.2)
3	Total Students	19,630 (100.0)	11,614 (100.0)
	English Learners	13,644 (69.5)	7,805 (67.2)
	Male	9,750 (49.7)	5,597 (48.2)
	Female	9,280 (47.3)	5,501 (47.4)
4	Total Students	14,534 (100.0)	8,350 (100.0)
	English Learners	9,885 (68.0)	5,502 (65.9)
	Male	7,467 (51.4)	4,063 (48.7)
	Female	6,604 (45.4)	4,034 (48.3)

5	Total Students	12,759 (100.0)	7,984 (100.0)
	English Learners	8,492 (66.5)	5,227 (66.1)
	Male	6,464 (50.7)	4,042 (50.6)
	Female	5,895 (46.2)	3,628 (45.4)

We created two analytical samples for this analysis. The first sample consisted of students who were emerging bilingual students with TELPAS scores that were in the beginning or intermediate levels in the prior school year. The second sample consisted of students who were more advanced bilingual students based on their scoring in the advanced category on the TELPAS the year before.

Measures

To answer the research questions, we analyzed curriculum usage data and TELPAS composite ratings and compared them to a derived growth measurement. We also used the ISIP Reading assessment scores.

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 quartiles were calculated by grade and school year based on the actual usage within the sample. Quartile 1 represents the lowest amount of usage, and quartile 4 represents the highest usage.

However, for the 2018-2019 school year, models constructed in this way did not converge in grades 3 – 5 for usage of the English curriculum. Therefore, a single dummy coded predictor variable was created for these grades, which assigned students a 1 if

they met the Istation recommended usage across the school year (1,100-1,600 min) or a 0 if they did not fall within the recommended usage band.

TELPAS

The state of Texas uses the Texas English Language Proficiency Assessment System (TELPAS) to collect performance data to meet federal reporting requirements. Using the TELPAS, ELs in kindergarten through grade 12 demonstrate their English language proficiency in four domains: listening, speaking, reading, and writing. TELPAS results are scored and reported based on a proficiency continuum. The continuum has four different proficiency levels: beginning, intermediate, advanced, and advanced high. Scores are reported by domain and as a composite score (Texas Education Agency. n.d.). This study uses the composite score for analysis.

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 assessment results to teachers 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. 2016).

Growth

TELPAS growth was defined by looking at the difference between a student's overall TELPAS composite rating year-over-year. Students who went up at least one category on the TELPAS composite rating improved, and students who went down or did not move up did not improve. Using this simple metric allowed for the creation of a binary variable, with 1 indicating improvement and 0 indicating no improvement.

Analytical Approach

For the emerging bilingual students, we used a logistic regression mixed effects model with four different nested models. Use of only Istation's English curriculum was included in the first nested model. The referent group is students who used English curriculum in the third or fourth quartiles of usage. The second nested model analyzed usage of only Istation's Spanish curriculum, with the referent group as students in the lowest quartile of Spanish curriculum usage. The third model had usage of both English and Spanish curricula. The referent group is students who used more English curriculum and less Spanish curriculum. The fourth nested model also included the ISIP Reading score from the beginning-of-the-year assessment.

Results

We first ran correlations with ISIP Reading and TELPAS scores to determine if there was a significant relationship. Using the 2017-2018 data, correlations ranged from .70 in grade two to .73 in grade five, indicating a strong relationship between ISIP Reading and the TELPAS. Results of the correlation analysis are available in Table 2. Correlations between ISIP Lectura and the TELPAS were less than .63 across all grades; therefore, ISIP Lectura was not included in the nested models.

Table 2. *Correlations between ISIP Reading and TELPAS by Grade*

Grade	Correlation
2	.70
3	.71
4	.70
5	.73

Next, we ran the nested models specified above to evaluate the relationship between the likelihood of improving on the TELPAS composite rating category and the time spent in the Istation English and Istation Spanish curricula. Students with lower English language proficiency had greater benefits from instruction in the Spanish curriculum. The trend, however, reversed for advanced students who increased their odds of growth on the TELPAS by receiving more instruction in the English curriculum. In grade 4 for the 2018-2019 school year, the models with the quartiles of Istation usage did not converge, and therefore we created a variable to capture whether or not the student met usage guidelines. Results of the statistical models are in Tables 3-14.

