An Exploration of the Factors Predicting Academic Performance for Students with Disabilities in Connecticut

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Research Question

What factors influence academic performance for students with disabilities within the State of Connecticut?

Can we use those factors to help create ambitious but challenging targets for students with disabilities under IDEA law?

Research Goal

To create an evidence base for the factors in school districts that predict academic performance for students with disabilities.

To create a model to predict academic performance for students with disabilities in order to create appropriately ambitious goals.

District Demographics & Performance

The effects of district level characteristics, organization, and performance have been researched extensively throughout the past decades (Bidwell & Kasarda, 1975).

There seems to be numerous factors that can predict the performance of student's academic performance, such as:

- **Socioeconomic Status of a District** (Caldas & Bankston, 1997; Liu et al., 2020; Van Zwieten et al., 2021)
- **Overall Attendance of a District** (Kim et al., 2020; Oghuvbu, 2010)
- **English Language Learners in a District** (Hung et al., 2020)

Gap in the Research

Although there has been extensive research in this area, research for how these variables may influence students with disabilities is lacking.

Furthermore, there are more areas that may affect students with disabilities not addressed such as:

- **Disability Inclusion** (Kart & Kart, 2021; Schwartz et al., 2021)

- **Per Pupil Expenditure** - Research suggests that it doesn't affect students without disabilities, but is this the case for students with disabilities? (Hung et al., 2020)

Importance For Students

Understanding academic performance and our different demographics for students with disabilities is imperative, it can help improve many different outcomes.

- **Mental Well-Being** (Kaya & Erdem, 2021)
- **Future Career/Education Goals**
- **Social Outcomes** (Oh-Young & Filler, 2015)

Importance For Students Cont.

Under the Individuals with Disabilities Education Act (IDEA), students are entitled to a Least Restrictive Environment that is **"appropriately ambitious**" and have the "**chance to meet challenging objectives**" within the classroom (*Endrew F. v. Douglas County School District*, 2017).

Therefore, school districts need to be held accountable to the performance of their students in the school setting, and constantly trying to improve academic outcomes.

Data Collection: Sample

For this study, I examined publicly available data on all of Connecticut's Public-School Districts (N ≈ 170). This data was collected from:

- Edsight.ct.gov - The official Connecticut website for educational data that is publicly available
- National Center for Education Statistics (NCES) - The primary statistical agency of the U.S Department of Education

Data Collection: Design

In order to measure our academic performance variables, we will be running three weighted least squares regression models (WLS) with multiple predictor (independent) variables. These variables include:

- **Median Income**
- **Per Pupil Expenditure**
- **Disability Inclusion**
- **English Language Learners**
- **School Attendance**

For our criterion (dependent) variables, we will be measuring academic areas of:

- **English Language Arts**
- **Math**
- **Science**

Data Collection: Operationalization

Here is how we will represent our predictor (independent) variables:

- **Median Income ->** NCES median income estimates for CT school districts
- **Per Pupil Expenditure ->** The average per pupil expenditure by district
- **Disability Inclusion ->** The percentage of students with disabilities spending 79.1-100% of Time with Nondisabled Peers by School District
- **English Language Learners ->** The percentage of students identified as ELL students by school district
- **School Attendance ->** The percentage of students with disabilities who are chronically absent (absent for any reason for 10% or more school days) by school district

