What factors predict a child's 3rd Grade Reading Scores?

An Analysis of 2015-16 Kindergarten Assessment Scores matched with 2018-19 Third Grade Reading Scores for one cohort of students in the Early Learning Hub Region

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Early Learning Hub
of Linn, Benton & Lincoln Counties

Report Background

The Oregon Kindergarten Assessment consists of three fundamental measures: Early Literacy, Early Mathematics, and Approaches to Learning.[1] The Kindergarten Assessment is intentionally created to compile measures that are predictive of 3rd Grade Reading proficiency, social and emotional development, and overall academic success.

The Oregon Department of Education (ODE) states that the Oregon Kindergarten Assessment provides:[1]

- "Local and statewide information that gives families, schools, communities, and state-level policy makers a snapshot of the social, self-regulatory, and academic skills of incoming kindergartners."
- "A consistent, statewide tool for identifying systemic opportunity gaps, determining Early Learning resource allocation to best support students in need, and measure improvement over time."

In the Fall of 2020, the Early Learning Hub Data & Evaluation Workgroup set out to further analyze Kindergarten Assessment data for cohorts of Kindergarteners in the EL Hub region, matched with their 3rd Grade Reading scores. This analysis is an expansion of a report completed by the previous Data and Evaluation intern, Kathryn Berns. Kathryn's analysis set the framework and direction for this research. Given that ODE had suspended student assessment for the 2019-20 and 2020-21 academic years, the group wanted to use this opportunity to perform further research on past data.

In particular, the group wanted to get an idea of the types of measures that predicted children's 3rd grade reading scores. The group sought to determine if any specific districts or schools had trends that differed from other areas, resulting in improved assessment scores and increased student growth over time.

In this report, we aim to analyze additional factors that influence third grade reading scores in our region. We focus primarily on Kindergarten Approaches to Learning Score and a composite measure of Kindergarten English Language Assessment scores and how these variables influence 3rd Grade Reading Scores.

Analysis Methods

Data Source

This data was acquired through a Data Use Agreement between the Early Learning Hub and ODE. The agreement provides the Hub with Kindergarten Assessment scores beginning in the 2013-14 academic year matched with the 3rd Grade reading scores for those same students through the 2018-19 academic year. In addition, we focused our analysis on findings from previous analysis by Early Learning Hub intern Kathryn Berns.

As previously mentioned, 2019-20 and 2020-21 student assessment was suspended in Oregon due to the COVID-19 pandemic. This limited the most recent 3rd grade assessment data to the 2018-19 academic year, matched with the Kindergarten Assessment scores for those same children during the 2015-16 academic year.

What questions did we seek to answer?

We focused primarily on how Kindergarten Assessment variables, specifically Approaches to Learning Total Scores, English Letter Name Recognition scores, and English Letter Sound Recognition scores might impact a child's 3rd grade reading score. Some specific questions we had before performing the analysis were:

- How do 3rd Grade Reading Scores differ between counties and districts in the Linn, Benton, and Lincoln County Region? Are certain districts doing things that are leading to an improvement in early childhood learning and educational assessment? Do differences in school district largely predict a student's 3rd grade reading scores?
- How do Kindergarten Approaches to Learning scores impact 3rd Grade Reading scores in our region?
- How do Kindergarten English Letter Name Recognition and English Letter Sound Recognition impact 3rd grade reading scores in our region?
- In combination with assessment variables, what influence do socioeconomic status, English Language Learner status, and disability-status have in predicting a child's 3rd grade reading scores?

How are these measures assessed and defined?

1) Third Grade Reading Scores

Annually in 3rd grade, school districts in Oregon administer performance assessments in English Language Arts/Literacy proficiency, which are synonymous with "3rd grade reading scores". These assessments align with the Oregon standards. For the 3rd grade reading assessments, students demonstrate their knowledge and skills and then receive a Depth of Knowledge level that describes the kind of thinking required.

The following table explains the categorization of 3rd grade reading scores:

Depth of Knowledge Level	Score Threshold	Description
1	**NA**	Requires students to receive or recite facts and use simple skill.
2	**2367**	Requires procedural knowledge and skills: integrating and application of concepts.
3	**2432**	Requires strategic thinking: non-routine problem-solving.
4	**2490**	Requires extended thinking; developing hypothesis and performing complex analyses

2) Approaches to Learning Total Scores

Teachers observe and record a child's interactions with other children and classroom materials using the Child Behavior Rating Scale (CBRS) in order to assess Approaches to Learning. An Approaches to Learning Total Score between 1 and 5 is given using the average score of all 15 items assessed. The assessment focuses on a child's approaches to learning, self-regulatory skills, and interpersonal skills. CBRS is shown to be strongly predictive of reading and math achievement in elementary grades and has been validated in a wide range of cultural contexts.

Knowledge Level	Score Interval	Description
Developing	**1-2.90**	Follows direction and completes tasks, interacts with peers and adults appropriately, and expresses thoughts and feelings appropriately with intensive adult support
Approaching	**2.91-3.99**	Follows directions and completes tasks, interacts with peers and adults appropriately, and expresses thoughts and feelings appropriately with some adult guidance/direction
Demonstrating And Above	**4-5**	Follows direction and completes tasks, interacts with peers and adults appropriately, and expresses thoughts and feelings appropriately with minimal adult reminders/support

3) Kindergarten English Language Composite Scores

Early Literacy variables, including English Letter Name and English Letter Sound Recognition are assessed and reported by teachers. Children identify as many letter sounds and names as they can while their teacher records their score out of 26. The English Letter Name Recognition measure consists of two distinct parts, uppercase and lowercase letter recognition.

Given the correlation between uppercase and lowercase letter recognition and letter sound recognition, we manually computed a "Kindergarten English Language Composite Variable" combining these variables. Uppercase and lowercase scores for each student were combined, and then scaled from 0-26, before being added to sound recognition scores to create a summative measure. We re-scaled this measure from a 0-52 scale to a 0-100 scale in order to make this composite score more easily interpretable alongside other assessment variables.

4) Economically Disadvantaged Status

Students are designated as Economically Disadvantaged if they are eligible for the Free or Reduced Lunch (FRL) program. While Oregon reports that approximately 50% to 55% of entering Kindergarteners are Economically Disadvantaged, some schools and districts provide free lunches to all of their students - meaning that all students get counted as Economically Disadvantaged in these areas. This could happen where there is a high percentage of disadvantaged students within the District.

5) English Language Learner Status

Students identified as English Learners (EL) are those with limited English language proficiency either because English is not their native language or because they come from an environment where a language other than English has had a significant impact on their English proficiency.[2] In essence, this designation makes them eligible to receive English Language Learners (ELL) services/programs.

6) Special Education Status

Special education status indicates a student with a disability (SWD) such as autism; communication disorders; deaf/blindness; emotional disturbances; hearing impairments, including deafness; intellectual disability; orthopedic impairments; other health impairments; specific learning disabilities; traumatic brain injuries; or visual impairments, including blindness. A SWD must have an Individualized Education Plan (IEP/IFSP), as required by the Individuals with Disabilities Education Act (IDEA).

Methods for assessing our questions:

1) We evaluated the basic demographic characteristics in each region, including:
    - Number of students by county and school district
    - Gender
    - Race and ethnicity

- Proportion of children in each county who are enrolled in free and reduced lunch (economically disadvantaged), who are considered English language learners, or who are living with a disability.