Table 3. *Results from Logistic Regression Models for Grade 2 in the 2017-2018 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	1.067		1.16	1.26
Some English Curriculum Usage	1.303***		1.29**	1.52*
Spanish Usage Quartile 2		1.55***	1.54***	1.90***
Spanish Usage Quartile 3		1.65***	1.66***	2.22***
Spanish Usage Quartile 4		1.72***	1.72***	2.37***
Beginning-of-Year ISIP ER Score				1.10*
AIC (Akaike Information Criterion)	9136.04	9107.391	9100.067	3718.43
ICC (Intra-Class Correlation)	.19	0.20	0.20	0.18

*** $p < .001$, ** $p < .01$, *$p < .05$

Table 4. *Results from Logistic Regression Models for Grade 2 in the 2018-2019 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	1.08		1.09	0.96
Some English Curriculum Usage	0.99		0.95	**1.23***
Spanish Usage Quartile 2		**1.52***	**1.53***	**1.79***
Spanish Usage Quartile 3		**1.88***	**1.90***	**2.40***
Spanish Usage Quartile 4		**1.27****	**1.28****	**1.86***
Beginning-of-Year ISIP ER Score				**1.655***
AIC (Akaike Information Criterion)	10104.22	10045.69	10048.17	3841.67
ICC (Intra-Class Correlation)	0.18	0.17	0.17	0.13

*** $p < .001$, ** $p < .01$, *$p < .05$

Table 5. *Results from Logistic Regression Models for Grade 3 in the 2017-2018 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	0.97		1.04	1.09
Some English Curriculum Usage	0.94		0.94	0.86
Spanish Usage Quartile 2		0.98	0.99	1.06
Spanish Usage Quartile 3		**1.36***	**1.37****	**1.45****
Spanish Usage Quartile 4		**1.56***	**1.58***	**1.39***
Beginning-of-Year ISIP ER Score				**0.768***
AIC (Akaike Information Criterion)	7795.81	7770.64	7773.35	4493.28
ICC (Intra-Class Correlation)	0.09	0.010	0.10	0.09

*** $p < .001$, ** $p < .01$, *$p < .05$

Table 6. *Results from Logistic Regression Models for Grade 3 in the 2018-2019 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	**0.77***		**0.75***	0.81
Some English Curriculum Usage	**0.83***		**0.79***	0.84
Meets Recommended Usage for Spanish Curriculum		0.85	0.83	**2.25***
Beginning-of-Year ISIP ER Score				**1.52***
AIC (Akaike Information Criterion)	4011.19	3656.66	3650.39	2296.23
ICC (Intra-Class Correlation)	0.06	0.06	0.06	0.07

*** *p* < .001, ** *p* < .01, **p* < .05

Table 7. *Results from Logistic Regression Models for Grade 4 in the 2017-2018 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	0.91		0.92	0.84
Some English Curriculum Usage	0.98		0.99	0.98
Spanish Usage Quartile 2		1.044	1.04	1.08
Spanish Usage Quartile 3		1.126	1.12	1.2
Spanish Usage Quartile 4		1.234^	1.22^	1.10
BOY Score (English)				0.71
AIC (Akaike Information Criterion)	5255.21	5254.71	5258.029	3272.24
ICC (Intra-Class Correlation)	0.06	0.057	0.056	0.05

*** *p* < .001, ** *p* < .01, **p* < .05 ^ *p* ≤ .08

Table 8. *Results from Logistic Regression Models for Grade 4 in the 2018-2019 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	1.003		0.992	1.70
Some English Curriculum Usage	**1.35***		1.21	1.341
Meets Recommended Usage for Spanish Curriculum		2.041	2.04	2.26
BOY Score (English)				**1.66***
AIC (Akaike Information Criterion)	1810.63	1618.11	1620.83	455.20
ICC (Intra-Class Correlation)	0.09	0.13	0.12	0.04

*** *p < .001, ** p < .01, *p < .05*

Table 9. *Results from Logistic Regression Models for Grade 5 in the 2017-2018 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	0.973		0.974	1.01
Some English Curriculum Usage	0.944		0.942	0.879
Spanish Usage Quartile 2		0.966	0.968	0.943
Spanish Usage Quartile 3		1.099	1.102	1.223
Spanish Usage Quartile 4		1.077	1.078	1.23
BOY Score (English)				0.977
AIC (Akaike Information Criterion)	4846.792	4847.837	4851.382	2251.17
ICC (Intra-Class Correlation)	0.064	0.064	0.062	0.034

*** *p < .001, ** p < .01, *p < .05*

Table 10. *Results from Logistic Regression Models for Grade 5 in the 2018-2019 School Year, Odds Ratios*