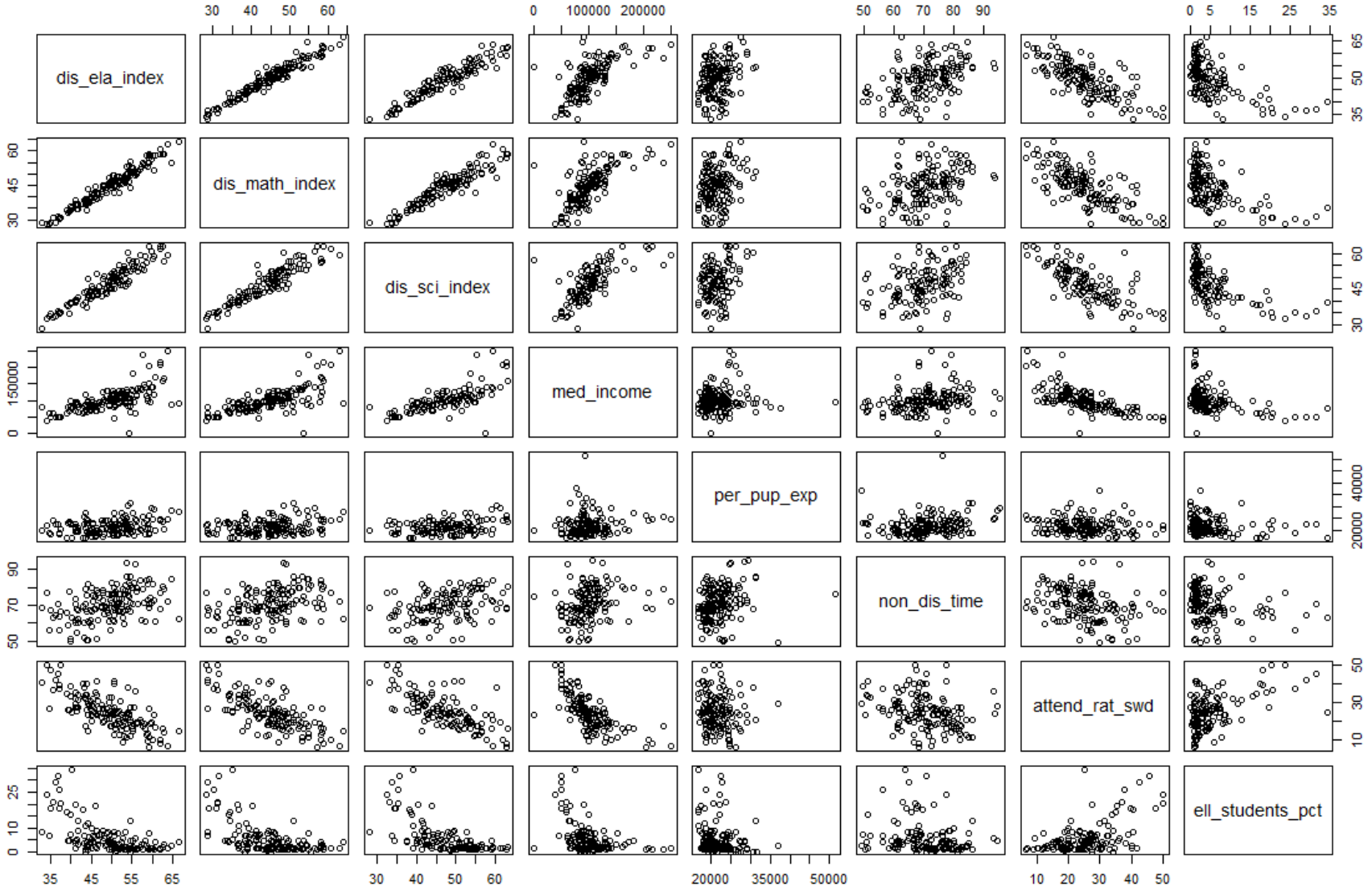
Data Collection: Operationalization Cont.

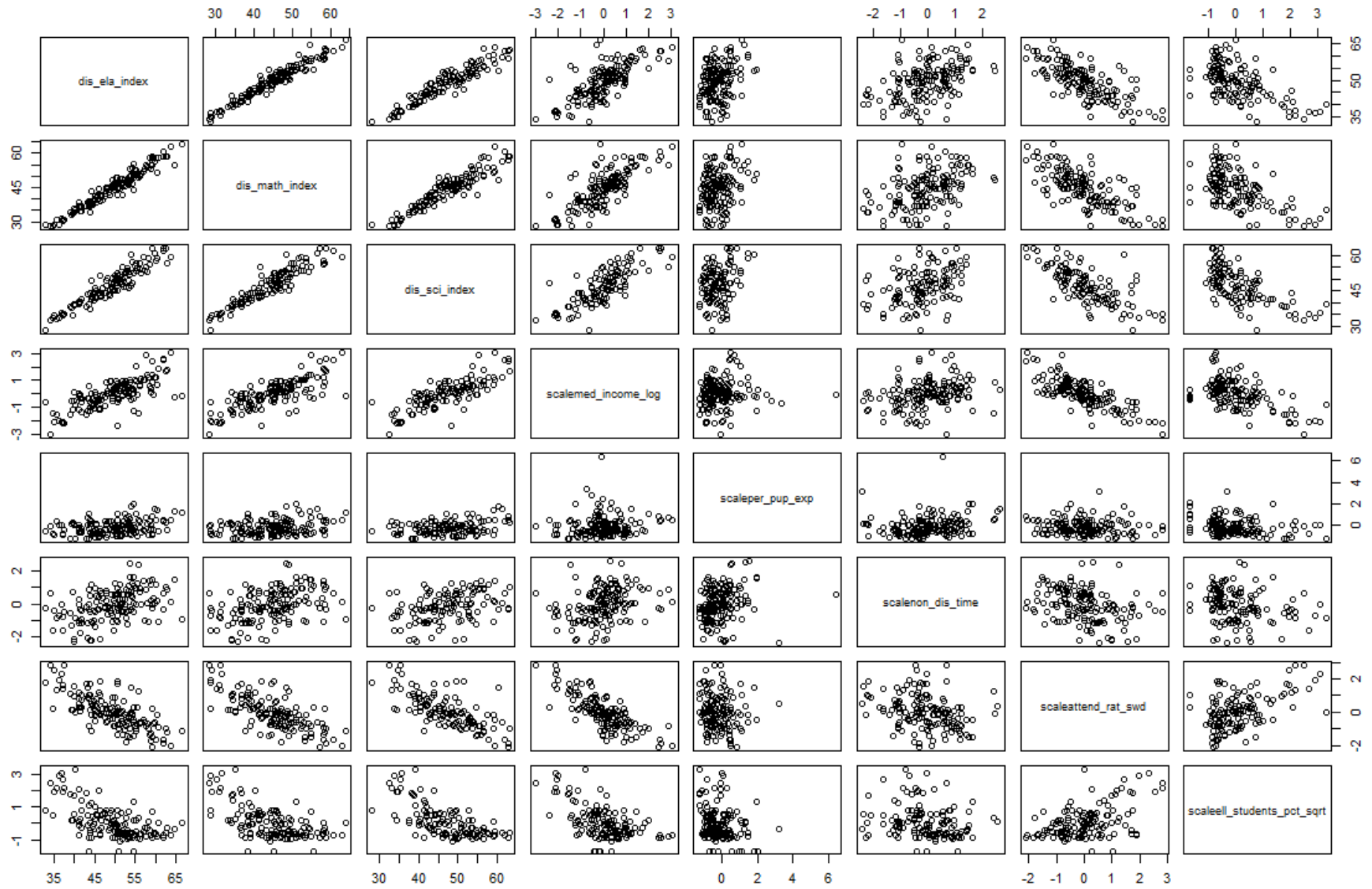
Here is how we will represent our criterion (dependent) variables:

