


Social Factors of Academic Success



We are delighted to release Social Factors of Student Success. This research, supported by the Colorado State University system office, is designed to identify potential interventions and recommendations early in a student's academic journey under the theory that early reading proficiency is a significant driver of later in life academic and professional success.

The study is unique in its approach. First, it assesses the local geography rather than the individual student as the unit of analysis. In this way, the findings are broader and focus on community rather than student level recommendations. Additionally, this study is the first of its kind to apply a full complement of social factors to the study of academic performance at the elementary school level. A social determinants approach has been widely applied to studies of health, including in previous CFC work. This study further applies our models of social factors, developed over the past 5 years to explore health equity and environmental justice, to student success.

The findings confirm earlier research on student success; children in high income and education communities perform better. Long term, we need to continue to work to alleviate poverty and provide educational opportunity to all Coloradans – continuing a multi-generational effort to improve outcomes for all Colorado students. But the study also identified other significant associations with student success, ones that lend themselves to more immediate policy recommendations. These factors, largely related to classroom environment, school funding, housing, and intergenerational community trauma and perceptions of health lead us to preliminary recommendations designed to improve academic outcomes for young students.

The release of this report is the beginning of the journey – not the end. We intend to follow this research with the convening of a series of community conversations, using the findings from this research to refine and augment the preliminary recommendations developed in the report. We hope to have you join us along the way.

July 2024



Social Factors of Academic Success

ABSTRACT

This research, commissioned by the Colorado State University System Office, applies a social determinants framework to educational and subsequent later in life success. It draws from and applies the widely used social determinants of health approach often deployed in studies of health equity and extends that framework to educational success. The World Health Organization defines social determinants of health as “the non-medical factors that influence health outcomes. They are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life.”¹ The proposition for this research is that similar social determinants also influence learning for elementary school age students. The further propositions of this research are first that intervening earlier in a student’s academic progression is related to later in life opportunities, both academic and professional and that a social determinant approach is an important tool for identifying options for early policy intervention.

With an application of a social factors of success construct, we identify ten factors as significantly associated with reading proficiency at the third grade level. These factors are related to the following significant dimensions of factors: income, employment opportunity, classroom, housing, and social. Additionally individual factors related to school finance and early childhood education are demonstrated as positively associated with student outcomes. Unlike many studies of student success which follow a cohort of students, this study uses the local geography as the unit of analysis, leading to a series of preliminary recommendations that can be implemented at the community level – extending the universe of potential interventions more broadly. Finally, we recognize that this research will be most impactful if it is the catalyst for a conversation and a series of efforts to refine the proposed interventions with the expertise of those involved daily in educating Colorado’s students and implementing education policy.

1 https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1

INTRODUCTION

Motivation for this inquiry

This commissioned research grew from a request from the Colorado State University System Office to study student readiness for university. As decades of academic and policy demonstrate, student success is a nuanced and complex area of inquiry. It is increasingly understood that success at all levels of education depends on factors that extend beyond the classroom to almost all aspects of a student's life.

To address this inquiry, we employ a unique approach; we apply a full complement of social factors¹ to exploring early educational performance and then rely on the existing research to establish the relationship between reading proficiency at the third grade level and later in life academic and professional success. We draw from and apply the widely used social determinants of health approach, often deployed in studies of health equity, and extend that framework to educational success. The World Health Organization defines social determinants of health as “the non-medical factors that influence health outcomes. They are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life.”² ***The proposition for this research is that similar social determinants also influence early educational and subsequently later in life academic and professional success.***

The extension of a social determinants approach to educational success is far less widespread than the applications to health and to our knowledge this is the first study of its kind to apply a full complement of social determinants, at the community level, to the assessment of elementary school academic performance.