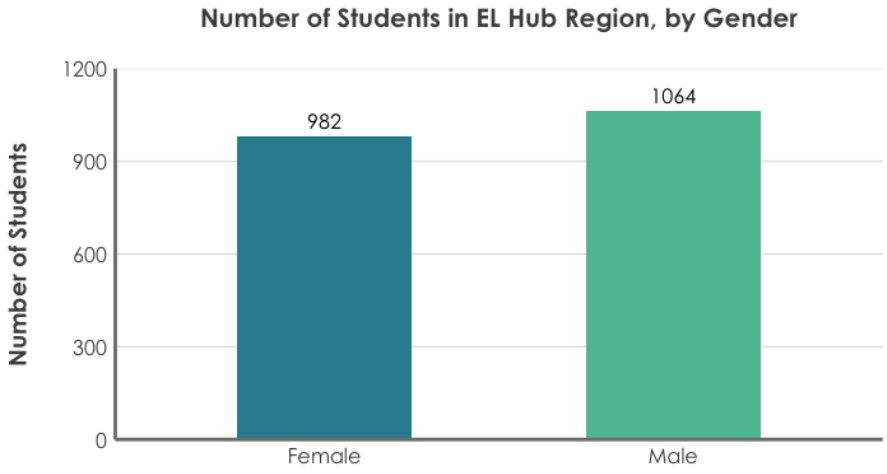
2) We looked at the distribution of key assessment variables across region.
   - We looked at the distribution of 3rd grade reading scores, Approaches to Learning Total scores, and Kindergarten English Language Composite scores in the EL Hub region.
   - We used an ANOVA test to determine if there were statistically significant differences in the mean scores of each variable across County and District in the EL Hub Region. We used a Tukey Pairwise Comparison Test to determine which relationships (i.e. between districts, between counties) had statistically significant differences in scores.

3) We looked at the relationship between Kindergarten Assessment variables and 3rd grade reading scores.
   - We used linear regression to find out which academic assessment and demographic variables are most important when predicting a child's 3rd grade reading scores.
     - For instance, linear regression can tell us how much we could expect a child's 3rd grade reading score to increase if their Approaches to Learning Score a 4 instead of a 3.
     - In our case, we used *multiple linear regression* to quantify the relationship between 3rd grade reading scores and Approaches to Learning Total scores, Kindergarten English Language Composite scores, and other predictors including economically disadvantaged status (a proxy for poverty), English Language Learner status, and disability-status. Multiple linear regression simply means we used more than one variable to form a model that predicts 3rd grade reading scores.
   - We used linear mixed modeling in order to assess the impact that differences in district have when predicting 3rd grade reading.
     - Since children are "clustered" within district, it is important to account for the effects that differences in district-specific assessment protocol or instruction might have in 3rd grade reading scores and other outcomes.
     - In this modelling, we consider students (our observation) to be clustered by district, which is referred to as the "random effect" in the model.
     - We calculated an R^2 value for our mixed model along with each predictor variable, which tells us how closely the data are to the fitted regression line. The R^2 can also be thought of as the percentage of variation in our response variable (3rd grade reading scores) that can be explained by the model or any

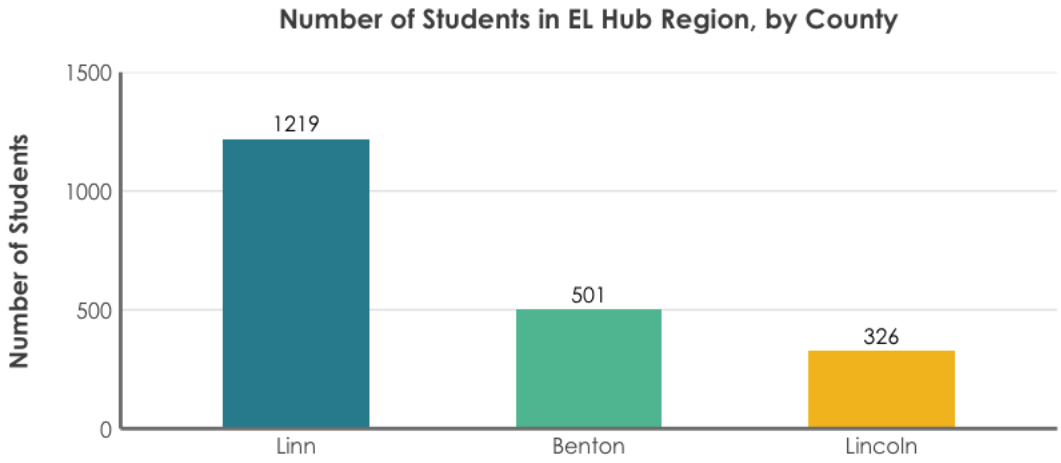
individual predictor variable. The higher the R2 value, the better the model or individual variable fits your data.

Findings

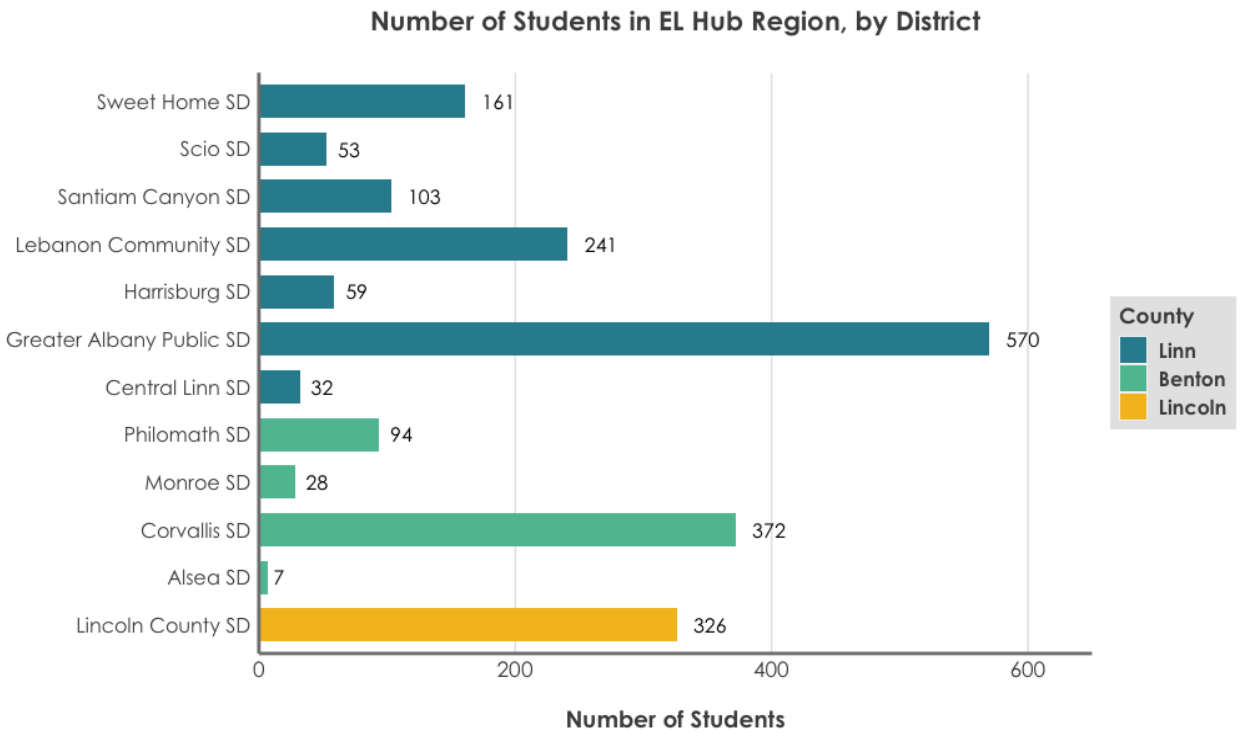
Regional Context – Demographic Information