- **English Language Arts ->** The average performance of students with disabilities on ELA state assessments by district (RPI)
- **Math ->** The average performance of students with disabilities on Math state assessments by district (RPI)
- **Science ->** The average performance of students with disabilities on science state assessments by district (RPI)

Our weights for our models will be determined by:

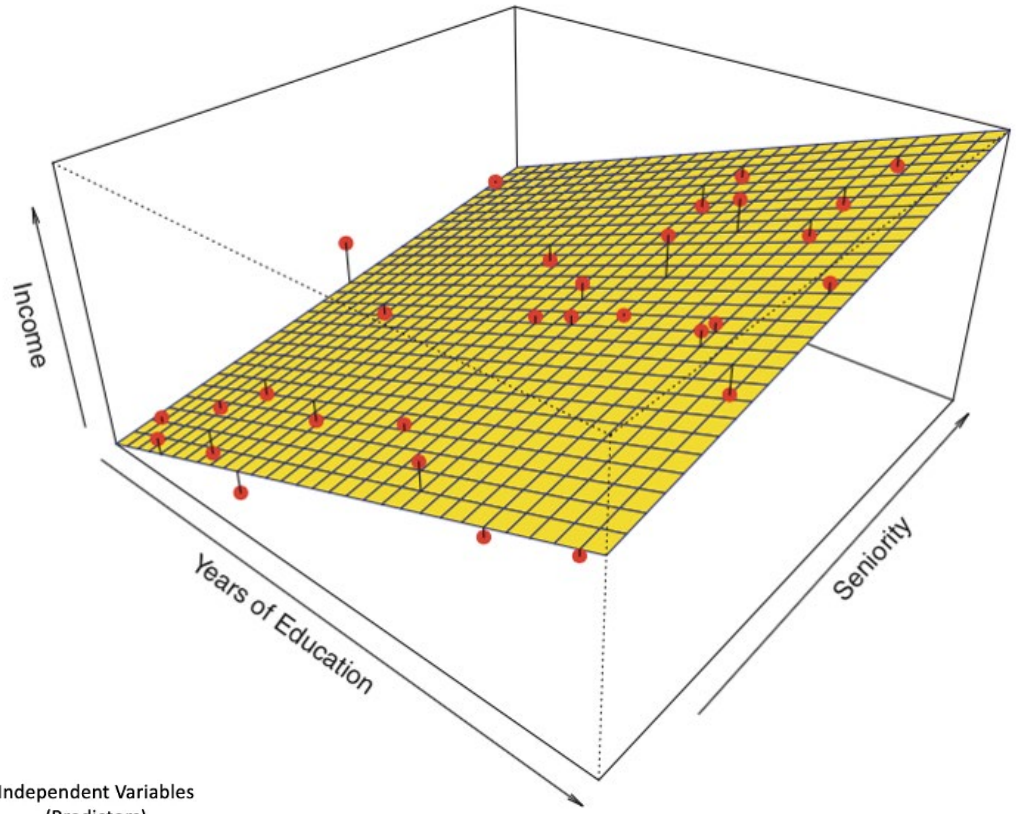
- **ELA ->** The number of students with disabilities who took the ELA assessment
- **Math ->** The number of students with disabilities who took the Math assessment
- **Science ->** The number of students with disabilities who took the Science assessment


dis_ela_index
dis_math_index
dis_sci_index
med_income
per_pup_exp
non_dis_time
attend_rat_swd
ell_students_pct


dis_ela_index
dis_math_index
dis_sci_index
scalemed_income_log
scaleper_pup_exp
scalenon_dis_time
scaleattend_rat_swd
scaleell_students_pct_sqrt

Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. dis_ela_index	49.50	7.05								
2. dis_math_index	44.68	7.87	.97** [.96, .98]							
3. dis_sci_index	47.12	7.48	.94** [.91, .96]	.93** [.90, .95]						
4. non_dis_time	70.96	9.17	.45** [.31, .57]	.43** [.28, .55]	.36** [.20, .51]					
5. per_pup_exp	22458.34	4536.21	.32** [.16, .45]	.28** [.12, .42]	.33** [.17, .48]	.21** [.06, .36]				
6. attend_rat_swd	25.05	8.91	-.73** [-.79, -.64]	-.72** [-.79, -.63]	-.71** [-.79, -.61]	-.31** [-.45, -.16]	-.09 [-.25, .07]			
7. ell_students_pct	5.34	6.44	-.58** [-.69, -.46]	-.58** [-.68, -.46]	-.62** [-.72, -.50]	-.20* [-.35, -.04]	-.21* [-.36, -.05]	.53** [.39, .64]		
8. med_income_log	4.98	0.14	.74** [.65, .80]	.77** [.69, .83]	.79** [.71, .85]	.29** [.13, .43]	.08 [-.07, .24]	-.78** [-.84, -.71]	-.56** [-.67, -.44]	
9. ell_students_pct_sqrt	1.99	1.18	-.59** [-.69, -.47]	-.59** [-.69, -.47]	-.67** [-.76, -.56]	-.23** [-.38, -.07]	-.26** [-.41, -.10]	.51** [.38, .63]	.95** [.93, .96]	-.53** [-.64, -.40]



Dependent Variable
(Response Variable)

Independent Variables
(Predictors)

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \varepsilon$$

Y intercept

Slope
Coefficient

Error Term

Regression results using scaledis_ela_index as the criterion

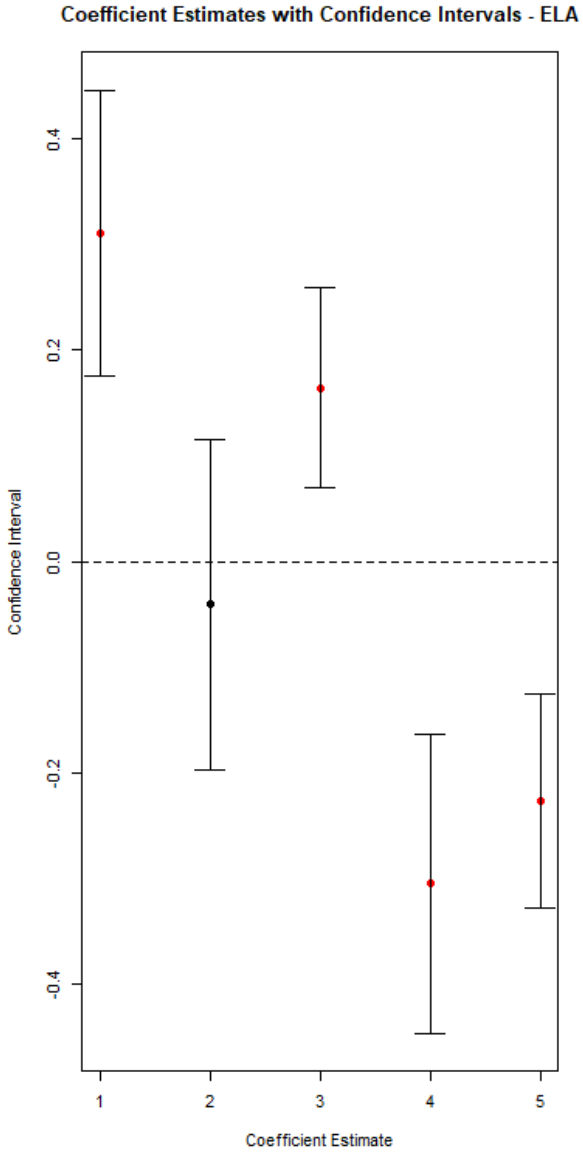
Predictor	*b*	*b* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	-0.06	[-0.17, 0.05]				
scalemed_income_log	0.31**	[0.18, 0.45]	.02	[.00, .05]	.76**	
scaleper_pup_exp	-0.04	[-0.20, 0.12]	.00	[-.00, .00]	.32**	
scalenon_dis_time	0.16**	[0.07, 0.26]	.01	[-.00, .03]	.42**	
scaleattend_rat_swd	-0.30**	[-0.45, -0.16]	.02	[.00, .04]	-.76**	
scaleell_students_pct_sqrt	-0.23**	[-0.33, -0.13]	.02	[.00, .04]	-.63**	
						R^2 = .855**
						95% CI[.80,.88]

