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The Impact of Knowledge-Building Curricula on Reading Achievement: Closing the Poverty Gap

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Abstract

The purpose of this study was to examine the effects of knowledge-building curricula on closing the opportunity gap between students from lower socioeconomic backgrounds compared to more affluent peers. Data consisted of fourth through eighth-grade students' reading achievement levels on statewide summative reading assessments from 2015 to 2019 attending US school districts implementing, and not implementing, knowledge-building curricula. Of the school districts implementing knowledge-building curricula, four separate knowledge-building curricula were analyzed among six experimental districts. We found statistically significant differences in the frequencies of students performing at varying proficiency levels between districts that implemented a knowledge-building curriculum versus districts that did not. A greater frequency of students than expected who were attending school districts implementing a knowledge-building curriculum was performing at higher proficiency levels compared to matched controls in twenty-two of twenty-seven comparisons. Overall, our study found that there is evidence to the claim that exposure to knowledge-building curricula closes the opportunity gap in reading achievement for students residing in economically disadvantaged environments.

Keywords

Knowledge-Building, Curriculum, Reading, Poverty

1. Introduction

Students' living in high poverty must overcome numerous barriers to reading at the same grade level as affluent peers (Jensen, 2013; Neuman, 2013; Neuman & Celano, 2012; Neuman et al., 2018). For example, research shows that children

living in poverty have fewer opportunities to engage in a variety of formal conversational dialogues at home or in the community (Conant et al., 2017; Duff et al., 2015; Hirsch Jr., 2003; Hoff, 2003; Kim et al., 2015; Merz et al., 2020; Nation et al., 2010; Neuman et al., 2018; Rowe, 2012, 2018; Weizman & Snow, 2001). As a result, students are at-risk for entering school with depressed language skills, less sophisticated communication experiences, lowered vocabulary, and less general background knowledge (Conant et al., 2017; Hirsch Jr., 2003; Kim et al., 2015; Merz et al., 2020; Nation et al., 2010; Neuman et al., 2018; Rowe, 2018; Rowe et al., 2016; Seidenberg et al., 2020).

Caregiver conversations in the early years, particularly those consisting of richer or more sophisticated vocabulary, have been found to be of utmost importance to vocabulary and reading proficiency in elementary school (Duff et al., 2015; Weizman & Snow, 2001). Affluent families spend seven to nine times more money on their children's education and read to their children twice as much compared to low-income households. The effect yields deficits of more than 400 hours of reading activity prior to kindergarten (Jensen, 2013; Tavernise, 2012). In a formal education setting, these impact reading comprehension and continued learning (Chall & Jacobs, 1983; Larson et al., 2015; Lervag et al., 2018; Merz et al., 2020; Wexler, 2019).

Deficits in vocabulary and language comprehension (Catts et al., 2006; Conradi et al., 2016; Duff et al., 2015), access to print and literacy activities (Davidson, 2019; Hoff, 2003; Larson et al., 2015; Neuman & Celano, 2006; Schugar & Dreher, 2017), exposure to new and varied words (Conant et al., 2017; Neuman et al., 2018; Rowe, 2018; Weizman & Snow, 2001), exposure to complex expressive sentence structure (Neuman et al., 2018), and exposure to informational text (Neuman, 2013) are all identified barriers linked to high-poverty and reading achievement. Research suggests that the gaps in achievement related to literacy widen as students' progress throughout formal education, and subsequently result in fewer students from low SES backgrounds prepared for college compared to middle-class peers (Chall & Jacobs, 2003; Hernandez, 2011; Kieffer, 2012). Students living in poverty and reading below level in third grade are six times more likely to drop out of high school than proficient readers, and 63% of high school dropouts were reading below grade level (Hernandez, 2011).

Arguably, students from lower socioeconomic backgrounds need curriculum and instruction that deviates from traditional literacy programs (Davidson, 2019; Hirsch Jr., 2003; Kaefer et al., 2015; Wexler, 2019; Wexler, 2020). Over the last few years, research has emerged focusing on the importance of knowledge-building curriculum to address documented knowledge and vocabulary gaps in children from high-poverty communities (Cervetti et al., 2016; Cervetti & Hiebert, 2015; Neuman, 2013; Wexler, 2019, 2020). Cognitive scientists postulate that the most essential requirement for text comprehension is relevant knowledge of the topic instead of comprehension strategies developed through skills-instruction (Hirsch Jr., 2016; Hirsch Jr. & Hansel, 2013; Willingham, 2006/7).

Content-focused, or knowledge-building instruction, is linked closely to the

way in which readers process text whereby students are afforded opportunities to build upon mental representations of text ideas through repeated, systematic and sequential exposure. A reader's knowledge about the topic, or domain knowledge, is essential for constructing a mental model of what is said in text (Hirsch Jr., 2003; Kintsch, 2009; Kintsch & van Dijk, 1978; Oakhill & Cain, 2008; Willingham, 2006/7). In the classroom, knowledge-rich curriculum and instruction can be envisioned as rich, student-led, meaningful academic discussions about content within a text (McKeown et al., 2009). In contrast, skills-instruction is aligned with general learning models that direct readers to think about their thinking, and to employ strategies that relate to the text (McKeown et al., 2009). In summary, instructional programs rich in building background knowledge are essential for students' reading achievement (Cervetti & Hiebert, 2015; Hirsch Jr., 2016; Hirsch Jr. & Hansel, 2013; Wexler, 2020; Willingham, 2006/7).

Purpose

Prior research suggests considerable differences in language and vocabulary development in children from high-poverty homes compared to non-impoverished peers, which has great impact on pre-literacy skills and subsequent reading proficiency and academic success (Duff et al., 2015; Golinkoff et al., 2019; Rowe, 2018; Rowe et al., 2016). Likewise, ample research has shown the importance of prior knowledge on reading achievement (Cervetti & Hiebert, 2015; Hirsch Jr., 2016; Hirsch Jr. & Hansel, 2013; Wexler, 2020; Willingham, 2006/7). Upon analysis of prior studies, one could assume that students who are exposed to a district implemented knowledge-building curriculum would have increased reading achievement. The purpose of this study was to question this assumption using common measures among similar districts. The first research question was: Is there a statistically significant difference in the frequency of students' performing at various proficiency levels between districts that implemented knowledge-building curricula compared to those that did not? Students in these analyses met the criteria for Free/Reduced priced meals, appropriate state assessments were used as the common measure for the analyses, and data were utilized from ten separate districts from two separate states. The second focus of this study sought to identify whether there were statistically significant differences among the frequencies of students' performing at respective English Language Arts (ELA) proficiency levels on grade-specific state assessments as the district began implementing a knowledge-building curriculum over time.

2. Review of Literature

The National Institute of Child Health and Human Development was authorized by Congress in 1997 to investigate the status of knowledge on reading research and the effectiveness of reading instruction (National Reading Panel, 2000). That panel, widely known as the National Reading Panel, named five areas of substantial reading research: phonemic awareness, phonics, fluency, vocabulary, and comprehension, now known and referenced as the five pillars of reading instruc-

tion. These five pillars became the source of continued reading research and a primary emphasis in instructional practice (Cassidy et al., 2010). Since the publication of the National Reading Panel report (National Reading Panel, 2000), some researchers have posited the need for the addition of a sixth pillar, knowledge (Cervetti & Hiebert, 2015; Neuman & Celano, 2006).

Background knowledge has been defined in the literature as "general or academic information related to the domain of reading comprehension passages" (Talwar et al., 2018: p. 253). Stated differently, "background knowledge comprises all of the world knowledge a reader brings to the task of reading" (Smith et al., 2021: p. 216). Research shows a distinct relationship between the extent of an individual's prior knowledge to greater comprehension of read text (O'Reilly et al., 2019; Talwar et al., 2018). Students with more comprehensive background knowledge are better at retaining and recalling passage information (Recht & Laslie, 1988). Priebe et al. (2012) found that poor readers with prior knowledge were able to read more words correctly per minute and demonstrated fewer errors and fewer substitutions that impacted meaning when reading aloud (Priebe et al., 2012).

Linguistic and general background knowledge contributes to one's reading proficiency (Gough & Tunmer, 1986). Linguistic knowledge aides a reader's ability to decode unknown words in context and contributes to overall reading fluency (Adams et al., 1995; Miller & Keenan, 2009; Priebe et al., 2012; Stanovich, 1986). Readers use general background knowledge to interact with information in text, make connections and inferences that bridge textual elements to new information, and to support coherent comprehension (Adams et al., 1995; Perfetti et al., 2005). Readers activate background knowledge when reading with ease, whereby one's working memory can successfully grapple with new information (Cervetti & Hiebert, 2015). A readers' existing knowledge is utilized to form a situation model, where the reader successfully integrates new information from text with prior knowledge to comprehend text (Kintsch, 2009; Willingham, 2006/7).