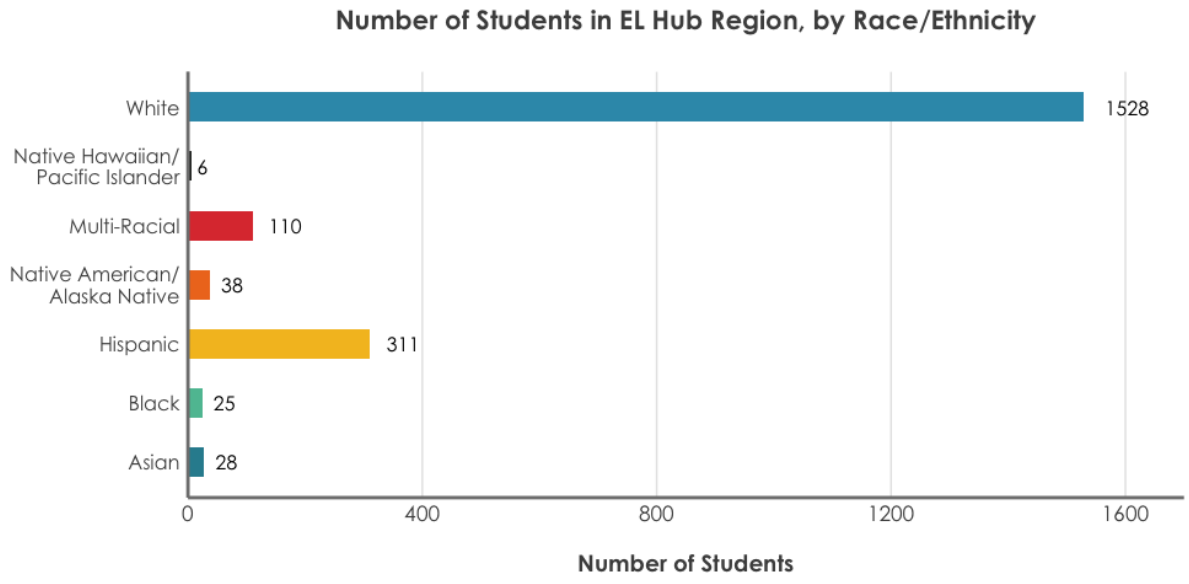
There is a relatively even distribution of male and female-identifying children in the EL Hub region.



The majority of children in the region attend school in Linn County. In total, 2046 students were in this 2015-16 kindergarten class and assessed again in the 2018-19 3rd grade student assessment.

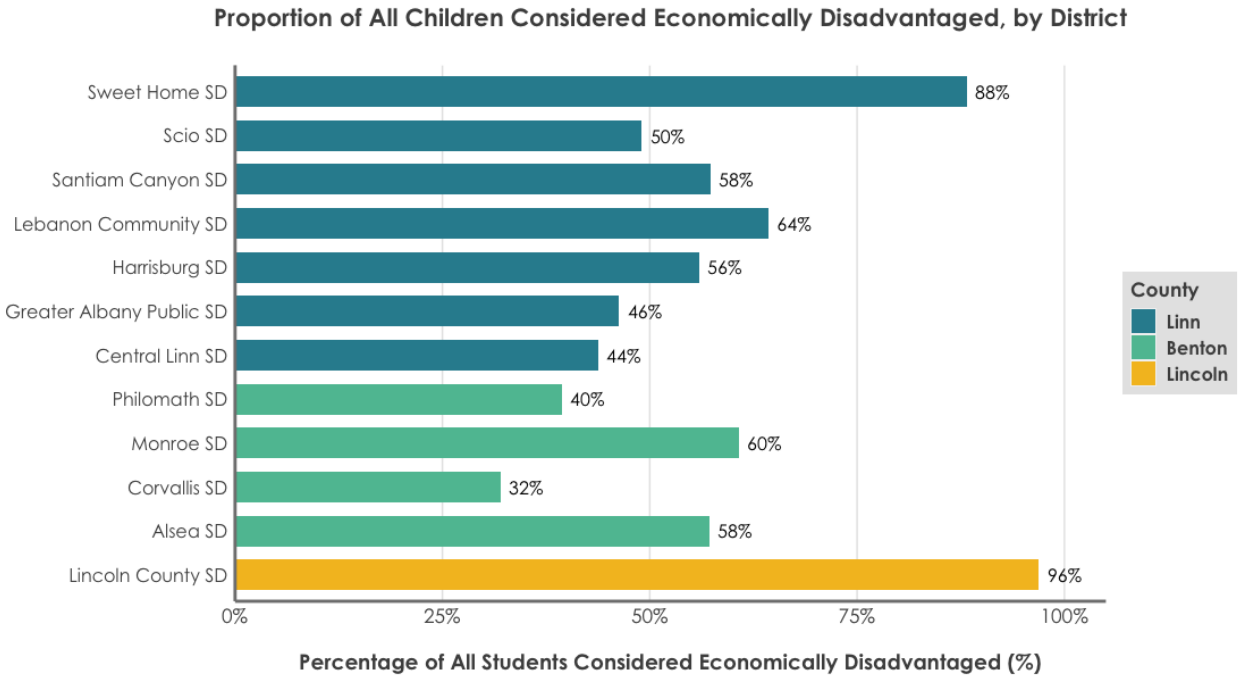


There is a wide variation in the number of students in each district in the EL Hub region. For this reason, some demographic variables (including Race/Ethnicity, economically disadvantaged status, etc.) were not analyzed in more detail than the county-level.

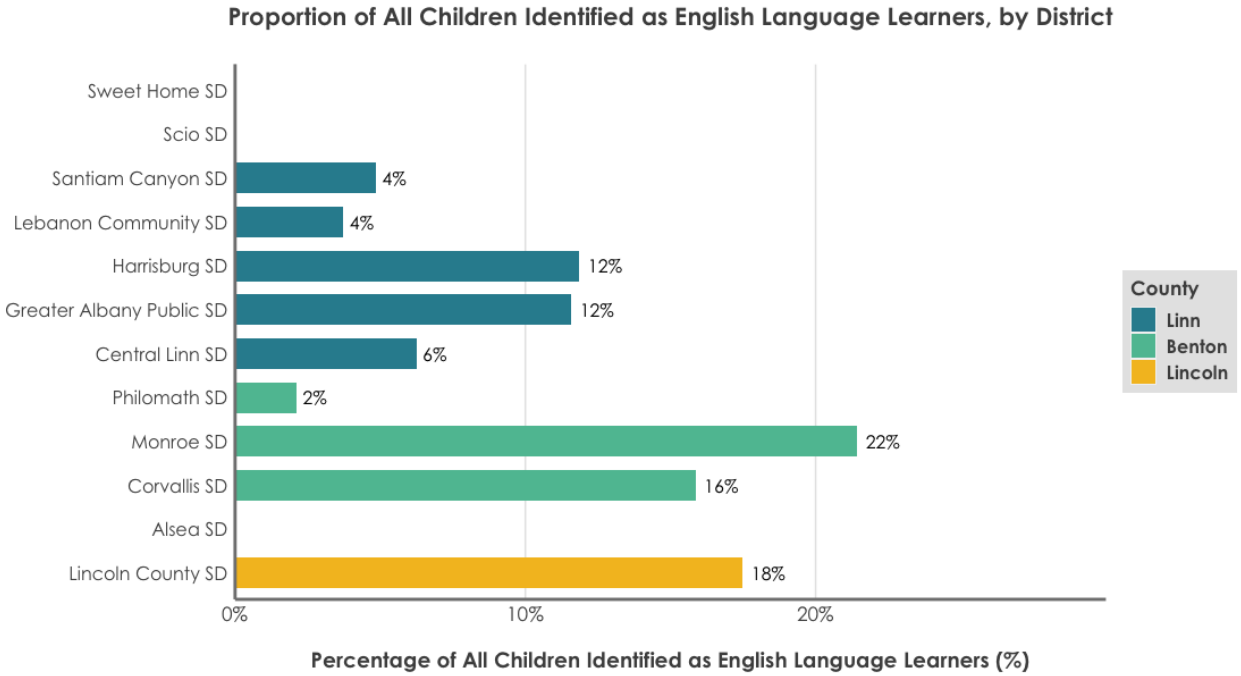


The EL Hub region consists primarily of White-identifying students. Hispanic/Latinx children make up the second largest racial/ethnic group, while Multi-racial students