	Model 1	Model 2	Model 3	Model 4
No English Curriculum Usage	1.029		1.036	1.229
Some English Curriculum Usage	0.931		0.935	0.924
Spanish Usage Quartile 2		1.677***	1.677**	1.831*
Spanish Usage Quartile 3		1.008	1.006	1.359
Spanish Usage Quartile 4		0.805	0.807	1.167
BOY Score (English)				1.913***
AIC (Akaike Information Criterion)	2382.51	2366.466	2370.133	873.63
ICC (Intra-Class Correlation)	0.07	0.076	0.075	0.096

*** $p < .001$, ** $p < .01$, * $p < .05$

Spanish Curriculum Use and TELPAS Improvement

Time spent in the Istation Spanish curriculum predicted much higher odds of improving by at least one category on the TELPAS from the previous year. In the 2017-2018 school year, the amount of time a student spent using the Istation Spanish language curriculum significantly predicted a greater odds ratio (OR) of improving a category on the TELPAS composite rating. Similarly, the results of the analysis suggest that more time spent using the Istation Spanish curriculum predicted greater odds of improvement for second grade students in the 2018-2019 school year for usage quartile 2 ($OR = 1.79$, $p < .001$), usage quartile 3 ($OR = 2.40$, $p < .001$), and usage quartile 4 ($OR = 1.86$, p < .001). Using some English curriculum also improved students' odds of increasing a level ($OR = 1.23$, $p < .05$).

In third grade, we found for the 2017-2018 school year that students in the third and fourth quartiles of Spanish curriculum usage were more likely to improve their

TELPAS category from the previous year. Using the dummy coded usage variable for the Spanish curriculum in the 2018-2019 school year also yielded significant results for third graders (OR = 2.25, p < .05). Thus, students in third grade who met the Istation usage recommendations had greater odds of improving by at least a category on the TELPAS compared to students who did not meet Istation usage recommendations.

There were no significant effects for fourth or fifth graders in the 2017-2018 school year. In 2017-2018, results for fourth-grade students in Spanish usage quartile 4 approached significance (OR = 1.22, p ≤ .08). In the 2018-2019 school year results showed that using the Spanish curriculum helped increase fifth-grade students' odds of achieving the Advanced category (OR = 1.83, p ≤ .05). There may be several reasons for these results. First, usage in grades four and five is substantially lower than usage in grades two and three. Second, the sample sizes were smaller in grades four and five. The smaller sample sizes may be attributable to students who exit the program by meeting the language proficiency criteria.

English Curriculum Use and TELPAS Improvement

Second grade students in the 2017-2018 school year who were in either the first or second quartile of English curriculum usage were more likely to improve their TELPAS scores (OR = 1.52, p < .001), as were second grade students in these quartiles in the 2018-2019 school year (OR = 1.23, p < .05). Third grade students who were in quartile 1 or 2 of Istation English curriculum usage in 2017-2018 and 2018-2019 were significantly less likely to improve their TELPAS category rating than those in the referent group with more English curriculum usage.

These results suggest that there are differences by grade. In second grade, lower proficiency EL students who spent some time throughout the school year on the English

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curriculum but focused primarily on the Spanish curriculum were more likely to improve on the TELPAS. Those who met usage guidelines in Spanish were 140% more likely to increase a category, and students with some English curriculum usage were 23% more likely to increase a category than those that had more English curriculum. In third grade, lower performing students benefit from having more instruction in the Spanish curriculum but also need some instruction in English as well. Furthermore, the results were insignificant for fourth grade students, and there were no effects for fifth grade students.

Advanced Students and TELPAS Improvement

Advanced students who used the Istation curriculum also had greater odds of improving on the TELPAS year over year, but the pattern of usage that predicted greater odds differed for these students compared with emergent bilingual students. Results from these models are in Tables 11-14. For all of the models, the referent group consists of students who were in the first quartile of English usage and the fourth quartile of Spanish curriculum usage. Second grade students in 2017-2018 had greater odds of improving on the TELPAS from the previous year if they were in the second English curriculum usage quartile ($OR = 1.925$, $p = .003$) and first quartile of Spanish curriculum usage ($OR = 2.754$, $p < .001$). In 2018-2019, second grade students in the highest quartile of English curriculum usage had significantly higher odds of improving on the TELPAS ($OR = 1.538$, $p = .035$) as well as students in the lowest quartile of Spanish curriculum usage ($OR = 1.423$, $p = .045$). Third grade students in the 2017-2018 school year had higher odds of improving on the TELPAS overall category if they were in the top quartile of English curriculum usage ($OR_{Q4} = 1.466$, $p = .001$) and were in the bottom quartiles of Spanish curriculum usage ($OR_{Q1} = 1.461$, $p < .001$; $OR_{Q2} = 1.321$, $p = .012$).