Willingham (2006/7, 2017) summarized that an individual's ability to comprehend text is related to a reader's ability to monitor their comprehension, relate sentences to one another, and relate content to prior knowledge. The more prior knowledge an individual has, the easier the reader can relate new information from text to existing understandings, and thus better comprehend and analyze text. When reading, prior knowledge supports student word identification, which influences fluency and comprehension (Priebe et al., 2012). Prior knowledge impacts the rate in which students read and assists readers in making rapid connections between what was already known and new information, thus facilitating and speeding comprehension (Hirsch Jr., 2003). Many contemporary reading researchers have emphasized the limited effectiveness of skills-only comprehension instruction, especially for America's most underprivileged learners, and have acknowledged the need for reading instruction that included the teaching of knowledge and acquiring knowledge (Cervetti et al., 2016; Cer-

vetti & Hiebert, 2015; Davidson, 2019; Hirsch Jr., 2003, 2016; Hirsch Jr. & Hansel, 2013; Kaefer et al., 2015; McKeown et al., 2009; Smith et al., 2021; Wexler, 2019, 2020; Willingham, 2006/7).

3. Theoretical Framework

The context of the investigation was rooted in arguments specific to how societal structures inherently create systemic disadvantages for some groups of individuals. There is a discrepancy in achievement for US students from high-poverty backgrounds compared to their non-impoverished peers (Chall et al., 1990; Chall & Jacobs, 1983; Conradi et al., 2016; Jensen, 2013; Kim et al., 2015; Kim et al., 2019; Larson et al., 2015; NAEP, 2019; Neuman & Celano, 2012; Reardon, 2013; Reardon et al., 2012; Schugar & Dreher, 2017; Sirin, 2005; von Hippel et al., 2018; White, 1982). Attributes of poverty include unpredictable housing, parental absence due to work schedules consistent with low-wage jobs, inadequate access to or knowledge of quality healthcare, food insecurity induced trauma, parent-child interactions, and access to quality childcare and preschool programs (Jensen, 2013; Neuman & Celano, 2012; Neuman et al., 2018). Poverty undermines students' readiness as evidenced by differences in students' exposure, background knowledge, and subsequent success (Chall & Jacobs, 1983; Duff et al., 2015; Hirsch Jr., 2016; Lervag et al., 2018; Nation et al., 2010; Rowe et al., 2016; Stanovich, 1986; Weizman & Snow, 2001; Wexler, 2019). This disparity is long lasting and rooted in a history of systemic racism, bias, and access to privilege (Jensen, 2013; Neuman et al., 2018; Willingham, 2012).

Students' access to meaningful, continuous, and numerous learning opportunities are, in part, crucial to their development of knowledge. Students with fewer learning opportunities have significantly less exposure to words, experiences, or access to rich and well-represented literacy (Neuman & Celano, 2012). Children who are not read to or not spoken to for the purposes of regularly imparting knowledge enter school with gaps in language knowledge, vocabulary knowledge, and background knowledge (Kim et al., 2015; Neuman & Celano, 2012). The impact on education becomes most pronounced when students are asked to read to understand at the fourth grade and expected to analyze text with greater sophistication and nuance thereafter (Chall et al., 1990; Indrisano & Chall, 1995). Logically, students who lack vocabulary are not able to comprehend text because they do not understand the words of the passage (Hirsch Jr., 2003; Nagy & Scott, 2000). In effect, students' access, opportunity, and exposure to academic or educational settings affects their foundational background knowledge that is essential for successful academic learning and comprehension of complex text (Duff et al., 2015; Hirsch Jr., 2003; Kim et al., 2015; Nation et al., 2010; Neuman et al., 2018).

4. Methodology

4.1. Research Participants

Data were collected from eleven purposefully selected districts that enrolled

fourth through eighth-grade students who met criteria of "high poverty" due to their qualification for free or reduced priced meals. The sample was purposeful to ensure results reflected low-income students enrolled in school districts implementing knowledge-building curricula since 2017 across specific grades. Frequency achievement data on the state ELA assessments were examined for high-poverty students attending the targeted knowledge-building school districts in grades four through eight. Frequency data were compared to a second set of frequency data retrieved from districts not utilizing knowledge-building curriculum for reading comprehension instruction. The districts not implementing knowledge-building curricula are considered "controls". "Control" districts were selected due to their similarity of student demographic and relative geographic proximity to the targeted school districts. Both the knowledge-building and control districts pairings were in the same states utilizing the same state ELA assessments to ensure the comparisons were valid.

The large amount of data publicly available allowed us to examine the achievement of more than 57,000 students meeting state criterion for high poverty. In this study, district enrollments ranged from 2500 to over 170,000 from small cities to urban cities, and large metropolitan communities. The overall percentage of students who met criteria for Free/Reduced priced meals for the sample was 39 percent, and the average minority (not classified as Caucasian/White) was 58 percent.

4.2. Instrumentation

Data were categorized by district implementation of a knowledge-building curriculum. All curricula utilized as part of this study are marketed and known as "knowledge-building". The ideas and pedagogical features of "knowledge-building curricula" can be traced to the research of E.D. Hirsch and are represented through organizations such as The Core Knowledge Foundation, StandardsWork, and the Knowledge Matters Campaign in response to the opportunity gap in American children based on income and race. The tenets of these curricula emphasize building knowledge through systematic content rich in non-fiction text over the instruction of reading strategies such as identifying the main idea or drawing conclusions to strengthen text comprehension and subsequent reading achievement.

State level assessments in the US undergo extensive content validity, construct validity, and reliability procedures to ensure that they align to test frameworks, which in turn are aligned to state standards. State level assessments also undergo bias review and interrater reliability in production, collection, and scoring. The state assessment data had undergone rigorous evaluation to ensure construct validly, content validity, and reliability for the measurement of students' proficiency of (ELA) reading and writing state standards.

4.3. Data Collection

After Institution Review Board (IRB) approval and informed consent documents

were collected, state assessment data were downloaded from respective department of education websites over the assessment years 2014-15, 2015-16, 2016-17, 2017-18 and 2018-19, referenced here after as 2015, 2016, 2017, 2018, 2019. During the 2019-20 school year, state departments did not administer summative assessments due to the COVID-19 pandemic; therefore, assessment results are not included in research findings. State assessments conducted during the 2020-2021 school year were not representative of district enrollments. Subsequently, state departments suggested that 2020/21 assessment results should be interpreted with caution. As a result, 2020/21 state data were excluded from this study.

4.4. Data Analyses

Data from five experimental districts (B, D, F, H and J) fully implementing knowledge-building curricula in the assessed grade levels initiating from 2015 to 2017 was compared to five control districts (A, C, E, G, I) not known to implement knowledge-building curricula during the assessment years. Because knowledge-building is a cumulative process, data from 2019 was only examined across grades four through eight. Table 1 provides demographic details between control and experimental districts for comparative analyses. Control districts were selected due to their similarity in student demographic and relative geographic proximity to the targeted school districts. Both the knowledge-building and control districts pairings were in the same states to ensure validity of comparative data.

Pearson's Chi-square for Independence was performed to evaluate the significance in varied achievement for students in districts implementing a knowledge-building curriculum compared to those who attended districts of similar

Table 1. Demographic information (%) of participating school districts.

District	Enrollment	F/R	Black	Multi	HI	Total Minority	Miles
A	8000	24	27	8	9	44	40
B	5900	21	11	4	15	30	
C	6300	41	53	6	13	72	36
D	3300	41	35	7	26	68	
E	2500	36	23	5	26	54	14
F	2500	38	25	6	19	50	
G	53,800	48	30	5	28	63	23
H	76,100	49	41	4	17	62	
I	160,200	40	38	2	25	65	172
J	173,900	35	23	4	19	46	
K	77,900	58	76	-	14	90	

Note. F/R = percentage of students meeting criterion for Free or Reduced priced meals.

demographic not implementing a knowledge-building curriculum. Analysis was done by grade level for each year to ensure that minimal to none of the participants could be counted more than once within the contingency tables given that a grade level equates to a single academic year. Categories were evaluated in both knowledge-building districts and control districts for statistical significance by grade level for each year.