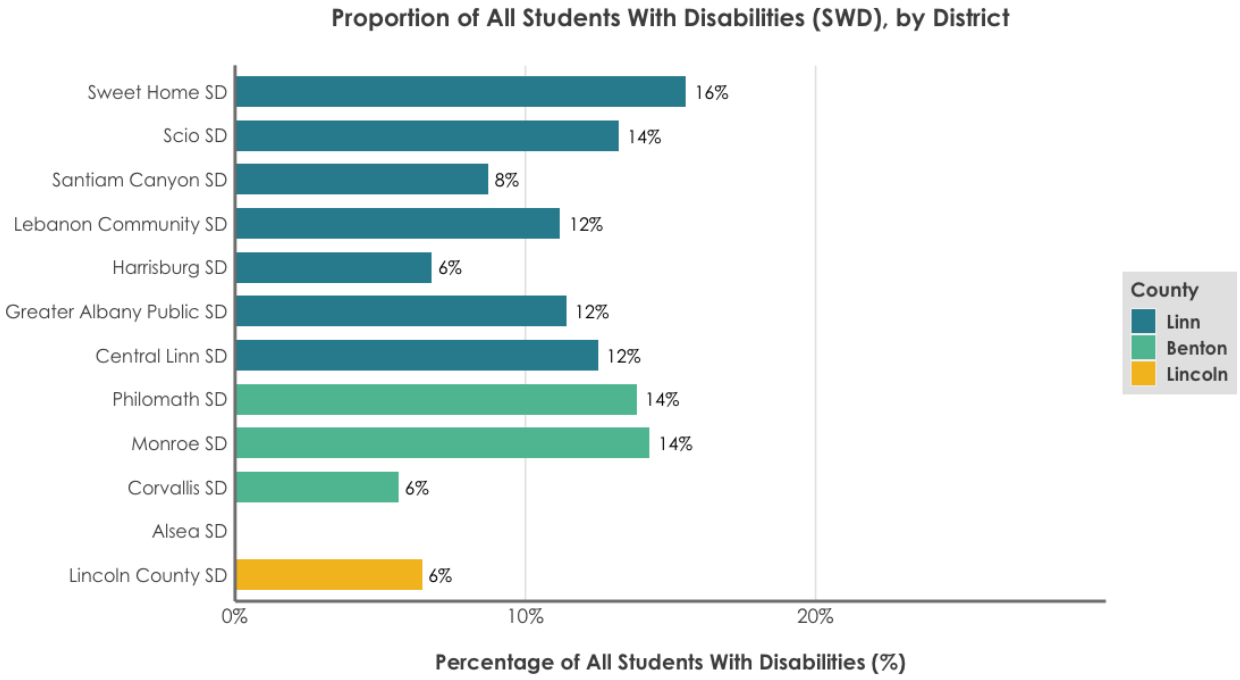
make up the third largest group. Due to the low number of non-White students in most districts and schools, race/ethnicity was not evaluated beyond the county-level.



There is a wide variation in the proportion of children in each district considered to be economically disadvantaged.



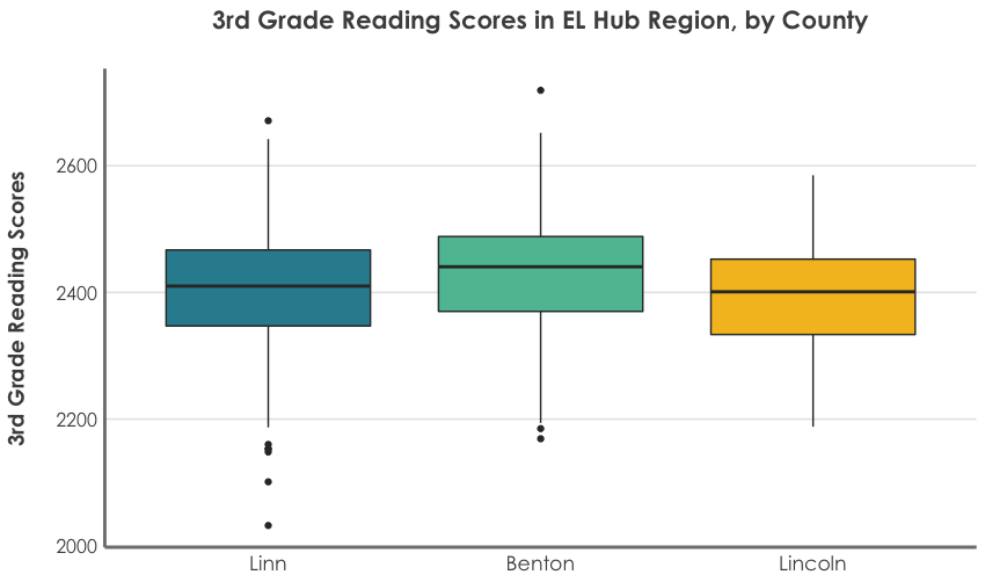
The proportion of children identified as English Language Learners (ELL) varies substantially between district and county in the EL Hub region.



The proportion of Students with a Disability (SWD) varies substantially between district and county in the EL Hub region.