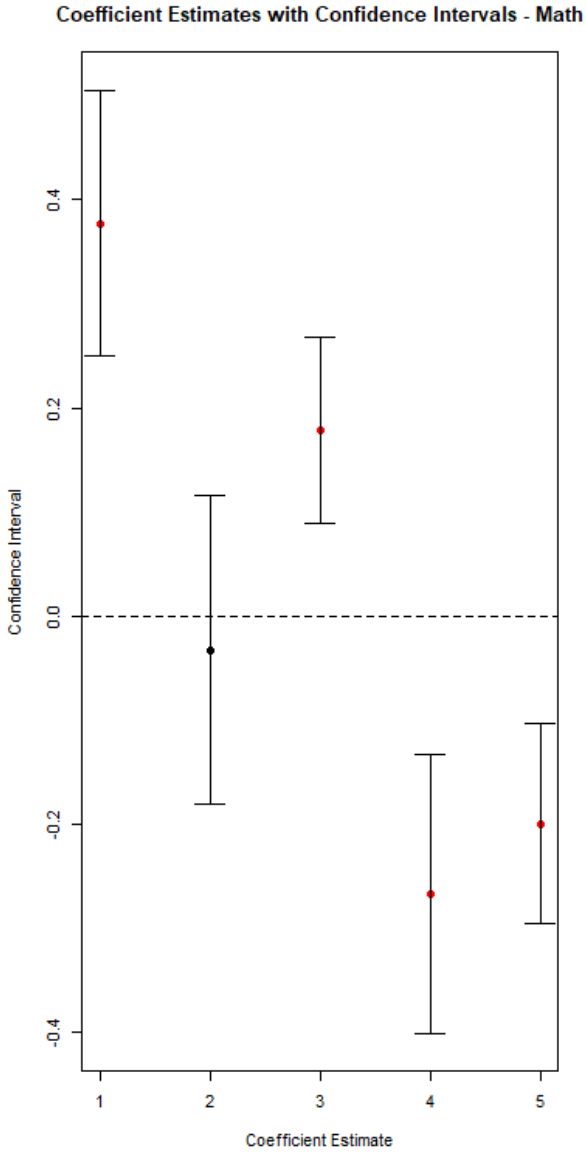
Regression results using scaledis_math_index as the criterion

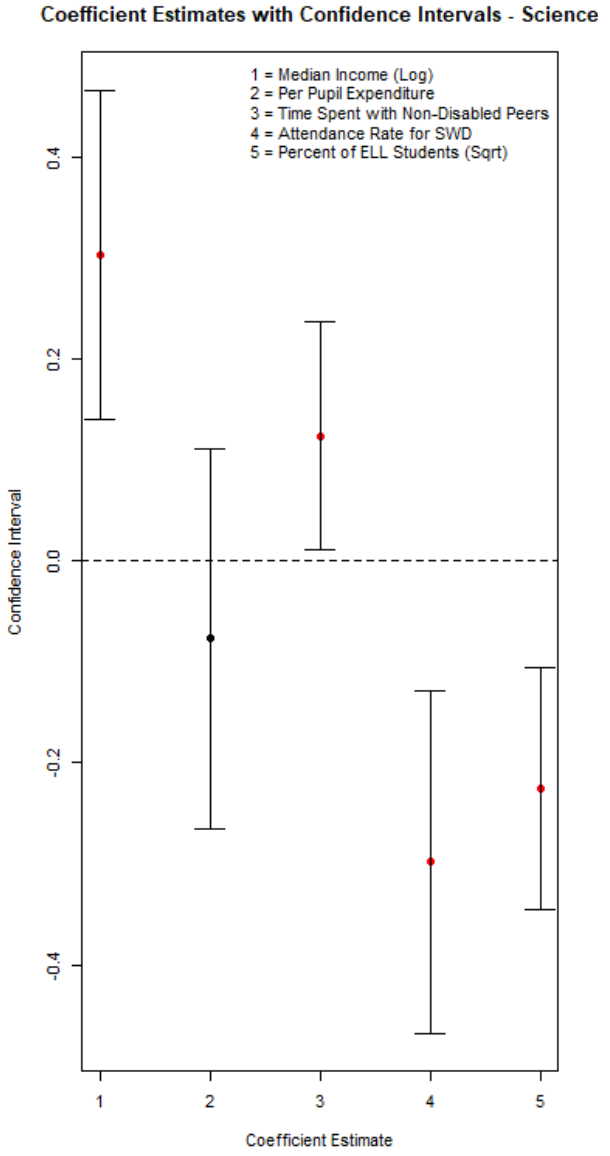
Predictor	*b*	*b* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	-0.05	[-0.15, 0.06]				
scalemed_income_log	0.38**	[0.25, 0.51]	.04	[.01, .06]	.78**	
scaleper_pup_exp	-0.03	[-0.18, 0.12]	.00	[-.00, .00]	.29**	
scalenon_dis_time	0.18**	[0.09, 0.27]	.02	[-.00, .03]	.41**	
scaleattend_rat_swd	-0.27**	[-0.40, -0.13]	.02	[-.00, .03]	-.76**	
scaleell_students_pct_sqrt	-0.20**	[-0.30, -0.10]	.02	[.00, .03]	-.63**	
						R^2 = .873**
						95% CI[.83,.89]