Confounding variables in this research design include unreported students who were held back a grade level and teacher retention. Additionally, limitations of this study were the lack of observing teachers implementing knowledge-building curriculum; and secondly, this study was not a pre-test/post-test research design of students' performance. It is important to note that when comparisons are made by year for a specific grade level; the comparison is of different groups of low-income students' performance on a single grade-specific state exam. In this regard, the same measurement is repeated, but the students do not repeatedly take the same grade-specific ELA exam. Given that this is a student-level unit of analysis; an independent inferential statistic was most appropriate.

5. Results

5.1. Research Question One

Figure 1 details the combined frequency of achievement in grades four through eight for three experimental districts B, D, and F of a single state in 2019 compared to the combined achievement in grades four, five, six, seven and eight for three control districts A, C, and E of that same state in 2019. Results revealed a statistically significant difference in the observed frequencies compared to expected frequencies of students scoring proficient and not proficient on the state assessment exam between experimental and control school districts. Specifically, data from the experimental districts yielded a greater frequency of observed students scoring proficient on the state exam than the expected frequency for low-income students, and a lower frequency of observed students scoring not proficient than expected. Conversely, the combined data from control districts yielded a greater frequency of expected students scoring proficient on the state exam than observed, and a higher frequency of observed students meeting criteria for Free/Reduced priced meals scoring not proficient than the frequency expected. There is evidence that districts implementing a knowledge-based curriculum are closing opportunity gaps for students.

Figure 2 details the combined achievement of Experimental Districts H and J compared to Districts G and I in the second state of study analysis. Consistent with the comparative analysis of the other six districts, due to the cumulative nature of knowledge-building curricula, only 2019 data from all four districts was used in research findings. Results showed the combined frequency of students in grades four through eight in experimental and control districts scoring proficient, indicated by an achievement level 3 or above, and not proficient, indicated by an achievement level 1 or 2. A statistically significant difference was

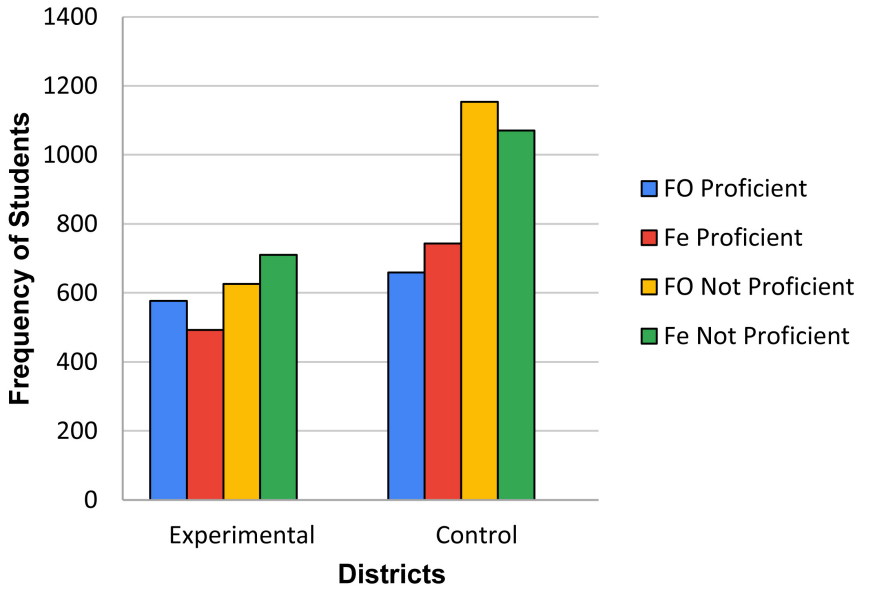

Figure 1. Combined grade level 2019 frequency observed and expected proficient/not proficient achievement for experimental and control districts, state one. Note: Chi-square = χ^2 (4) = 40.34, $p < 0.05$.

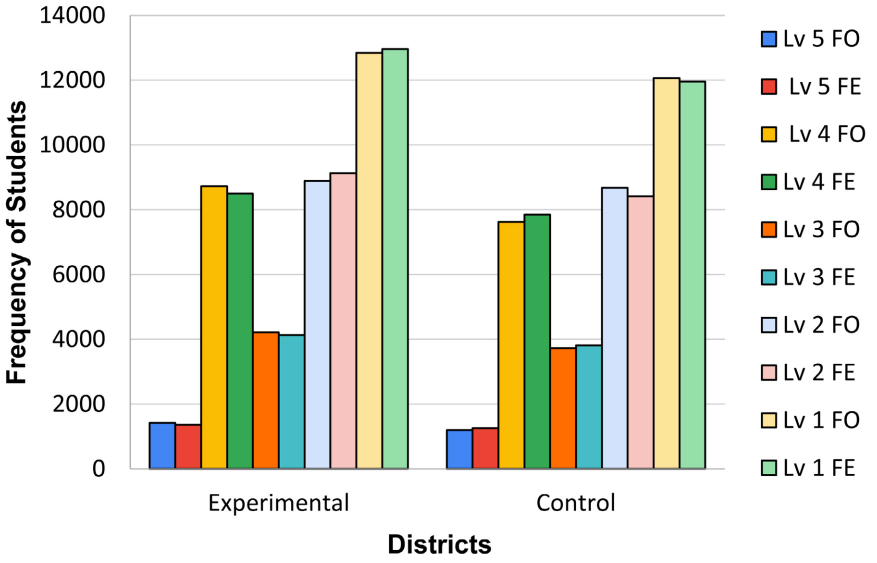

Figure 2. Combined grade level 2019 frequency observed and expected proficient/not proficient achievement for experimental and control districts, state two. Note: Chi-square = χ^2 (4) = 36.46, $p < 0.05$.

found in the frequency of students who met criteria as "economically disadvantaged" performing at the various proficiency levels on the state assessment between schools that implemented knowledge-building curricula compared to those that did not. Namely, in the experimental districts, the frequency of observed students who performed at achievement levels 3 - 5 was greater than the frequency expected, and the frequency observed of students who scored at achievement levels 1 or 2 was less than the frequency expected. Conversely, in

the control districts, the frequency of observed students who met criteria as economically disadvantaged and performed at proficiency levels 3 - 5 was less than the frequency expected, and the frequency of students observed to score not proficient level 1 or 2 was greater than the frequency expected.

5.2. Research Question Two

Research Question Two sought to identify whether a statistically significant difference existed in the frequency of students who met criteria for Free/Reduced priced meals performing at the various proficiency levels on the state assessment before and after implementation of knowledge-building curricula by grade level. In this analysis, as districts implemented Knowledge-Building curricula, some students experienced the curriculum implementation while other students in prior years did not receive the curriculum. Research findings indicated statistically significant differences in the frequency of achievement for students in poverty before and after implementation of knowledge-building curricula in five of six Experimental Districts (i.e., Districts B, D, F, H, J, K).

Findings from District D indicated statistically significant differences in the frequency of low-income students scoring proficient and not proficient before and after implementation of knowledge-building curriculum in all assessed grade levels. Figure 3 details a steady increase in the number of observed students scoring proficient on the state exam across the assessment years. In 2015, the frequency of observed students was less than the frequency of expected for the proficient group, and the frequency observed was greater than the frequency expected for students scoring not proficient. In 2019, the opposite pattern emerged whereas the frequency observed students scoring proficient was greater than the frequency of expected proficient, and the frequency observed for students scoring not proficient was less than the frequency expected for students

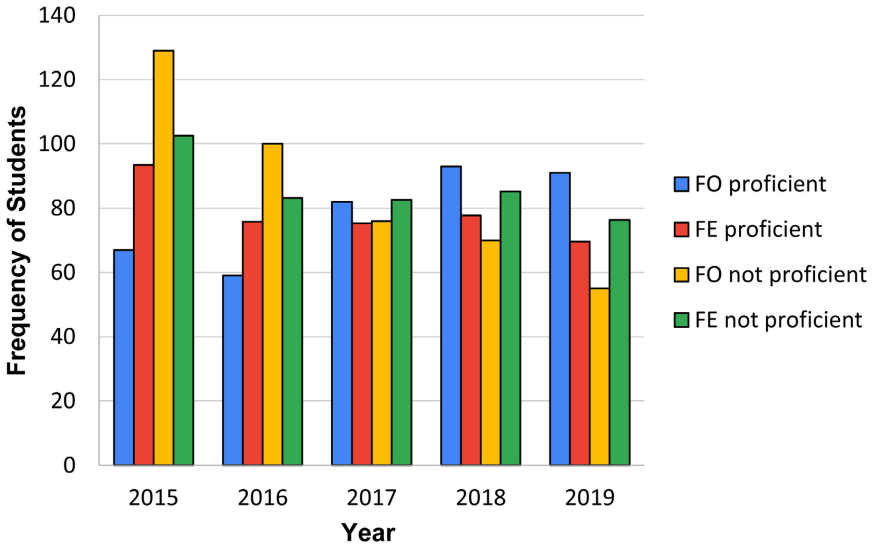

Figure 3. District D grade four frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 40.87, $p < 0.05$.

scoring not proficient (Figure 4).