Regional Trends in Key Assessment Variables

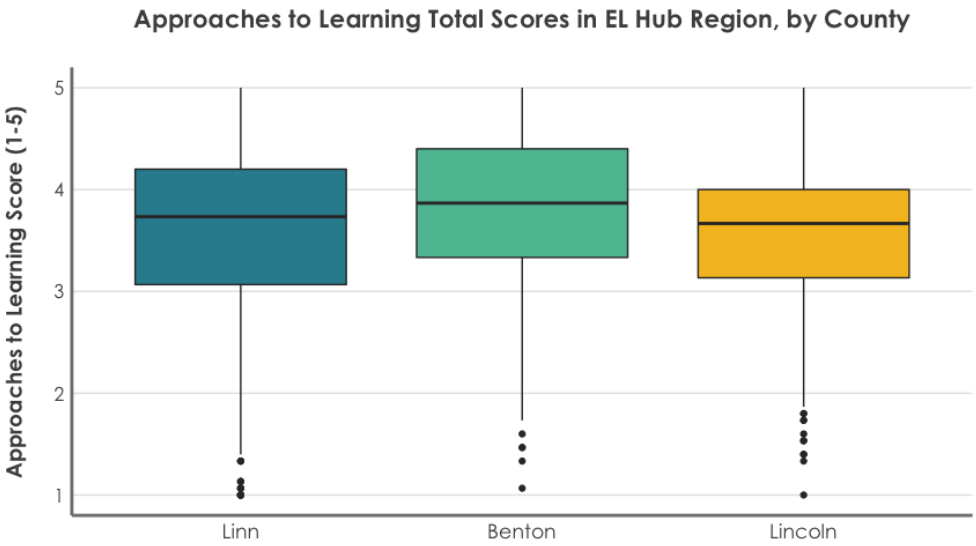
3rd Grade Reading Scores



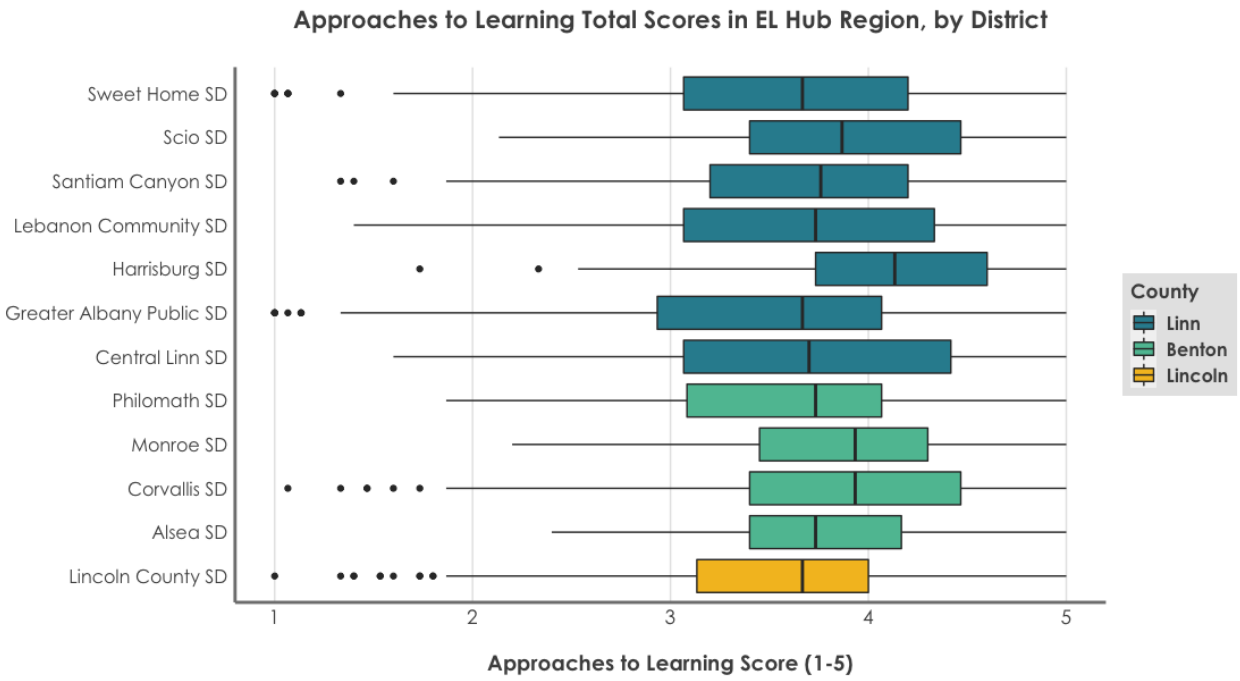
There is statistically significant difference in the mean 3rd grade reading scores between all three counties in the EL Hub region.

There is statistically significant difference in the means of 3rd grade reading scores between various districts within the EL Hub Region. A more important conclusion is that there is a reasonable amount of variation both within and between districts.

Approaches to Learning Total Scores

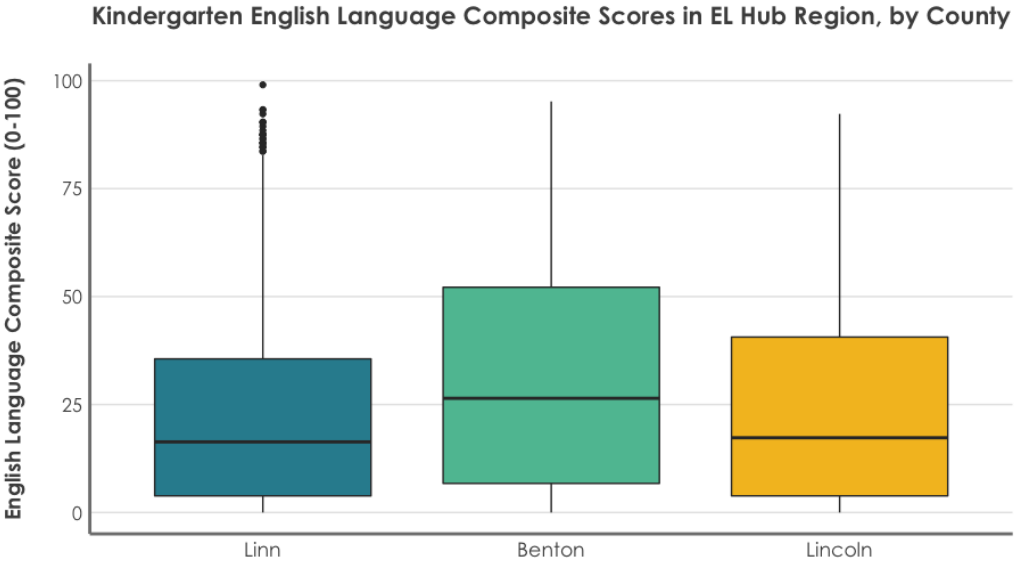


There is statistically significant difference in the means of Approaches to Learning Total scores between Linn and Benton Counties, and Benton and Lincoln Counties.

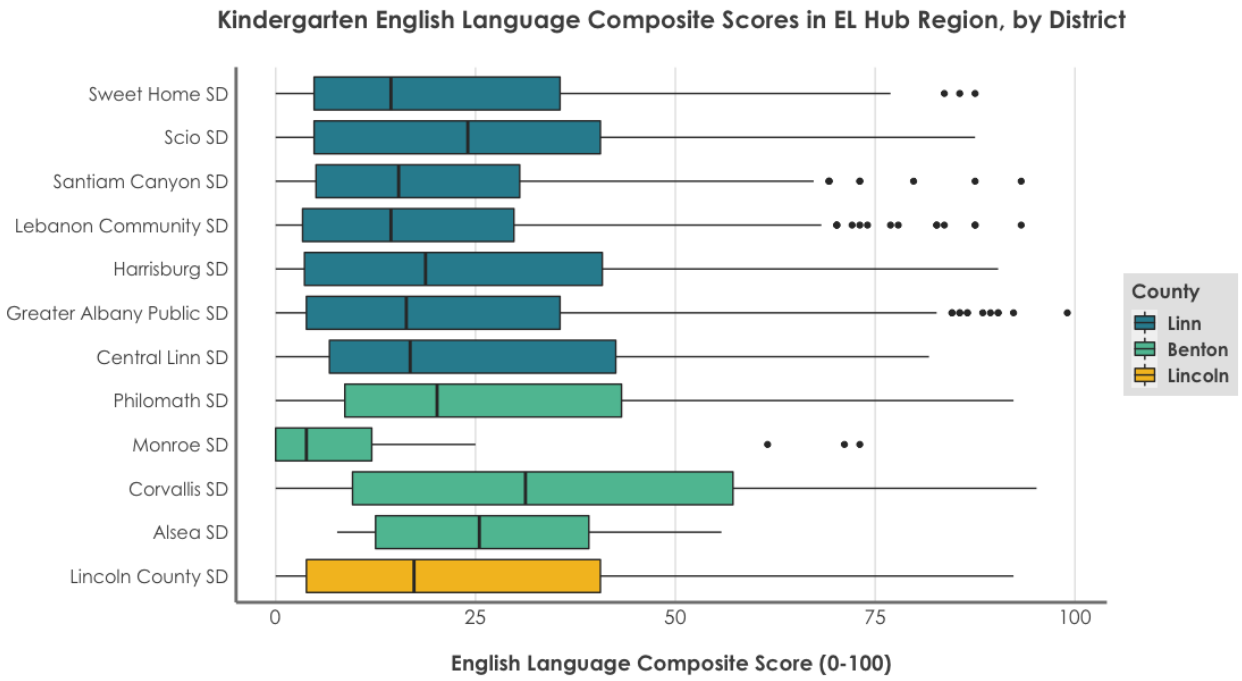


There is statistically significant difference in the means of Approaches to Learning Total scores between several district pairs in the EL Hub region. A more important conclusion is that there is a reasonable amount of variation both within and between districts.