Table 11. *Results from the Logistic Regression Model for Advanced Students in Grade 2 in the 2017-2018 School Year*

Term	Estimate	SE	Odds Ratios
Intercept (REF = English Usage Quartile 1, Spanish Usage Quartile 4)	−2.747	0.283	**0.064*****
English Usage Quartile 2	0.655	0.219	**1.925****
English Usage Quartile 3	0.230	0.258	1.259
English Usage Quartile 4	0.131	0.260	1.140
Spanish Usage Quartile 1	1.013	0.275	**2.754*****
Spanish Usage Quartile 2	0.091	0.300	1.096
Spanish Usage Quartile 3	0.465	0.289	1.592

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 12. *Results from the Logistic Regression Model for Advanced Students in Grade 2 in the 2018-2019 School Year*

Term	Estimate	SE	Odds Ratios
Intercept (REF = English Usage Quartile 1, Spanish Usage Quartile 4)	−2.004	0.169	**0.135*****
English Usage Quartile 2	−0.144	0.184	0.866
English Usage Quartile 3	0.179	0.185	1.196
English Usage Quartile 4	0.430	0.205	**1.538***
Spanish Usage Quartile 1	0.353	0.176	**1.423***
Spanish Usage Quartile 2	0.183	0.205	1.201
Spanish Usage Quartile 3	0.099	0.204	1.104

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 13. *Results from the Logistic Regression Model for Advanced Students in Grade 3 in the 2017-2018 School Year*

Term	Estimate	SE	Odds Ratios
Intercept (REF = English Usage Quartile 1, Spanish Usage Quartile 4)	−1.093	0.080	**0.335*****
English Usage Quartile 2	−0.060	0.113	0.942
English Usage Quartile 3	0.178	0.116	1.195
English Usage Quartile 4	0.382	0.120	**1.466****
Spanish Usage Quartile 1	0.379	0.102	**1.461*****
Spanish Usage Quartile 2	0.279	0.112	**1.321***
Spanish Usage Quartile 3	0.138	0.160	1.147

*** $p < .001$, ** $p < .01$, *$p < .05$

Discussion

The results of this study suggest that early intervention with Istation Spanish curriculum can help students with beginner or intermediate English proficiency (as categorized by the TELPAS) to strengthen their foundational language skills in their native language, which in turn helps these students acquire greater English language proficiency. This is evident from the consistent effects observed in second and third grades in the 2017-2018 and 2018-2019 school years. We observed significant increases in the odds of moving up by at least one category on the TELPAS for students in these earlier grades who used the Istation computer-adaptive curriculum as recommended. Our research also demonstrates that students need differentiated instruction depending on their prior TELPAS category.

Figure 1 displays the differences in odds ratios for students in grade 2 (2018-2019 school year) who were in the Advanced category the prior school year and are

working towards Advanced High Proficiency, versus Figure 2 that shows those that were in the beginning or intermediate category. For the graph for Advanced students, the comparison group is students who were less likely to move up to Advanced High: They received less English instruction (Quartile 1) and more Spanish instruction (Quartile 4). These results show that students who used Istation English greater than 30 minutes a week had 54% greater odds of moving up a category, and if they used the Spanish curriculum about 6 minutes a week or less, they had 42% greater odds of moving up a category.

In contrast, for students who were in the beginning or intermediate category the year before (Figure 2), the comparison group is students who used the Istation English curriculum at a higher level (Quartiles 3 and 4) and used Spanish less (Quartile 1). These students were least likely to move up a category. However, if the students had some usage in English (Quartiles 1 and 2) they had 23% greater odds of moving up a category, and if they had Spanish Usage in Quartile 3, which is comparable to the Istation recommended usage guidelines, they had 140% greater odds of moving up a category. Our findings of no significant changes for fourth grade and fifth grade could be attributable to several factors. First, most students for this school district do tend to move up by at least a category on the TELPAS each year, and many students exit the TELPAS. As a result, there are substantially fewer students in fourth and fifth grade who take the TELPAS and would be included in this study. Additionally, usage of Istation Spanish curriculum across the year is much lower for fourth and fifth grade students compared to second and third grade students. With few students approaching the usage guidelines, it is reasonable that students would not have growth on the TELPAS associated with usage of Istation.