District D grade five data revealed similar findings. In 2015, there was a stark difference between the frequency of observed versus frequency of expected performing at the "not proficient" level. Conversely, in 2018 the frequency observed not proficient was much less than the frequency expected not proficient. After 2016, more students were performing at the proficient level than expected.

As shown in Figure 5, there was a statistically significant difference in the frequencies of students performing proficient across the year 2015 to 2019 in

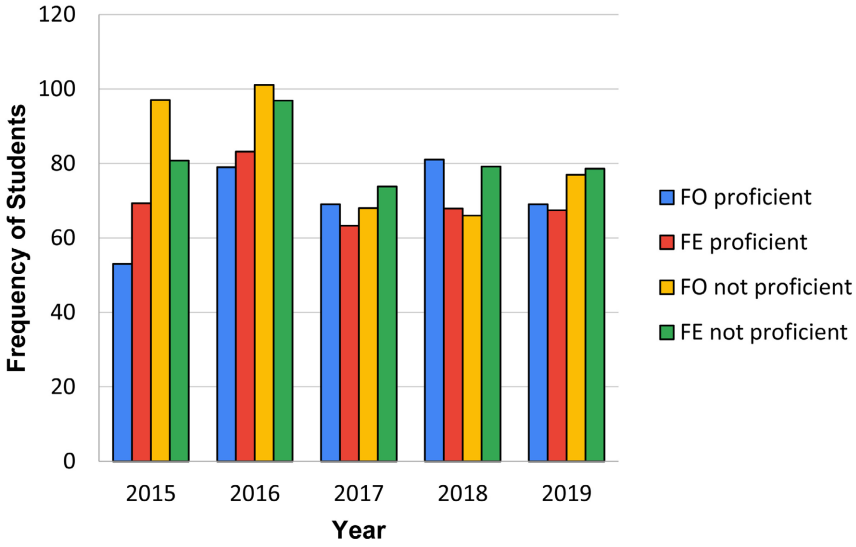

Figure 4. District D grade five frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 13.22, $p < 0.05$.

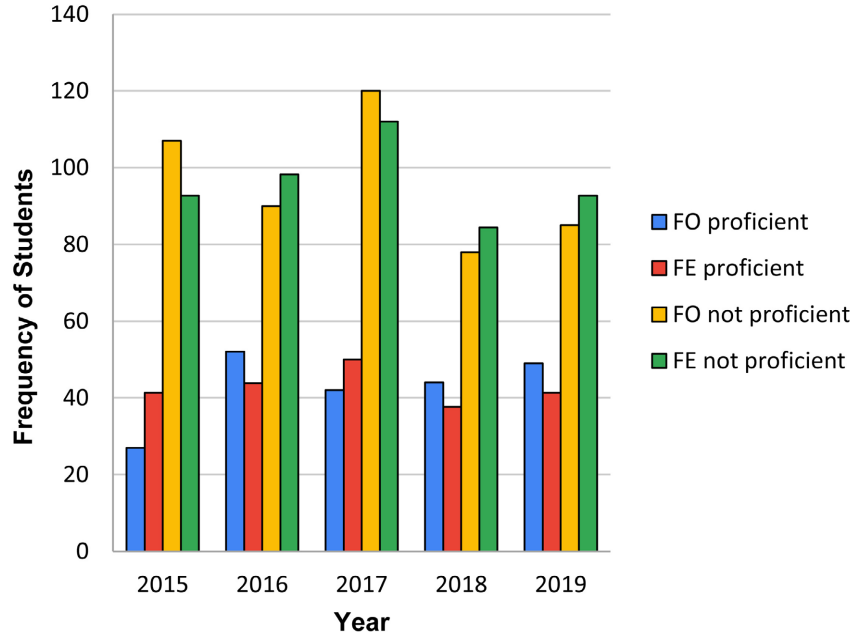

Figure 5. District D grade six frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 14.86, $p < 0.05$.

grade six of District D. A large increase occurred in the frequency of observed students scoring proficient occurred between 2015 and 2016, and a steady shift in the frequency of observed to expected frequency of achievement occurred in 2018 and 2019. The findings show that the observed frequency of students performing proficient exceeded the expected frequency, and that observed frequency of students performing not proficient was less than expected.

Significant findings were noted in the frequencies of students meeting criteria for Free/Reduced priced meals scoring proficient in grade seven of District D (see Figure 6) and grade eight (see Figure 7) over the assessment years 2015 to 2019. For students in grade seven, the greatest difference in observed and expected frequencies occurred in 2016, with an increase in the frequency of observed students scoring proficient on the state exam compared to 2015. District

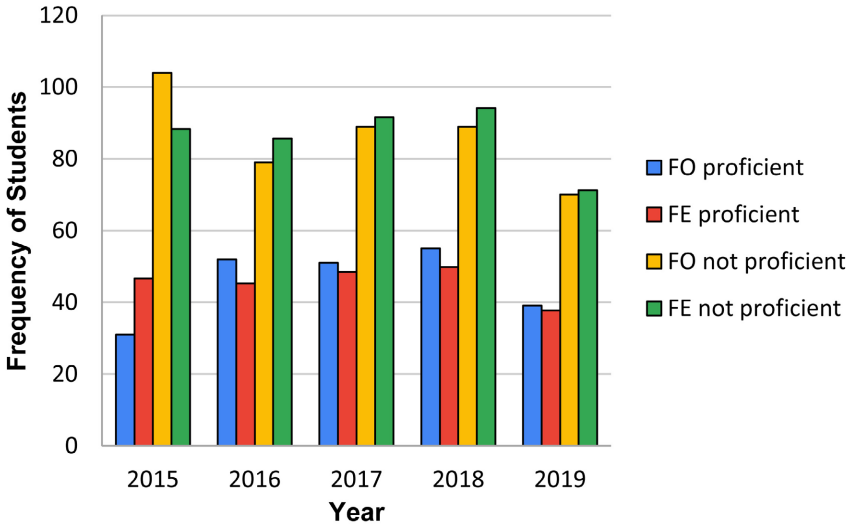

Figure 6. District D grade seven frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 10.68, $p < 0.05$.

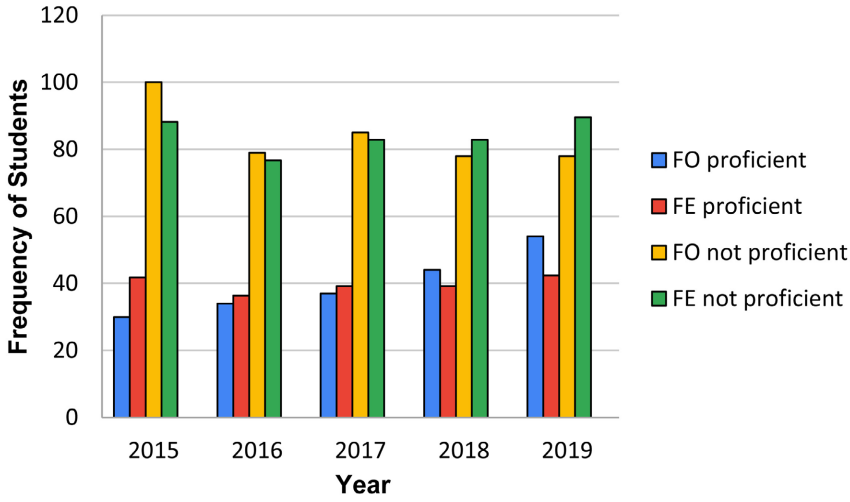

Figure 7. District D grade eight frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 10.81, $p < 0.05$.

D eighth-grade findings revealed a steady increase in the frequency of observed students scoring proficient across the assessment years, and a shift in the frequency observed and expected proficiency that occurred in 2018 and 2019 from previous years. In 2018 and 2019, a greater frequency of observed students scored proficient than expected, and fewer students performed not proficient than expected.

District F findings revealed statistically significant differences in the frequency of students who meet criteria for Free/Reduced priced meals performing at the various proficiency levels on the state assessment over years 2015-2019 in four out of five assessed grade levels, with the greatest significance occurring in eighth-grade assessment results. For fourth-grade students, detailed in Figure 8, the area of growth that most greatly impacted significance was the increase in the frequency of observed students scoring proficient in 2017 compared to previous years 2015 and 2016.