Notwithstanding, the application of social determinants to educational success is not entirely novel. There are limited instances, in both the academic and policy literature, of extensions of a social factors approach to education, generally with a focus on higher education and on the relationship between single factors such as transportation or food security and higher ed completion. While this approach is valuable, it is equally limiting. First, by definition, it excludes students who never matriculate into institutions of higher education from the universe of study. Further, it fails to address the significant challenge of students who do embark on higher education but with significant gaps in their primary and secondary education, thus requiring remediation for success. Most education research demonstrates that interventions are most successful earlier in a student's academic life, particularly in a manner that ensures reading proficiency by the third grade level.³ And finally, by limiting the study to a single factor approach, existing studies fail to assess the complexities of the interrelatedness of multiple social factors on student success. For these reasons, we argue in this paper that the appropriate application of a social factors approach requires a multi-dimensional matrix of factors applied far earlier in educational pursuits, specifically at the primary school level.

While there are fewer examples of comprehensive applications at the primary school level, educators have long recognized that factors outside the classroom impact learning. This approach did garner some attention as the COVID shutdown placed a stronger spotlight on factors outside the formal classroom, but many of these efforts were singularly COVID focused, do not appear to have persisted, and were largely the domain of educational consulting not research. This inquiry is designed to be more universal and enduring, applying a full complement of social factors to learning success far earlier in a student's academic life. However, to be relevant to studying post-secondary academic success, applying this approach to primary education requires a throughline to success in higher education and beyond. For this we rely on existing research demonstrating

1 Throughout this research, we use the terms social factors and social determinants interchangeably.

2 https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1

3 A brief review of this research is presented in the sections that follow.

INTRODUCTION

Motivation for this inquiry

that reading proficiency at the third grade level is associated with educational and other professional success.

This approach then combines two propositions - that social factors matter, particularly specific social factors, and that their impact on early learners affects student readiness in later endeavors including higher education. Drawing upon previous Colorado Futures Center work on social determinants originally focused on both health outcomes and disproportionately impacted communities, this study takes a holistic approach to the exploration of the relationship between 12 dimensions of social determinate variables and early (third grade) reading proficiency. Then we rely on the existing research for the relationship between third grade reading and later in life academic success. As an added advantage, the design, which uses a local geography as the unit of analysis, allows for a simultaneous assessment of community level performance in each of the major dimensions and variables affecting success. This facilitates a deeper evaluation and conversation of community determinants and better lends itself to the identification of directed interventions at both the state and local level.

This study is the first in Colorado to explore a full complement of social factors and their individual and combined relationships with educational success. And while the data and findings are specific to Colorado, the approach may be applied universally to address a wider gap in the inquiry nationwide. The research proposition – ***that a comprehensive set of social factors is jointly and individually associated with third grade reading which is then associated with success later in life*** – is one that lends itself to being tested in Colorado and beyond, allowing for powerful insights and the opportunity to explore relationships beyond the specific case of Colorado.

