Examining Drivers of School District Academic Performance: Evidence from Illinois

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ABSTRACT

This study examines the factors influencing academic performance in Illinois school districts using data from the Report Card Data Library of Illinois State Board of Education. Our analysis includes metrics such as teacher characteristics, funding levels, and academic performance. The results reveal that both teacher characteristics and wealth have a significant impact on educational outcomes. Higher-income areas tend to have better academic achievement and funding, while lower-income areas struggle with limited resources and lower test scores. Teacher characteristics such as experience, attendance, and advanced degrees are also shown to have an impact on academic performance. These findings highlight the need for equitable distribution of educational resources and policies that support teacher retention and professional development. Our study provides important insights for policymakers and stakeholders to guide interventions aimed at improving educational outcomes for all students in Illinois.

INTRODUCTION

The quality of education provided by a school is an integral factor that has a profound impact on the future success and well-being of its students. It is widely acknowledged that the school district academic performance is determined by a complex interplay of various factors such as instructional quality, funding, teacher qualifications, and resources. Understanding these factors and their influence on school district academic performance is crucial for policymakers, educators, and researchers who are committed to improving the quality of education in their communities.

In this study, we use data from the Illinois State Board of Education's report card to investigate the academic performance of school districts in Illinois. Our unit of analysis is district-level, and we focus on three variables from the ELA Math Science worksheet - percentage of students proficient in English Language Arts (ELA), mathematics, and science. By conducting a factor analysis, we determine that all three variables load highly onto a single factor, which we name "School Academic Performance".

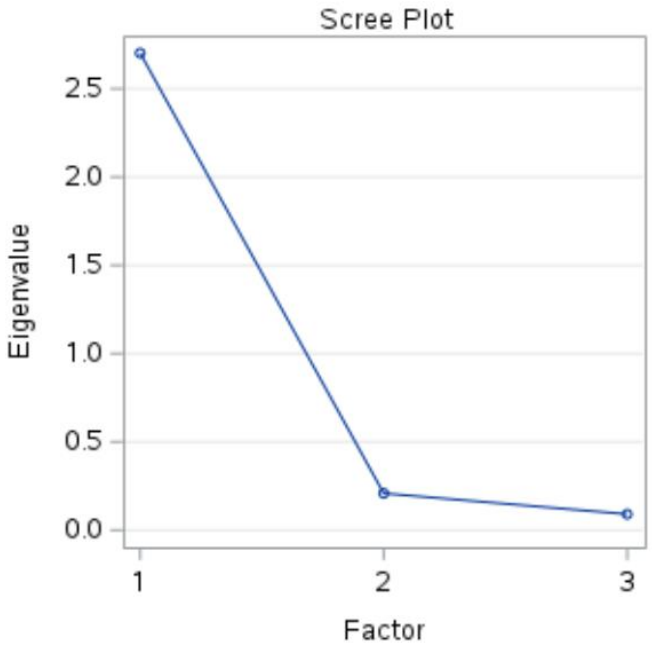
To understand the factors that contribute to school district academic performance, we conduct a multiple regression analysis using School Academic Performance as the dependent variable. Our analysis considers the relationship between school performance and a comprehensive set of independent variables, including percentage of transportation expenses, percentage of supporting services expenses, federal funding, average teaching experience, teacher evaluation rate, local property taxes, instruction expenses, teacher retention rate, teacher attendance rate, percentage of white teachers, and the proportion of teachers with a master's degree.