Fifth-grade results shown in Figure 9 indicated growth that yielded significant differences in achievement, most remarkably due to changes in the frequency of observed proficient and expected proficient and frequency observed not proficient and expected not proficient from 2015 to 2016, and substantial increase in the frequency of observed students performing proficient in 2019 from subsequent years. The frequency of observed students scoring proficient exceeded those expected, and frequency of observed students performing not proficient was less than the frequency expected in 2016 compared to 2015, with performance maintained in 2017 and 2018 followed by an additional increase in the proficiency observed in 2019.

Significant differences in the number of sixth-grade students performing at the proficient or not proficient levels was not observed during 2015 to 2016; however, significant results were noted in seventh grade (see Figure 10). There

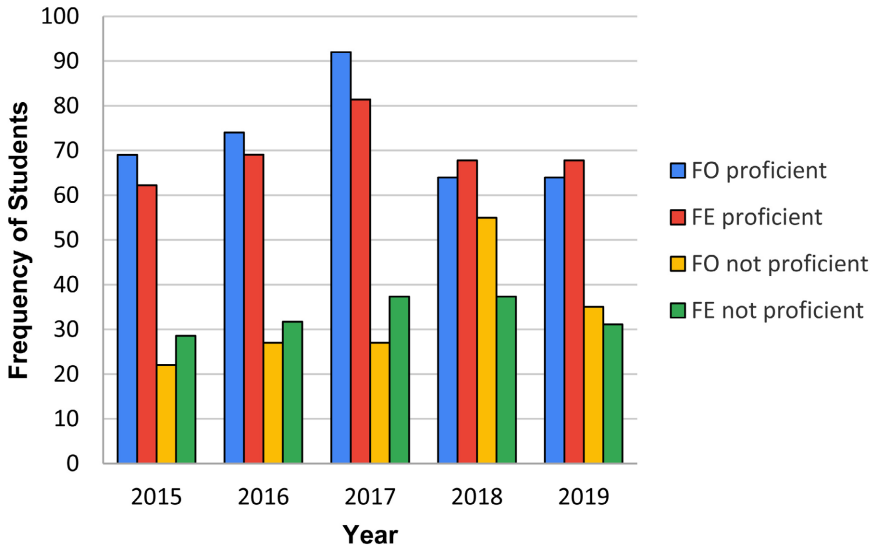

Figure 8. District F grade four frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 16.77, $p < 0.05$.

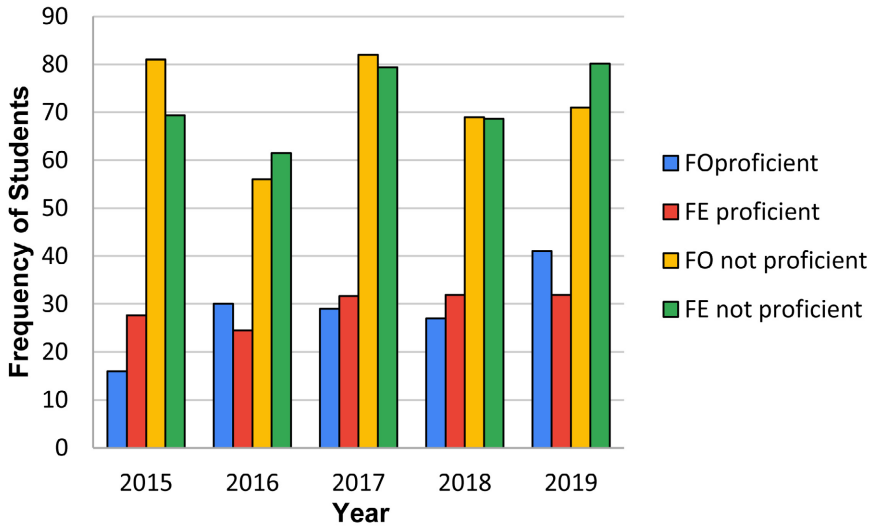

Figure 9. District F grade five frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 13.26, $p < 0.05$.

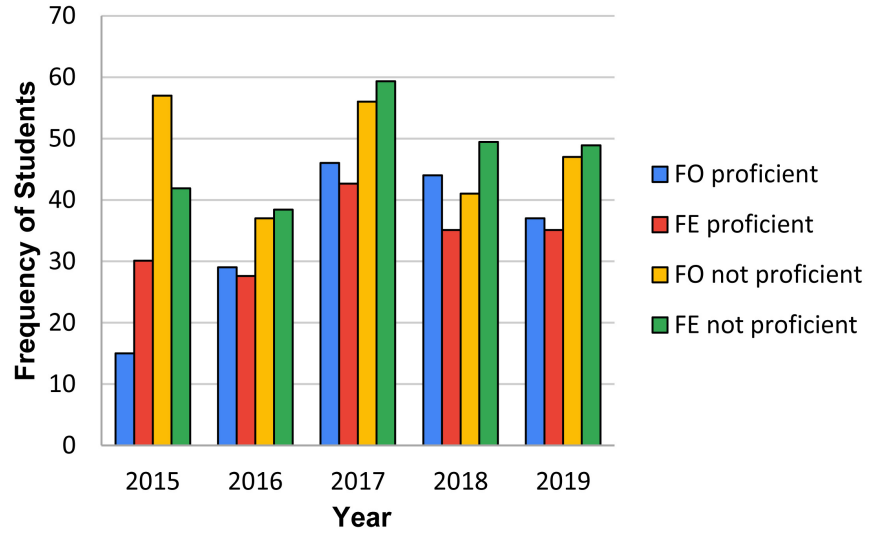

Figure 10. District F grade seven frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 17.46, $p < 0.05$.

were substantial gains in the frequency of observed students performing proficient in 2016 through 2018.

Eighth-grade assessment results for District F shown in Figure 11 indicated the most significant findings. The factor that contributed most to significance was the increase in the frequency of observed students who achieved at the proficient level in 2016 from 2015 and again in 2018 compared to previous years.

Experimental Districts H and District J were among the largest districts in their state consisting of large metropolitan communities. The state assessment reported achievement via proficiency levels 1 - 5, whereas student performance at levels 3 and above met standards of proficiency qualified as Level 3, Grade Level Proficient and levels 4 - 5 indicated College and Career Readiness, and

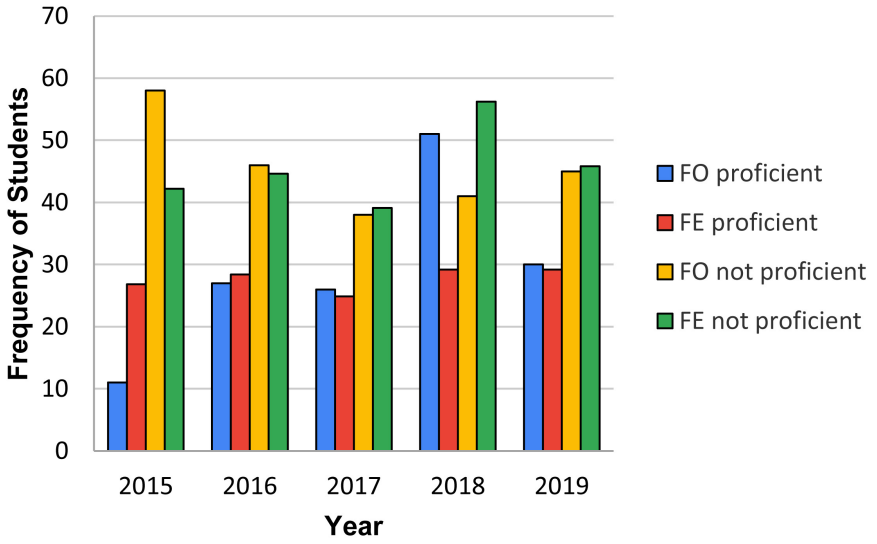

Figure 11. District F grade eight frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 36.00, $p < 0.05$.

students performing at levels 1 and 2 scored not proficient. Statistically significant differences in the frequency of students who met criteria for Free/Reduced priced meals performing at the various proficiency levels on the state assessment were found over the assessment years 2018-2019 in both District H and District J.