Regression results using scaledis_sci_index as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	0.02	[-0.11, 0.15]				
scalemed_income_log	0.30**	[0.14, 0.47]	.02	[-.00, .05]	.79**	
scaleper_pup_exp	-0.08	[-0.27, 0.11]	.00	[-.00, .01]	.31**	
scalenon_dis_time	0.12*	[0.01, 0.24]	.01	[-.01, .02]	.37**	
scaleattend_rat_swd	-0.30**	[-0.47, -0.13]	.02	[-.00, .04]	-.76**	
scaleell_students_pct_sqrt	-0.23**	[-0.35, -0.11]	.02	[-.00, .05]	-.69**	
						R^2 = .820**
						95% CI[.75,.85]


Coefficient Estimates with Confidence Intervals - ELA
Confidence Interval
0.4
0.2
0.0
-0.2
-0.4
1
2
3
4
5
Coefficient Estimate


Coefficient Estimates with Confidence Intervals - Math
Confidence Interval
0.4
0.2
0.0
-0.2
-0.4
1
2
3
4
5
Coefficient Estimate


Coefficient Estimates with Confidence Intervals - Science
1 = Median Income (Log)
2 = Per Pupil Expenditure
3 = Time Spent with Non-Disabled Peers
4 = Attendance Rate for SWD
5 = Percent of ELL Students (Sqrt)
Confidence Interval
0.4
0.2
0.0
-0.2
-0.4
1
2
3
4
5
Coefficient Estimate

Limitations

Looking at the results and based on our methodology, there are some apparent limitations:

- **Lack of Causation**: Our methods of regression do not allow us to make a causal inference
- **Operationalization:** For example, the difference in disability inclusion could be due to inclusion, or it could be because of the type of the disability
- **N/A Values**: If there is a missing value, the whole district is excluded from the model (N ≈ 130, N ≈ 130, N ≈ 110)
- **Multicollinearity**

Implications

Even with these limitations, there are some significant implications and findings from these results:

- **Improving Student Achievement Outcomes**
- **Creating Better Predictions for School District's & IDEA**
- **A Base for Future Causal Research on Disability Inclusion**
- **Better Understanding of Some of the Predictors of Academic Achievement**