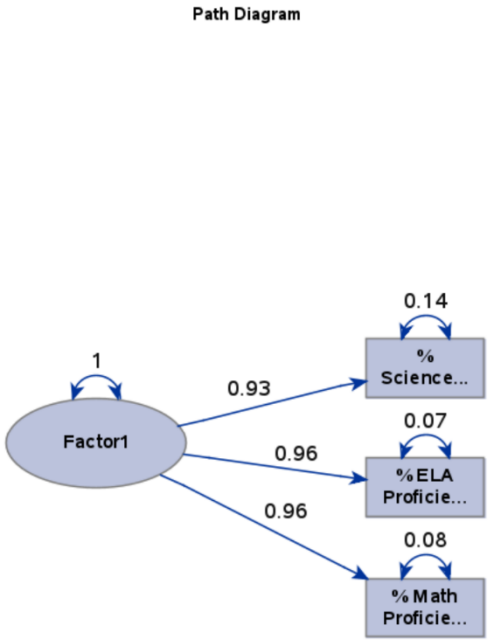
The results of this study will contribute to the larger body of knowledge on the determinants of school district academic performance and provide valuable insights into the factors that impact the quality of education in Illinois.

UNDERSTANDING SCHOOL DISTRICT ACADEMIC PERFORMANCE

Our dependent variable is School district academic performance. To measure the academic performance, we utilized three variables from the ELA and math worksheet, which are the percentage of students who are proficient in English Language Arts (ELA), mathematics, and science. These variables were chosen as they are widely accepted indicators of a school's academic success.

By performing factor analysis using SAS® Studio, we determined that there was one factor that emerged based on the Scree plot, Kaiser criterion and the path diagram (refer figure 1 and 2).





The results of the principal component analysis revealed that all three proficiency variables were highly loaded onto the single factor of School District Academic Performance. Thus, we saved the generated factor scores and used it as the dependent variable in our subsequent multiple regression analysis. This factor provided a more comprehensive and accurate representation of school district academic performance compared to using any single proficiency variable.

THE MANY FACETS OF SCHOOL DISTRICT ACADEMIC PERFORMANCE: A COMPREHENSIVE MULTIPLE REGRESSION ANALYSIS

Our study aimed to determine the factors influencing a school district's academic performance using data from the Illinois Public School Performance Dataset. We used multiple regression to identify significant predictors and their impact on the school district academic performance. Our model included 11 variables from three different worksheets, as we believed these factors were important in understanding a school district's academic performance. The 11 variables include two categories one related to school resources or funding and the other related to teacher characteristics.

We found that out of the 11 variables chosen, five of them were significant predictors of academic performance, including teacher retention rate, teacher attendance rate, percentage of local property taxes, percentage of instruction expenses, percentage of supporting services expenses, percentage of white teachers, and the percentage of teachers with a master's degree.

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	178.21597	16.20145	39.35	<.0001
Error	584	240.43678	0.41171		
Corrected Total	595	418.65275			

Root MSE	0.64164	R-Square	0.4257
Dependent Mean	0.21084	Adj R-Sq	0.4149
Coeff Var	304.32953		

Parameter Estimates								
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standardized Estimate	Variance Inflation
Intercept	Intercept	1	-4.44377	0.81285	-5.47	<.0001	0	0
% Transportation	% Transportation	1	-0.00260	0.01530	-0.17	0.8652	-0.00613	1.32697
% Supporting Services	% Supporting Services	1	-0.02084	0.00590	-3.53	0.0004	-0.13055	1.38958
% Local Property Taxes	% Local Property Taxes	1	0.01723	0.00218	7.89	<.0001	0.41680	2.83512
% Instruction	% Instruction	1	0.01259	0.00393	3.20	0.0014	0.11176	1.23945
% Federal Funding	% Federal Funding	1	0.00636	0.00974	0.65	0.5136	0.03400	2.75071
Teacher Retention Rate	Teacher Retention Rate	1	0.01186	0.00569	2.08	0.0375	0.08090	1.53148
Avg Teaching Exp	Avg Teaching Exp	1	0.01949	0.01464	1.33	0.1836	0.05181	1.54028
Teacher Attendance Rate	Teacher Attendance Rate	1	0.00553	0.00192	2.88	0.0042	0.09318	1.06605
% Teachers - White	% Teachers - White	1	0.01515	0.00259	5.85	<.0001	0.22063	1.44558
Teacher Evaluation Rate	Teacher Evaluation Rate	1	0.00202	0.00652	0.31	0.7570	0.01009	1.07937
Masters Degree	Masters Degree	1	0.00675	0.00216	3.13	0.0018	0.14154	2.08175

Linear Regression Results on SAS® Studio

Below table provides an overall context about the variables used, their significance effect on the academic performance, impact (either positive or negative) on school district's academic performance and explanation.