For District H, statistically significant differences were noted in every assessed grade level. In grade four (see **Figure 12**), significance was found due to the increase in the frequency of observed students who performed at proficiency levels 3 - 5 in 2019 compared to 2018 and subsequent decrease in the frequency of students who performed at not proficient levels 1 - 2 from 2018 to 2019. The frequency of observed students performing at the proficient levels 3 - 5 in 2019 exceeded the expected proficiency, and frequency of observed students who performed not proficient was less than the frequency expected at levels 1 and 2. A shift in the frequency of observed and expected achievement occurred across 2018 and 2019 at all achievement levels.

In grade five (**Figure 13**), the frequency of observed students performing at proficient levels 3 - 5 maintained at level 5 and increased at levels 3 - 4 in 2019 compared to 2018. The areas of change that most notably contributed to significant findings were the shift in the frequency of observed students who scored at proficient level 3 in 2019 and students who performed at not proficient level 2. The frequency of observed students who performed at proficient level 3 exceeded the frequency expected. Subsequently, the frequency of observed students who performed at not proficient level 2 was less than the expected frequency in 2019 compared to 2018.

Seventh-grade state achievement results detailed in **Figure 14** yielded a change in the frequency of observed students who scored at proficient levels 3 and 4 in 2019 from 2018, whereas the frequency of observed students scoring proficient levels 3 and 4 exceeded the frequency observed. Further, the frequency

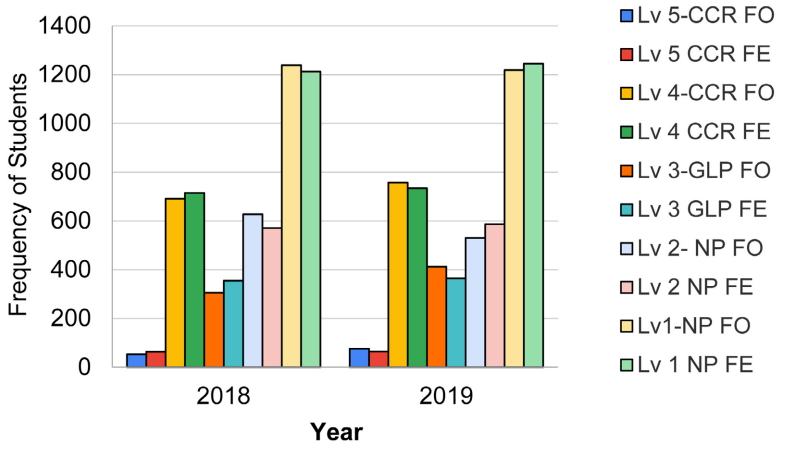

Figure 12. District H grade four frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 29.98, $p < 0.05$.

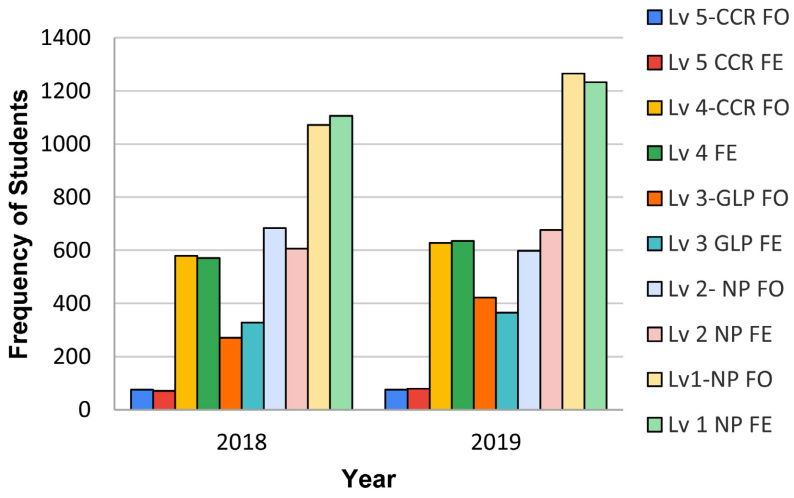

Figure 13. District H grade five frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 39.89, $p < 0.05$.

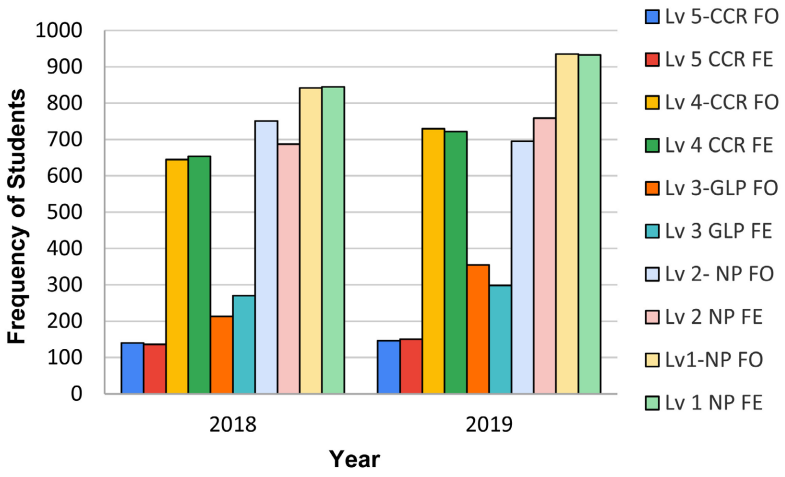

Figure 14. District H grade seven frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 34.63, $p < 0.05$.

of students observed to score not proficient level 2 was less than the frequency expected in 2019 compared to the reverse pattern in 2018. The change in achievement that most contributed to significant findings was the large shift in the frequency observed and expected achievement for levels 2 and 3 from 2018 to 2019.

Figure 15 shows a steady shift in the frequency of observed sixth-grade students who scored at proficient levels in 2019 compared to 2018. The area of difference that contributed most notably to significant findings was the decrease in the frequency of observed students who performed at not proficient level 2 in 2019 from 2018 and subsequent increase in the frequency of observed students who performed at levels 3 and 4. In 2019, there was a reversal in the frequency of observed students who scored proficient levels 4 and 3 from 2018, whereas the frequency of observed proficient levels 4 and 3 exceeded the frequency expected. Further, a shift occurred in the frequency observed and expected students who performed not proficient levels 2 and 1 from 2018 to 2019, whereas the frequency of students observed to score not proficient levels 2 and 1 was less than the frequency expected if comparisons were proportional in 2019 but greater than the frequency expected in 2018.

District H eighth-grade assessment data shown in Figure 16 revealed a steady shift in the frequency of achievement across levels 2 through 5. Specifically, the frequency of observed students who scored at proficient levels 4 and 3 was less than the expected frequency in 2018 but greater than the frequency expected in 2019. Subsequently, a shift in achievement was found in the frequency of observed students who performed at not proficient levels 2 and 1, whereas the frequency of observed students scoring not proficient was less than the frequency observed in 2019 but greater in 2018.

For District J, statistically significant differences were found in the frequency of students performing at the various proficiency levels on the state assessment in grades six (see Figure 17), seven (see Figure 18) and eight (see Figure 19)

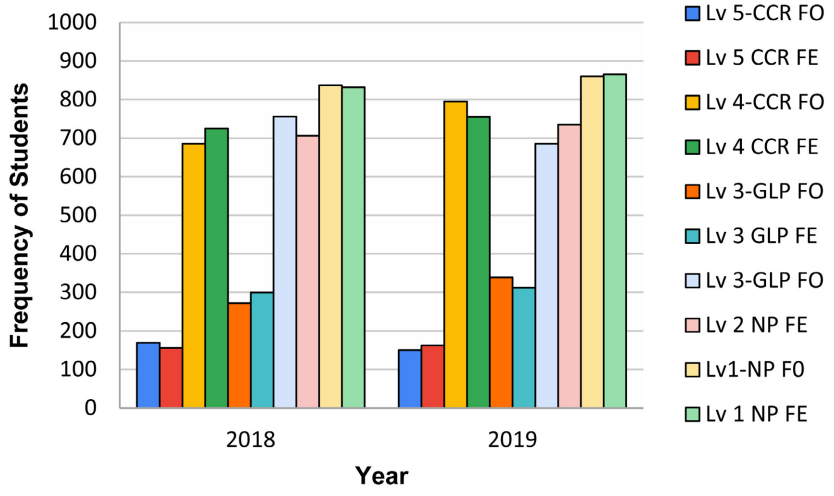

Figure 15. District H grade six frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 18.29, $p < 0.05$.