Figure 1. Comparison of Odds Ratios for Students Who Were in the Advanced category

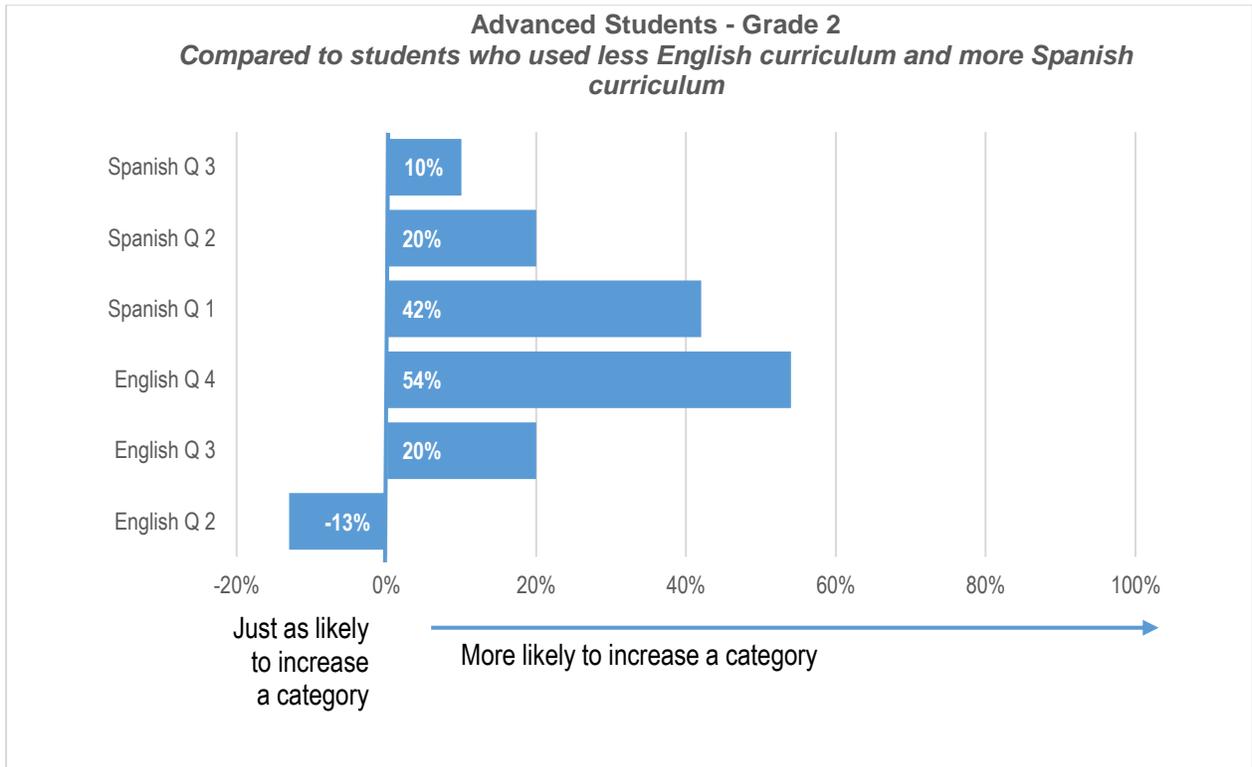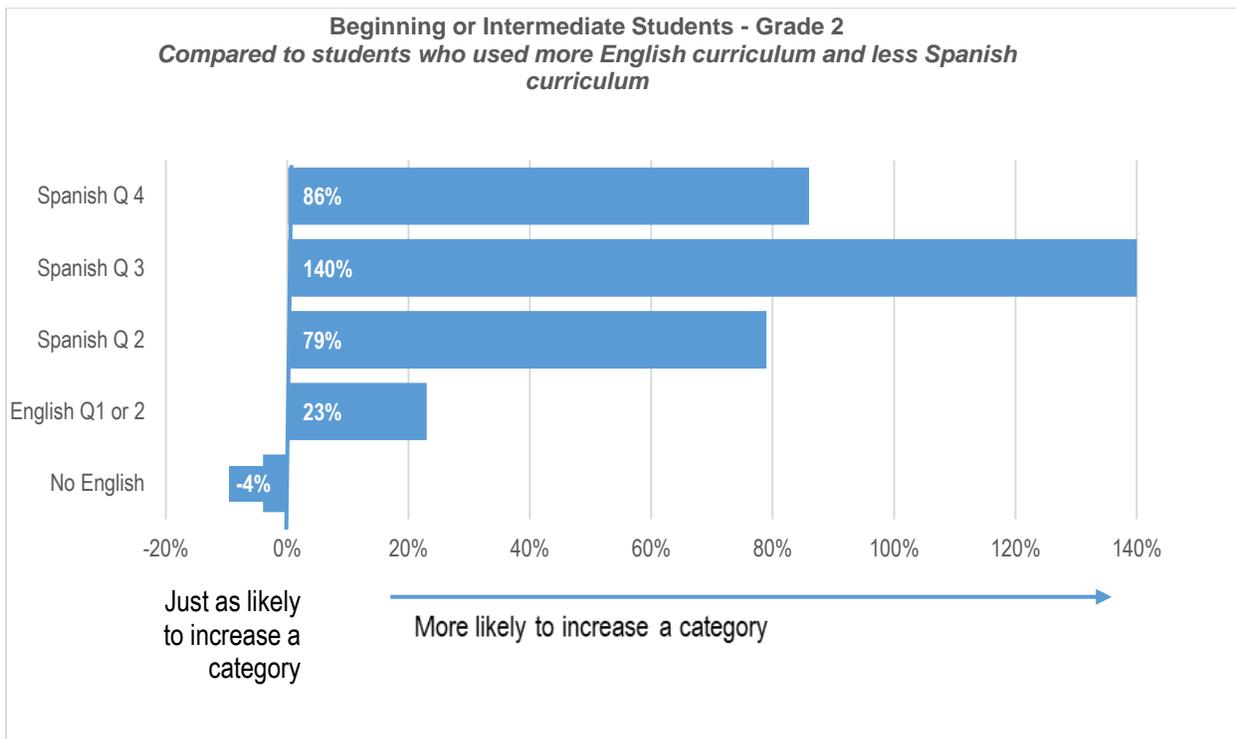**Figure 2.** Comparison of Odds Ratios for Students Who Were in the Beginning or Intermediate Category