Variable	Explanation	Impact
% Supporting Services	Supporting Services Expenditure	Significantly negative
% Local Property Taxes	Tax revenue from local properties	Significantly positive
% Federal Funding	Percentage of federal financial support	Non-significant
% Transportation	Percentage of transportation expenses	Non-significant
% Teachers - White	Percentage of white teachers employed	Significantly positive
% Instruction	Percentage of instructional expenses incurred	Significantly positive
Master's Degree	Percentage of teachers with master's degree	Significantly positive
Teacher Attendance Rate	Percentage of attended teachers daily	Significantly positive

Teacher Retention Rate	Percentage of retained teachers annually	Significantly positive
Avg Teaching Exp	Average years of teaching in schools	Non-significant
Teacher Evaluation Rate	Percentage of formally evaluated teachers	Non-significant

SUMMARY

Significant Variables:

Teacher-related factors were found to significantly impact academic performance at the district level. Teacher retention was found to have a positive impact on academic performance, as experienced teachers provide stability and enhance the quality of education. Teacher attendance was also identified as a key factor, as higher attendance rates lead to a positive learning environment and improved student engagement. The proportion of white teachers in a school was found to have a significant positive impact on academic performance, with a predicted increase in performance with a 1% increase in the proportion of white teachers. Additionally, the percentage of teachers with a master's degree was identified as a significant predictor of academic performance, suggesting that advanced degrees may have a greater impact on student learning and achievement. These findings suggest that investing in teacher-related factors is crucial for promoting academic success in schools.

Our analysis revealed that funding allocation plays a crucial role in academic performance. Supporting services expenses had a negative impact on academic performance, indicating that spending on these services may decrease academic performance by diverting resources from instructional activities [(2)]. In contrast, an increase in local property taxes had the highest positive impact on academic performance, as higher property taxes enable schools to afford better resources, teachers, and facilities [(1)]. In addition, our analysis showed that a higher percentage of instruction expenses is a significant predictor of academic performance. This finding aligns with previous research, which has shown that increased time spent on instruction is associated with better student achievement [(3)]. To achieve optimal student outcomes, it is essential to balance spending on supporting services and instructional activities.

Non-Significant Variables:

Our study found that several commonly believed factors do not have a significant impact on academic performance at the district level. These include transportation expenses, federal funding, teacher evaluation rate, and average teaching experience. While federal funding has long been considered crucial in determining school performance, we found that it is not the dominant factor in academic success [(4)]. Additionally, we found that teacher evaluations may not accurately reflect a teacher's true impact on student learning, and that other factors such as teacher experience, attendance, and advanced degrees may be more reliable indicators of a teacher's effectiveness in promoting academic success. Furthermore, contrary to popular belief, the average teaching experience of teachers in a school was found to not have a significant impact on academic performance. Overall, our findings suggest the need for further research to explore other factors that may impact academic performance at the district level.

CONCLUSION

In conclusion, our analysis of various factors impacting school district academic performance showed that local property taxes and the proportion of white teachers have a positive impact, while supporting services expenses negatively impact school district academic performance.

Instruction expenses, teachers with master's degrees, and teacher retention rate were also found to positively impact school district academic performance. On the other hand, federal funding, teacher evaluation rate, average teaching experience, and transportation expenses were not significant predictors of school district academic performance. It is important to note that while some factors may have a greater impact on school district academic performance, a balance of all factors is crucial for optimal student outcomes.

SCOPE FOR FUTURE WORK

We have performed an analysis on school district level and found various factors impacting school district academic performance, the future of this study is to analyze various variables related to student demographics, student to teacher ratio, resources on school level and provide findings.