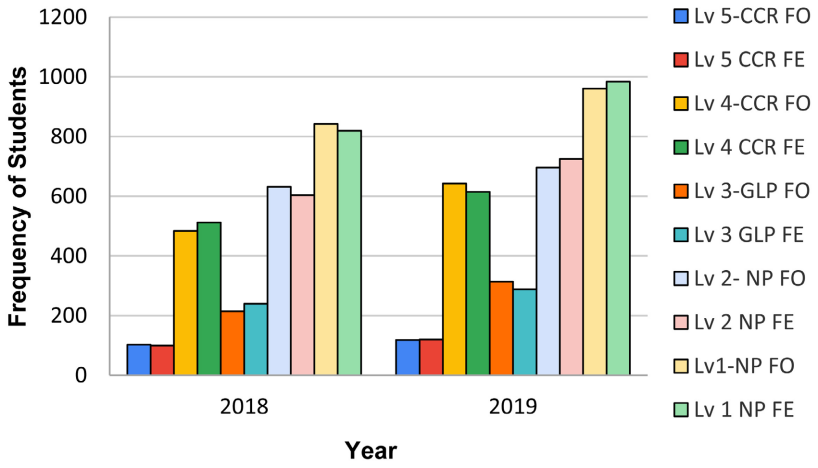

Figure 16. District H grade eight frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 11.58, $p < 0.05$.

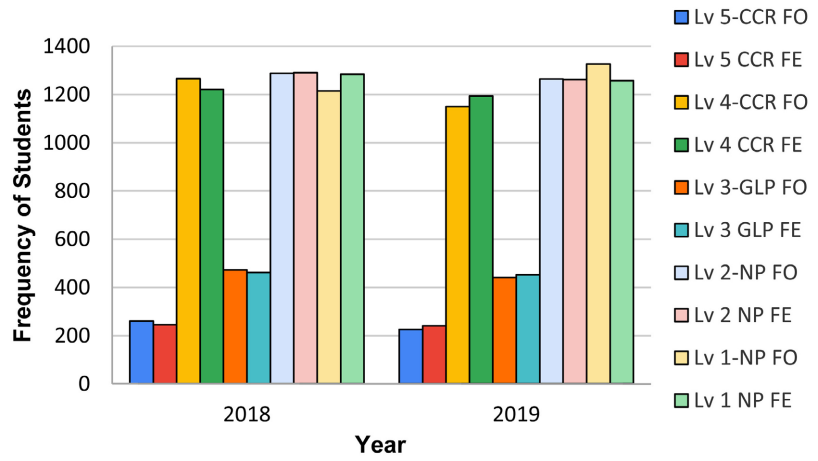

Figure 17. District J grade six frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 13.30, $p < 0.05$.

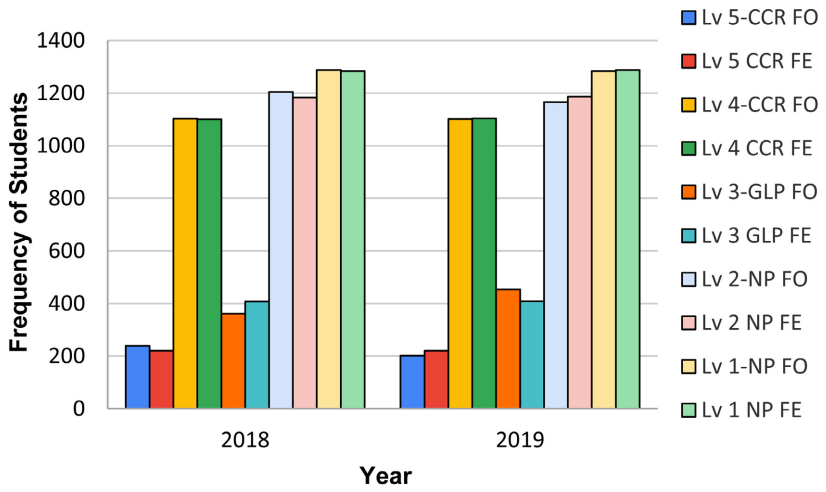

Figure 18. District J grade seven frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 14.32, $p < 0.05$.

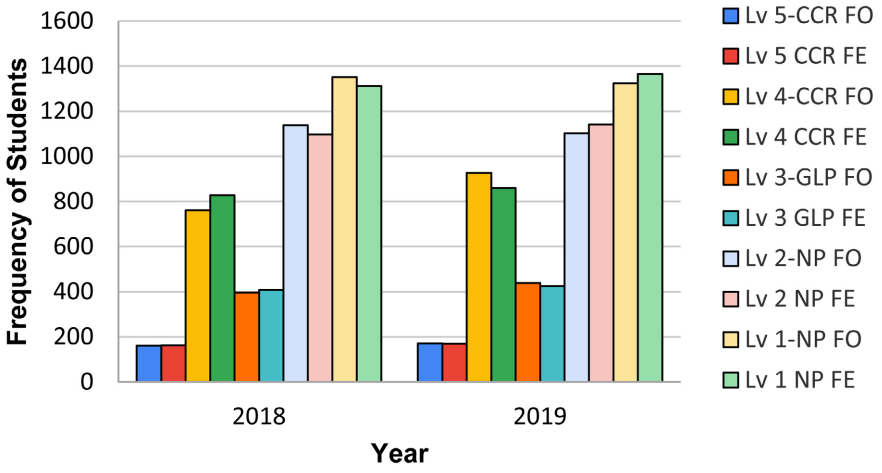

Figure 19. District J grade eight frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 16.83, $p < 0.05$.

over the assessment years 2018 and 2019, with the greatest difference evidenced in eighth grade. Sixth-grade student data revealed a pattern of achievement in 2018 where the frequency of students observed who scored at proficient levels 3 - 5 exceeded the frequency expected, and the frequency of students who scored not proficient levels was less than the frequency expected. However, that pattern reversed in 2019.

In grade seven, there was a significant finding stemming from the number of students performing at the proficient level 3 than expected, and fewer students performing at level two than expected in 2019 as compared to 2018.

District J eighth-grade data revealed a steady increase in the frequency of observed students who scored proficient, most notably at proficient level 4 than the frequency expected in 2019 from 2018.

District K was a large urban school district where most of the enrolled students met conditions of poverty and were students of color. Levels 1 - 3 performance on the state assessment was designated as performances not meeting proficient achievement, and Levels 4 - 5 indicated proficient performance towards grade level standards. Statistically significant differences in the frequency of students performing at the various proficiency levels were noted in all grades across the assessment years 2015-2019.

In grade four, there was a steady decline in the frequency of students performing not proficient across assessment years, and an increase in the frequency of students performing proficient after curriculum implementation (see **Figure 20**).

Similarly, as shown in **Figure 21** and **Figure 22**, for grades five and six respectfully, there was a steady decline in the number of observed students scoring not proficient across the assessment years, and there was an increase in the frequency of observed students performing proficient following curriculum implementation.

Seventh-grade data, shown in **Figure 22**, revealed a decline in the frequency of students performing not proficient than expected, and increase in the frequency

observed proficient than expected across the assessment years. The frequency of observed students that scored proficient exceed the frequency expected, and the frequency of observed students who performed not proficient was less than the frequency expected. This precise trend continued for eighth-grade students across the assessment years evidenced by a rise in the frequency of students observed proficient and decrease in the students not proficient compared to the frequency expected beginning in 2018 (see Figure 23).

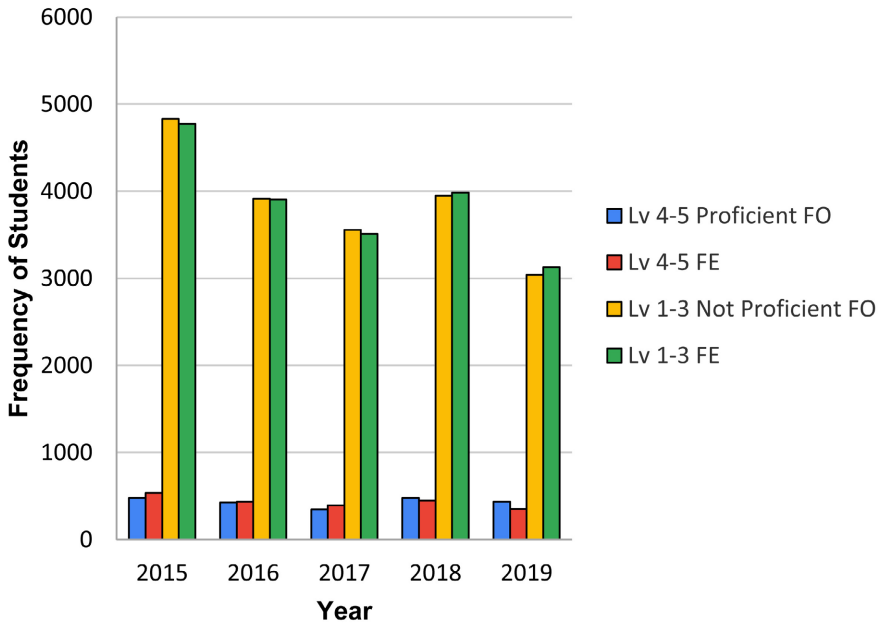

Figure 20. District K grade four frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 38.37, $p < 0.05$.