Kindergarten English Language Composite Scores



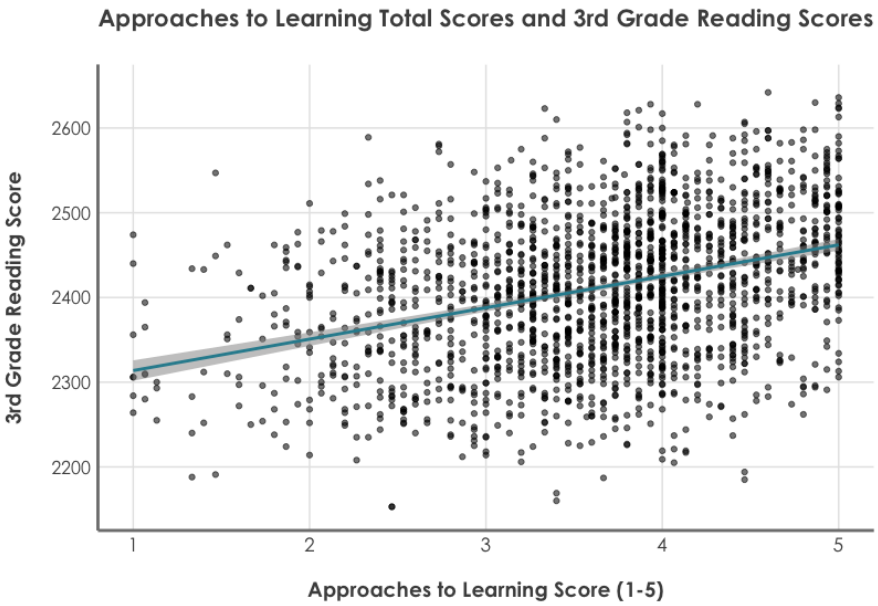
There is statistically significant difference in the means of Kindergarten English Language Composite scores between Linn and Benton Counties, and Benton and Linn Counties.



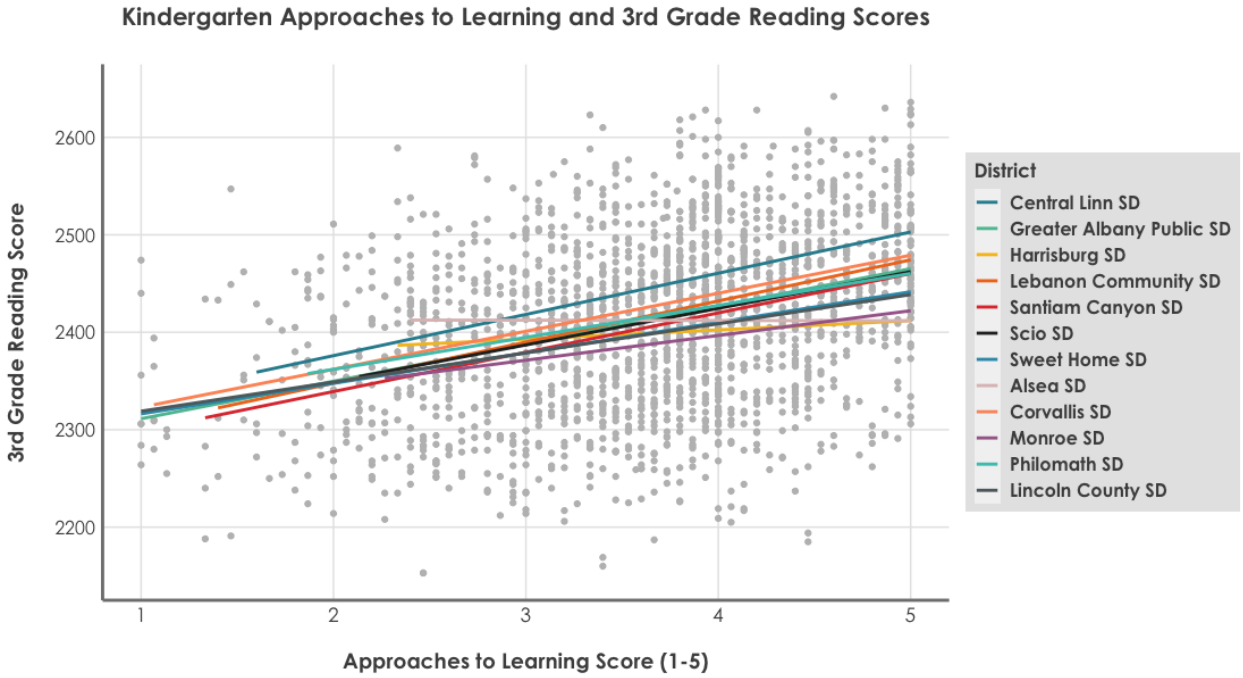
There is statistically significant difference in the means of Kindergarten English Language Composite scores between several district pairs in the EL Hub region. A more important conclusion is that there is a reasonable amount of variation both within and between districts.

District-Level Effects on 3rd Grade Reading Scores

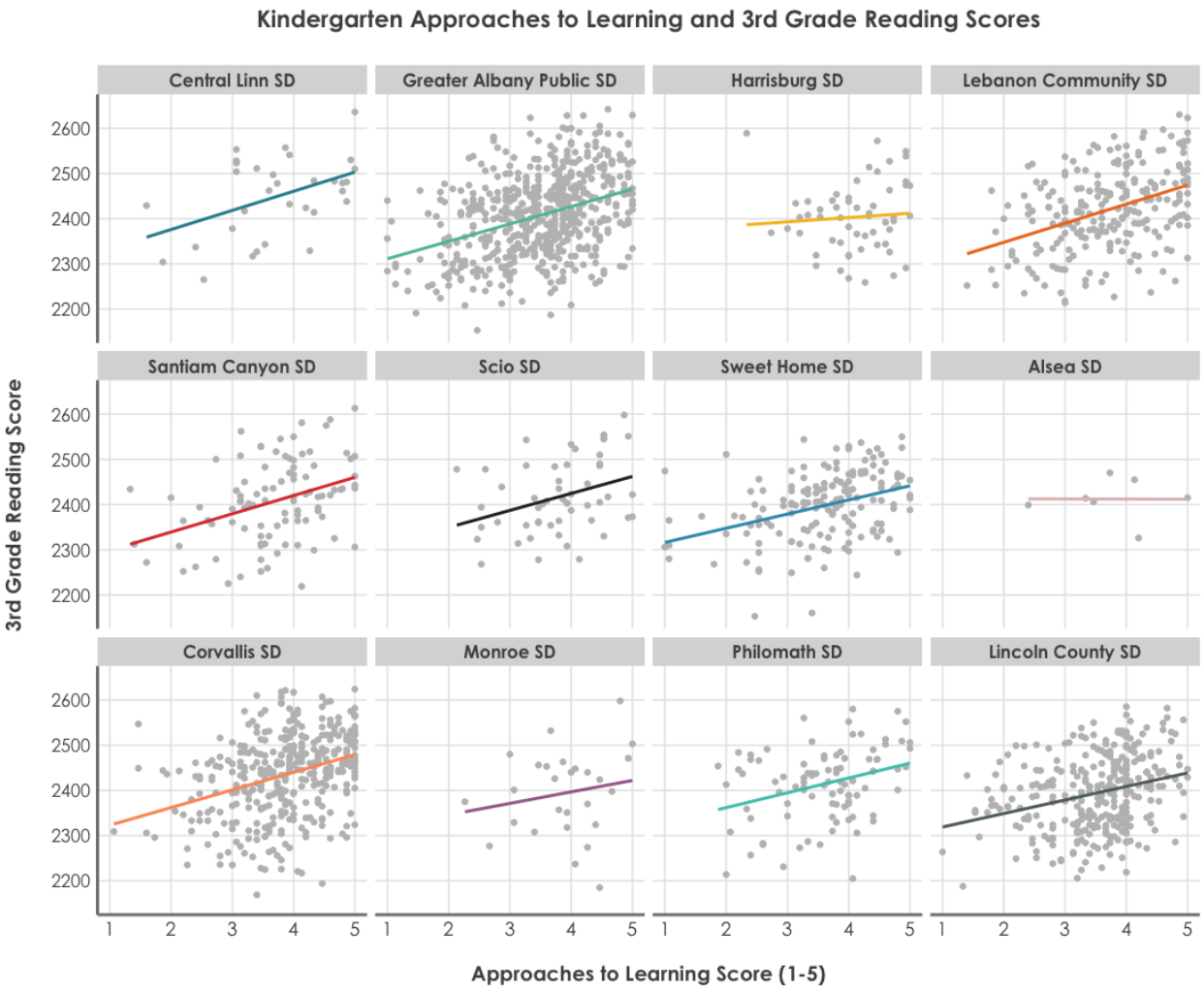
Approaches to Learning and 3rd Grade Reading Scores