REFERENCES

1. Hoxby, C. (2000). The effects of class size and composition on student achievement: New evidence from natural population variation. The Quarterly Journal of Economics, 115(4), 1239-1285. https://doi.org/10.1162/003355300555042
2. Fack, G., & Grenet, J. (2015). Improving school infrastructure in France: A priority for better learning conditions and student achievement. Economics of Education Review, 47, 1-22. https://doi.org/10.1016/j.econedurev.2015.07.002
3. Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness. Education Policy Analysis Archives, 13(42). https://doi.org/10.14507/epaa.v13n42.2005
4. According to a report by the National Center for Education Statistics (NCES), federal funding accounted for about 9% of total funding for public elementary and secondary schools in the United States in the 2016-17 school year. The remaining 91% of funding came from state and local sources (https://nces.ed.gov/programs/coe/indicator_cmb.asp).

CONTACT INFORMATION

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Factor Analysis Appendix

2/15/23, 9:50 PM Results: Factor Analysis

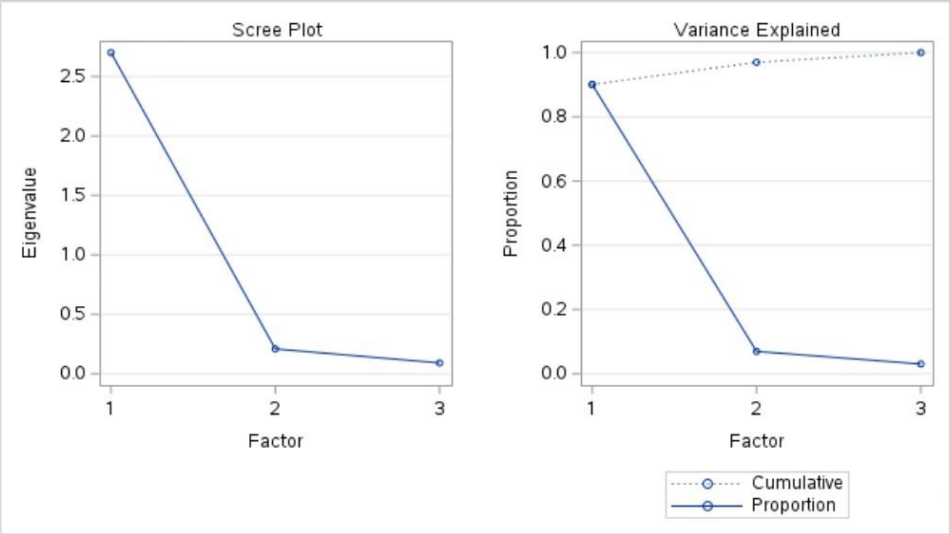
Input Data Type	Raw Data
Number of Records Read	4707
Number of Records Used	4058
N for Significance Tests	4058

Initial Factor Method: Principal Components

Prior Communality Estimates: ONE

Eigenvalues of the Correlation Matrix: Total = 3 Average = 1				
	Eigenvalue	**Difference**	**Proportion**	**Cumulative**
1	2.70148912	2.49333175	0.9005	0.9005
2	0.20815737	0.11780386	0.0694	0.9699
3	0.09035351		0.0301	1.0000

1 factor will be retained by the NFACTOR criterion.



Factor Pattern		
		Factor1
% ELA Proficiency	% ELA Proficiency	0.96187
% Math Proficiency	% Math Proficiency	0.95818
% Science Proficiency	% Science Proficiency	0.92639

Variance Explained by Each Factor
Factor1
2.7014891

Final Communality Estimates: Total = 2.701489		
% ELA Proficiency	**% Math Proficiency**	**% Science Proficiency**
0.92518976	0.91810744	0.85819193

Linear Regression Appendix

Model: MODEL1
Dependent Variable: School Performance School Performance

Number of Observations Read	1044733
Number of Observations Used	596
Number of Observations with Missing Values	1044137

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
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