The analysis for this sample of lower English proficiency students provides evidence that too much time spent using the Istation English curriculum was counterproductive with emerging bilingual students. This is consistent with the finding that the Spanish curriculum was beneficial to these students, and it is also consistent with the literature that demonstrates students benefit from literacy instruction in their home language (Genesee, Geva, Dressler, & Kamil, 2006; Goldenberg, 2013). Therefore, the results suggest that second grade students who receive some instruction using the English language curriculum but much more instruction in the Spanish language curriculum were more likely to go up a category on the TELPAS. Third grade students who received both English and Spanish were more likely to increase a level. The findings suggest that there is an optimal usage pattern for students whose first language is Spanish and who may struggle with acquiring English proficiency.

Finally, previous research has shown that development in phonological processing skills and vocabulary in the primary language is associated with acquisition of these skills in English, and because the Istation Spanish curriculum targets these skills directly, we believe that this may be the link between time spent using Istation's Spanish curriculum and improvement on the TELPAS. We cannot demonstrate causality due to limitations in the study design, but this is consistent with prior research. This may also help to explain why we found weaker effects in grades four and five. In future research it may be instructive to examine relationships between growth on specific ISIP Spanish language subtest scores and improvement on the TELPAS.

Recommendations

Based on this research, we recommend that educators adjust the amount of time spent in the English or the Spanish curricula by grade and by student proficiency. In grade 2, emerging bilingual students should receive more Istation curriculum in Spanish than in English, as our results show that this mixture of instruction best increases their odds of going up a category on the TELPAS. In grade 3, emerging bilingual students

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need instruction in both English and Spanish. In both grades, advanced students are ready to receive more instruction in English and less in Spanish. Our evidence shows that this will help them reach the advanced high category on the TELPAS.

Limitations and Future Research

This research has some limitations that can guide future research efforts. First, this data came from one school district in north Texas, and therefore it may not be generalizable to other districts. The results showed improvement on the TELPAS, but usage of Istation may not lead to increased performance on other English language ability assessments. Sample sizes decreased as the grade level increased, as students that had reached advanced high by the end of the previous year were dropped from the analysis. This made it difficult to find results in grades 4 and 5, particularly because Istation curriculum usage was low in these grades. There was not fidelity of implementation across all schools, and better fidelity may have changed the results, particularly in grades 4 and 5. While the quartiles of Istation usage helped to serve as a proxy variable for fidelity, this method did not work as well for grades 4 and 5.

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