Running a simple linear regression shows us that, although there is a lot of variation at every level of Approaches to Learning Scores, 3rd grade reading scores generally increase as Kindergarten Approaches to Learning Total Scores increase. Note that the linear regression line does not represent a change over time. Rather, the line represents the average predicted value of 3rd grade reading scores at each possible Approaches to Learning score. All following graphics hold this same pattern.

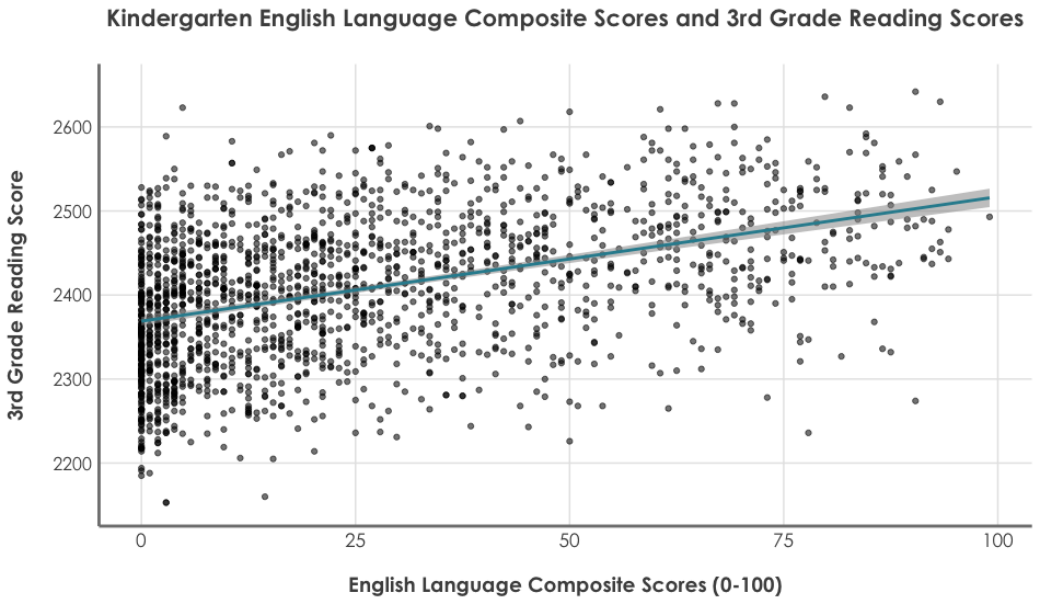


This plot displays the relationship between Approaches to Learning Total Scores and 3rd grade reading scores compared across districts in the EL Hub region. We see that there is a slight difference in the relationship between Kindergarten Approaches to Learning Scores and 3rd grade reading scores, by district. However, our mixed modeling confirmed that differences in school district have a relatively small impact explaining differences in 3rd grade reading scores relative to other variables (See Appendix I for more information).

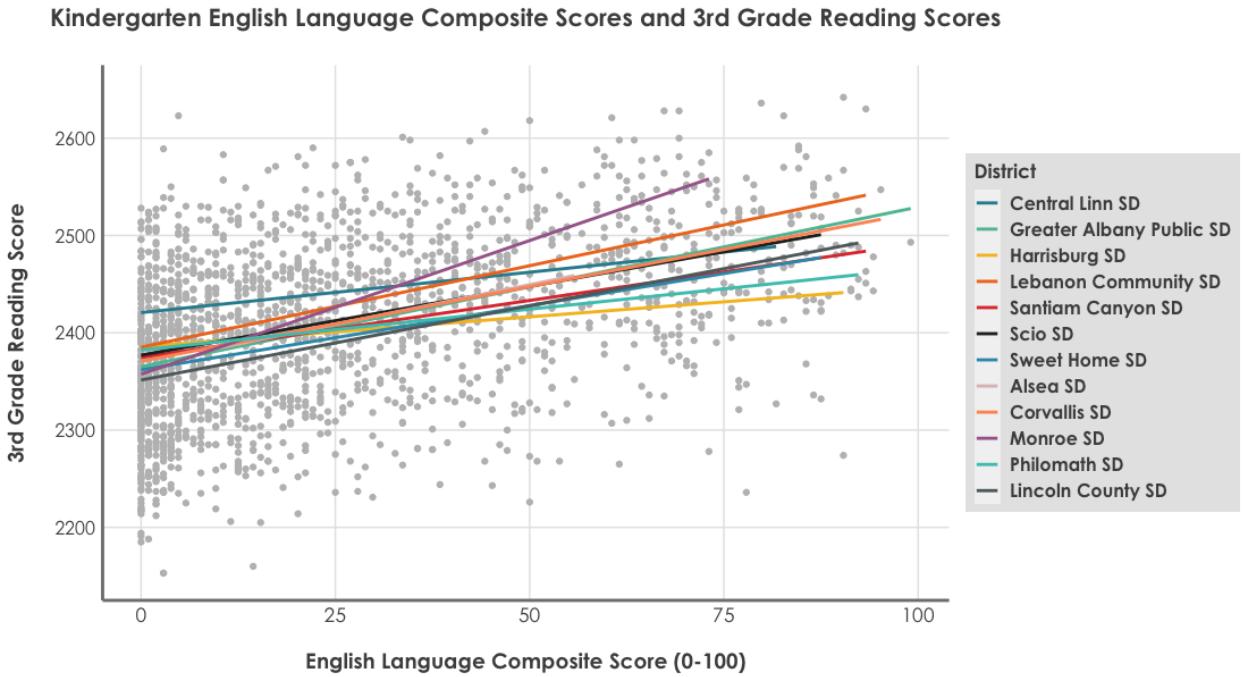


This plot displays the relationship between Approaches to Learning Total Scores and 3rd grade reading scores compared across districts in the EL Hub region, while allowing us to see the number of children assessed in each school district. We see that there is a slight difference in the relationship between Kindergarten Approaches to Learning Scores and 3rd grade reading scores, by district. We also see that some districts do not have large enough student populations to make a confident conclusion about academic development.