References

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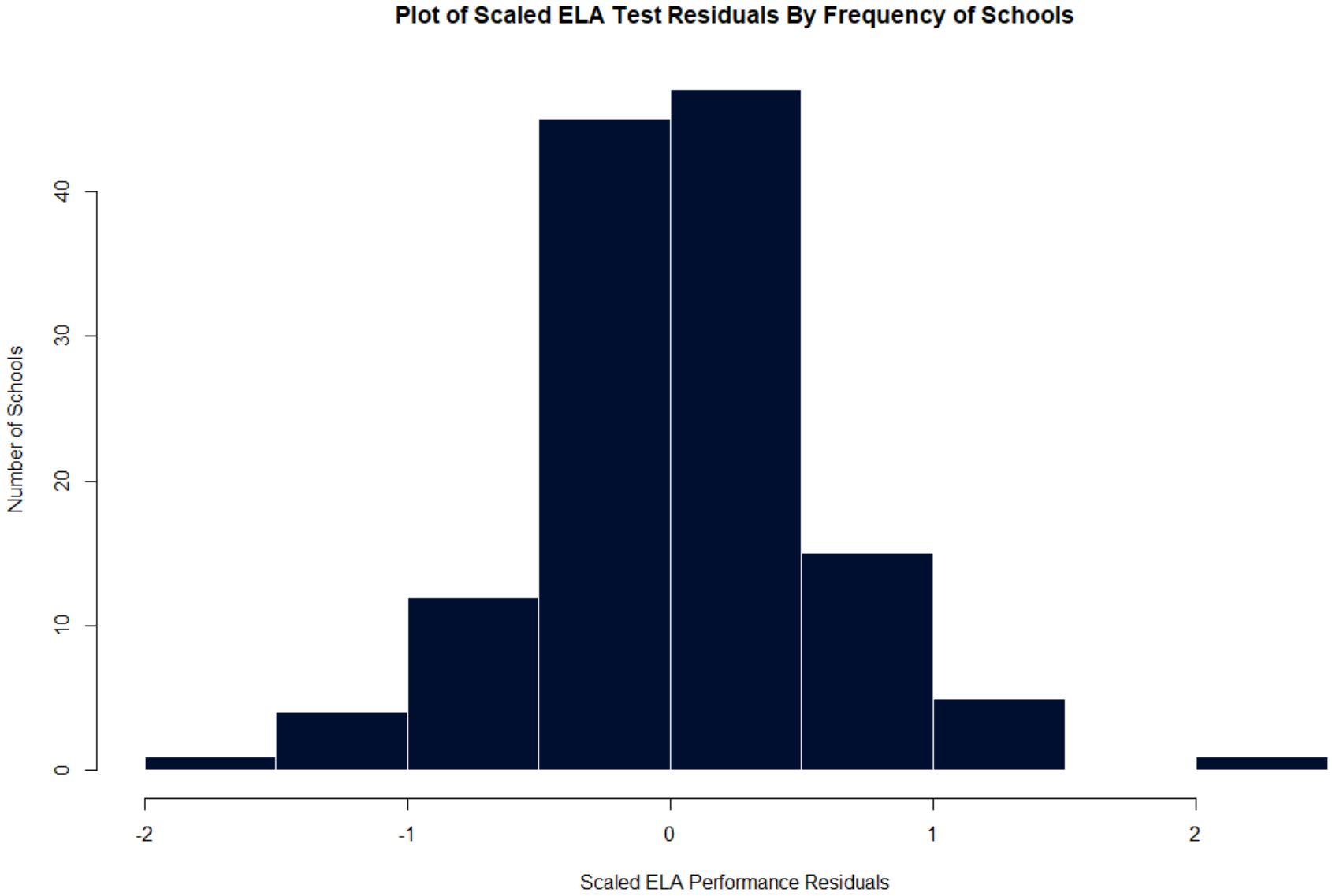
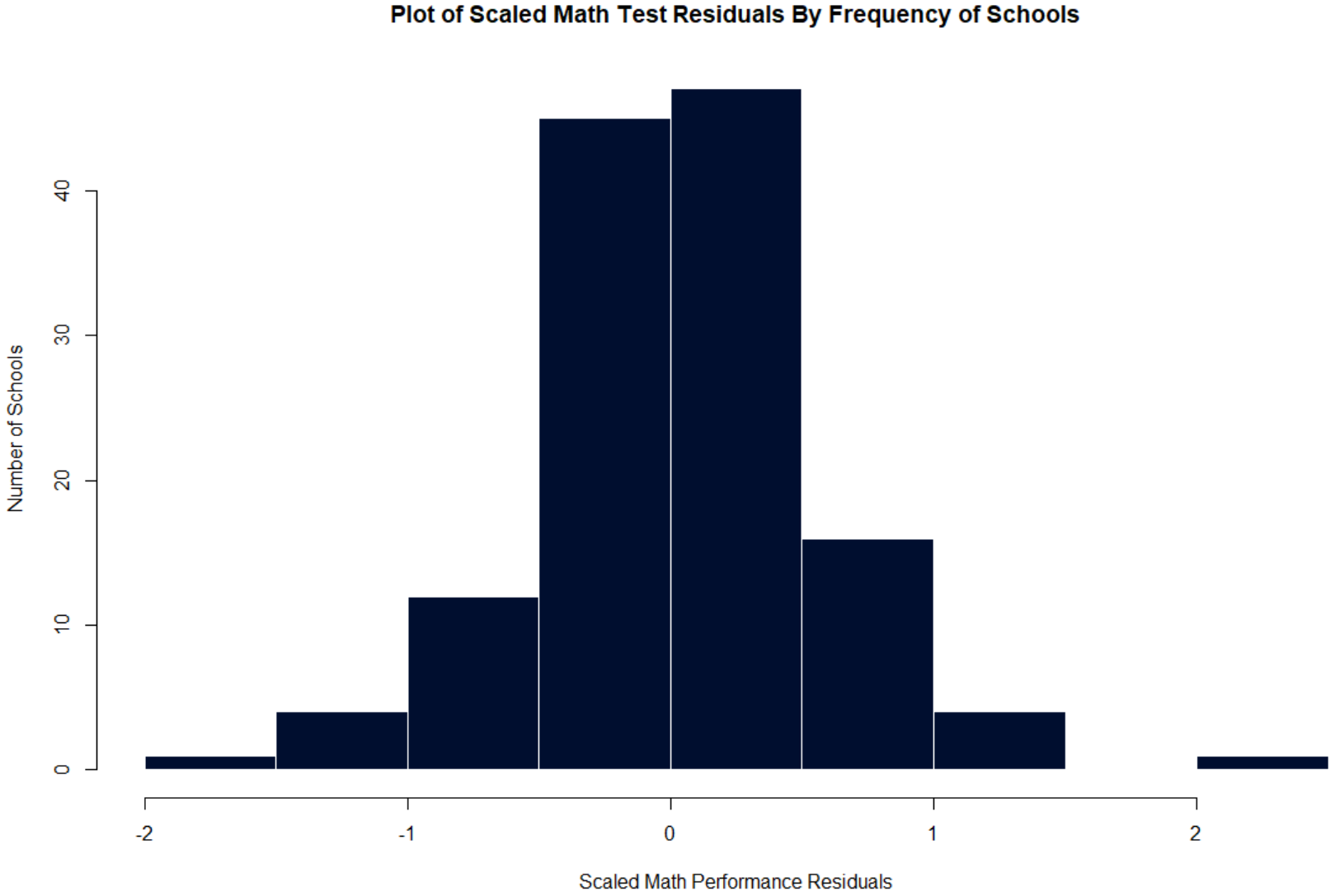
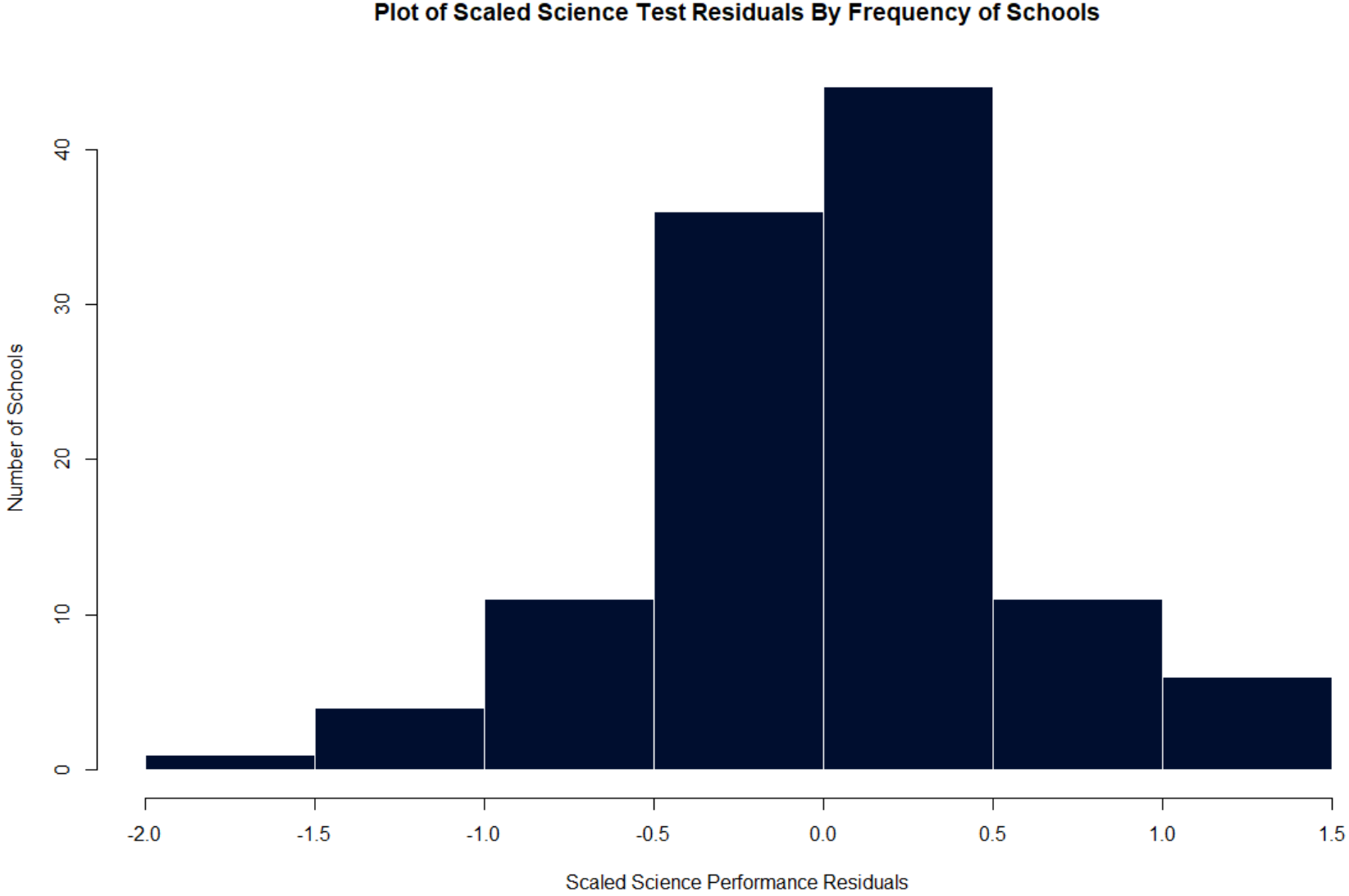

Plot of Scaled ELA Test Residuals By Frequency of Schools
Number of Schools
0
10
20
30
40
-2
-1
0
1
2
Scaled ELA Performance Residuals


Plot of Scaled Math Test Residuals By Frequency of Schools
Number of Schools
0
10
20
30
40
-2
-1
0
1
2
Scaled Math Performance Residuals


Plot of Scaled Science Test Residuals By Frequency of Schools
Number of Schools
0
10
20
30
40
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Scaled Science Performance Residuals