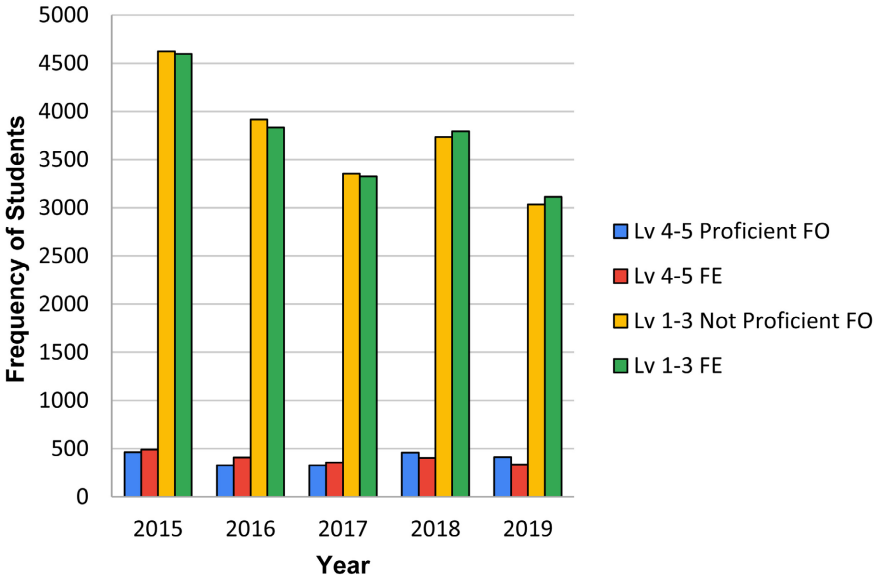

Figure 21. District K grade five frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 51.56, $p < 0.05$.

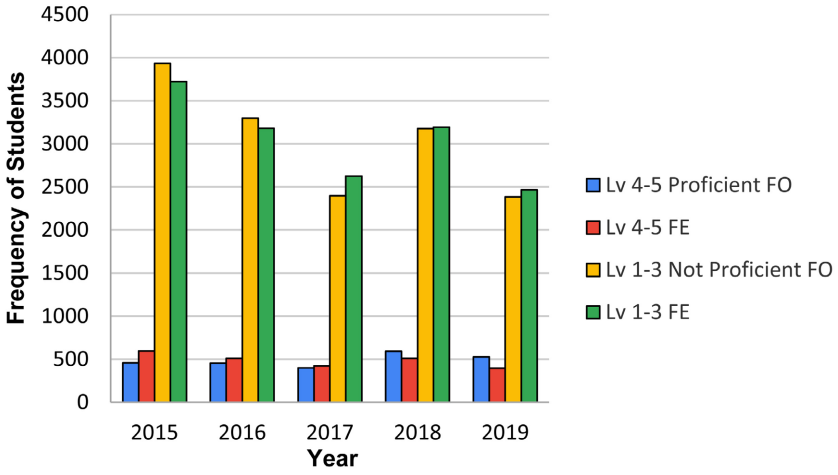

Figure 22. District K grade seven frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 135.47, $p < 0.05$.

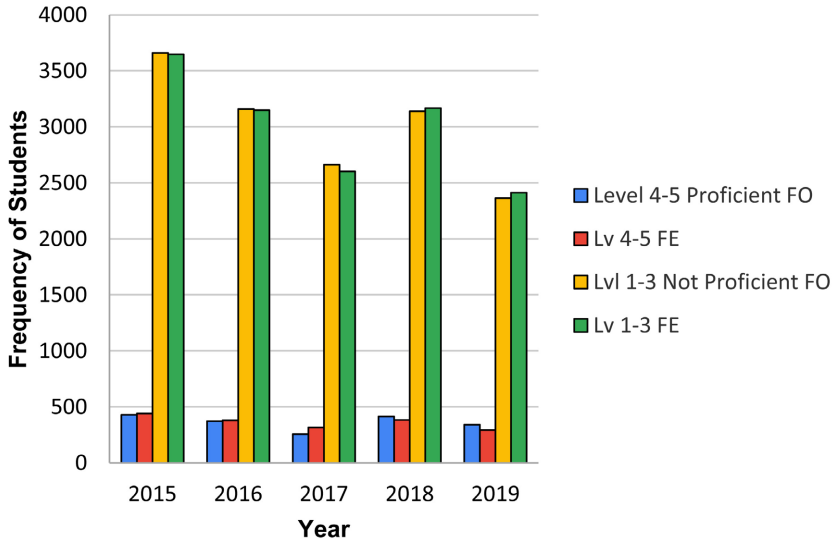

Figure 23. District K grade eight frequency of observed and frequency of expected proficient and not proficient achievement. Note: Chi-square = χ^2 (4) = 24.38, $p < 0.05$.

6. Conclusion

The purpose of this study was to investigate the frequency of students living in poverty across multiple districts implementing a knowledge-building curriculum, across multiple grade levels, and districts that implemented a knowledge-based curriculum within the data collection years. The findings of this study indicate that the districts that have implemented a knowledge curriculum have a greater number of students than expected at the proficient level for state-level ELA exams than expected; and districts that implemented such curriculum experienced a substantial increase in the number of students performing at the proficient level over time. Nearly all findings in this study are in-step with the conclusion that there were positive district-level outcomes in terms of increased numbers of students performing proficient on state-level ELA assessments. While

this study did not track students over time, we conclude that district implementation of a knowledge-building curriculum does contribute to closing the opportunity gap.

7. Discussion

Prior studies have provided insight regarding the discrepancy in achievement for US students from high-poverty backgrounds compared to their non-impoverished peers (Chall et al., 1990; Chall & Jacobs, 1983; Conradi et al., 2016; Jensen, 2013; Kim et al., 2015; Kim et al., 2019; Larson et al., 2015; NAEP, 2019; Neuman & Celano, 2012; Reardon, 2013; Reardon et al., 2012; Schugar & Dreher, 2017; Sirin, 2005; von Hippel et al., 2018; White, 1982). Differences in language exposure and background knowledge have been found to contribute to students' school readiness and subsequent success, and those differences correspond to income levels (Chall & Jacobs, 1983; Duff et al., 2015; Hart & Risley, 1995; Hirsch Jr., 2016; Lervag et al., 2018; Nation et al., 2010; Rowe et al., 2016; Stanovich, 1986; Weizman & Snow, 2001; Wexler, 2019).

Prior researchers have presented evidence that students' vocabulary and background knowledge are predictors to students' ability to make sense of written text (Cassidy et al., 2010; Conradi et al., 2016; Currie & Muijselaar, 2019; Duff et al., 2015; Hirsch Jr., 2003; Hirsch Jr. & Hansel, 2013; O'Reilly et al., 2019; Oslund et al., 2015; Talwar et al., 2018; Uccelli et al., 2015). A student's vocabulary knowledge aids in their ability to recognize words and make meaningful connections to words within connected text (Nagy & Scott, 2000). Students' content knowledge and exposure to ideas determine if they can interpret text and build upon pre-existing ideas for continued learning (Adams et al., 1995; Cervetti & Heibert, 2015; Perfetti et al., 2005). The findings of the present study support claim that content-focused, or knowledge-building instruction, can shift grade-specific ELA student performance for students living in poverty.

Studies that most closely resemble the work of the present study concluded that knowledge-building curricula raised reading achievement as measured by state summative exams for students attending elementary or middle schools in Texas, New York, North Carolina, and Maryland (Brading, 2004; Givens, 2008; McHugh & Stringfield, 1999; Vafiadi, 2010; Walberg & Meyer, 2004). All but one study indicated a rise in reading achievement for students attending experimental schools greater than those of matched controls (Brading, 2004; McHugh & Stringfield, 1999; Vafiadi, 2010; Walberg & Meyer, 2004). Findings from the present study substantiate and strengthen prior research into the effects of knowledge-building curricula on reading achievement by examining different knowledge-building curricula in a variety of schools, and the present study exclusively examined the achievement of students meeting criteria for Free/Reduced priced meals.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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