Kindergarten English Language Composite Scores and 3rd Grade Reading Scores

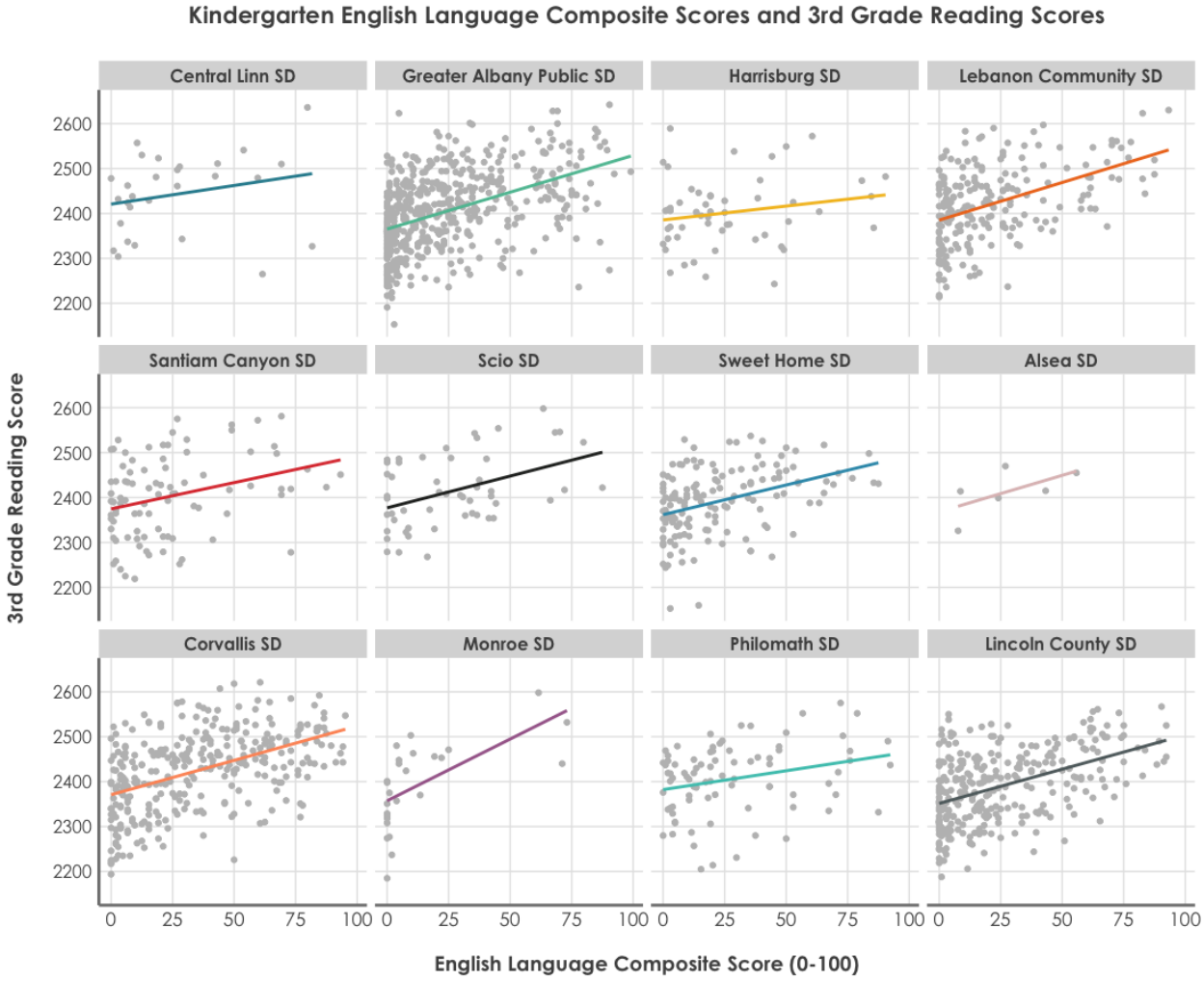


Running a simple linear regression shows us that as Kindergarten English Language Scores increase, 3rd grade reading scores tend to increase at a steady rate.



This plot displays the relationship between Kindergarten English Language Composite Scores and 3rd grade reading scores compared across districts in the EL Hub region. We see that there is a slight difference in the relationship between Kindergarten English

Language Scores and 3rd grade reading scores, by district. However, our mixed modeling confirmed that differences in school district have a relatively small impact explaining differences in 3rd grade reading scores relative to other variables (See Appendix I for more information).



This plot displays the relationship between Kindergarten English Language Composite Scores and 3rd grade reading scores compared across districts in the EL Hub region, while allowing us to see the number of children assessed in each school district. We see that there is a slight difference in the relationship between Kindergarten English Language Scores and 3rd grade reading scores, by district. We also see that some districts do not have large enough student populations to make a confident conclusion about academic development.

Conclusions

3rd grade reading scores in the EL Hub region vary substantially depending on geography, demographic group, and prior assessment scores.

- Third grade reading scores, Approaches to Learning scores, and Kindergarten English Language Composite scores vary significantly between Linn, Benton, and Lincoln Counties, as well as at the district sub-level. However, the effect of school district alone is not the most important factors for predicting 3rd grade reading scores, as initially expected.
- There is lots of district-level variation in the proportion of children who are Economically Disadvantaged, characterized as SWD, or identified as English Language Learners. These disparities are significant in impacting 3rd grade reading scores in addition to the Kindergarten Assessment variables.
- Out of all other variables, Kindergarten English Language Composite scores and Kindergarten Approaches to Learning Scores have the largest influence on predicting 3rd grade reading scores.
- Race and ethnicity, English language learner status, economically disadvantaged status, and special education status are all significant effect modifiers of 3rd grade reading scores – meaning that 3rd grade reading scores differ as these demographic characteristic variables differ.

Future evaluation should expand upon this approach in order to evaluate how schools and early education leaders can best improve early childhood outcomes. The Early Learning Hub of Linn, Lincoln, and Benton Counties is in the process of obtaining data from ODE that would allow for a detailed assessment of factors that predict 3rd grade mathematics scores, in addition to 3rd grade reading measures assessed in this report.

References

1. Oregon Department of Education: Kindergarten Assessment: Student Assessment: State of Oregon. (n.d.). Retrieved June 4th, 2021, from https://www.oregon.gov/ode/educator-resources/assessment/Pages/Kindergarten-Assessment.aspx
2. Oregon Department of Education: English Language Proficiency Standards. (n.d.). Retrieved July 15th, 2021, from https://www.oregon.gov/ode/students-and-family/equity/EngLearners/Pages/EnglishLanguageProficiencyStandards.aspx

Appendices

Appendix I: Mixed modeling approach to compute district-effects on 3rd grade reading

A statistical model was used to model the effect that variation in district has in determining a child's 3rd grade reading scores. On suggestion from ODE staff, along with Data and Evaluation Workgroup members, we considered that differences in administration of student assessment or differences in regional resources and instruction might explain differences in scores between districts

The following table displays the results of the mixed model we created, and demonstrates how much variation in 3rd grade reading scores can be explain by differences in district versus other factors in the model including Approaches to Learning scores, Kindergarten English Language Composite scores, along with ELL-status, disability-status, and SES.

Variable/Coefficient	Percentage of variation in 3rd grade scores explained by measure
Full Model	28.7%
Kindergarten English Language Composite (0-100)	10.1%
Approaches to Learning Total Score (0-100)	5.2%
English Language Learner Status (Y/N)	1.7%
Special Education Status (Y/N)	1.4%
Economically Disadvantaged (Y/N)	1.3%

School District	1.0%

From running this mixed model, we conclude that the full model can explain about 29% of variance in 3rd grade reading scores. Compared with other variables, the effect that differences in school district had on prediction of 3rd grade reading scores is relatively minor – only about 1%. While differences in district are significant in predicting 3rd grade reading scores, they are only of marginal importance relative to Kindergarten English Language scores, Approaches to Learning, and other key variables assessed.