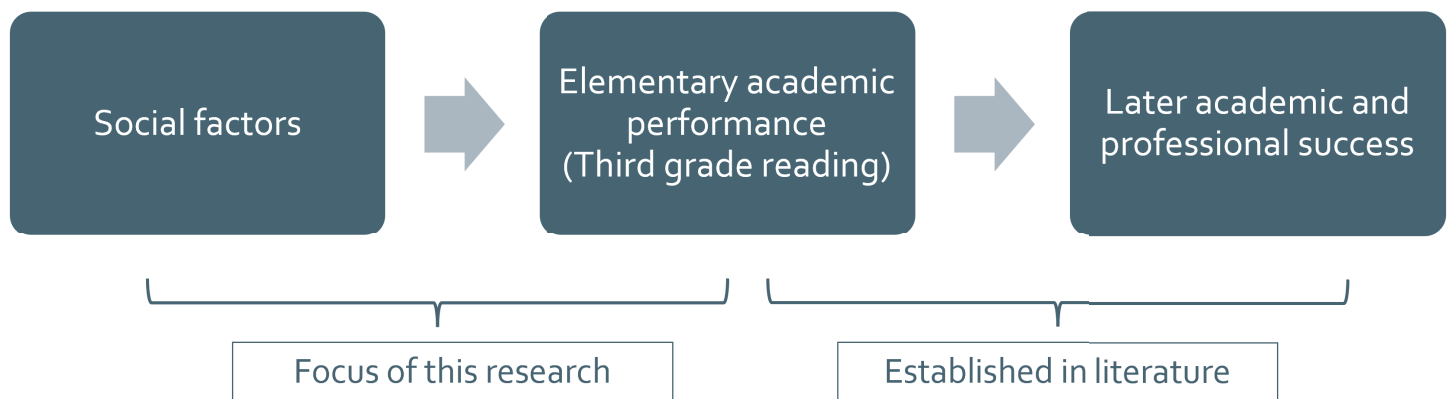
THE LITERATURE

Evidence from previous studies

This research relies on two bodies of literature. The first, and primary motivation for this work, explores the relationship between social factors and academic success and will be addressed first. This literature is growing but remains limited, allowing this study to fill a gap. We believe this is the first study to explore a comprehensive bundle of social factors, individually and as combined indices across over one thousand local geographies in Colorado, and their relationship directly to primary and then indirectly to post-secondary academic performance.

The indirect academic performance relies on the second body of research surveyed for this project: the studies exploring the relationship between third grade reading proficiency and later in life academic and other success. The proposition for this research, that social factors are associated with early reading performance which is then associated with subsequent academic performance requires the throughline between third grade reading and later performance. The review of the studies on third grade reading help establish that throughline and are summarized after the section of social factors and academic performance.

Figure 1. Schematic of research proposition



Social factors and academic performance

The literature on social determinants of health is well developed. Most references to healthy equity include some analysis of social determinants, "the non-medical factors that influence health outcomes...the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life".¹ Only recently has this social factors approach been applied to other social outcomes. For this study the outcome is educational success.

There is a nascent but developing body of studies directly associating selected aspects of social determinants with education. Some of the early works relating social factors to academic performance date back to the immediate wake of the Great Society programs and focus on the role of inequality in educational outcomes.² These later twentieth

¹ https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1

² A review of the first release of *Inequality: A Reassessment of the Effect of Family and Schooling in America* by Christopher Jencks is available at https://www-jstor-org.ezproxy2.library.colostate.edu/stable/pdf/2129121.pdf?refreqid=excelsior%3A21f849e13a371305fd3a22edfef8746b&ab_segments=&origin=&initiator=&acceptTC=1

THE LITERATURE

Evidence from previous studies

century works, with their sole focus on inequality, are among the early research that recognized that factors outside the classroom – social factors – impact outcomes in education.

Later works acknowledge the interaction between factors specific to the student combined with broader social factors. With foci on the interactions between emotional³ or psychological factors⁴ and social factors, this later literature presents limited social factors, typically related to family and culture variables, in a largely supporting role. Notably, many of these studies do focus on the primary rather than post-secondary level of education.

Other branches of literature consider limited numbers of social factors in relationship to the educational outcomes of specific cohorts of students. These studies explore outcomes for African Americans,⁵ Latino/a students,⁶ disadvantaged communities⁷ and students otherwise deemed at risk⁸. A small vector of social factors is prominent as controlling variables in a study exploring the differing academic outcomes of varying immigrant communities⁹ and social capital was demonstrated to be a strong predictor of academic performance specifically in urban school districts¹⁰. Finally, in a study closer to the broad social determinant approach taken in this research, the interrelatedness of community factors such as wealth, parent support, single-parent families, mobility, and school organization factors are explored for their relationship with student achievement.¹¹ However, compared to more comprehensive social determinant approaches, the social factors considered here remain limited in scope.

Other research, often with a more policy than academic focus, establishes the widely acknowledged relationship between the socioeconomic status and educational attainment of parents and student success. In 2017, the American Psychological Association published a research blog¹² highlighting the relationship between parent status and both student success and the choices students make around their education. Other blogs originating in the United States,¹³ the United Kingdom¹⁴ and Australia¹⁵ further support these findings. Later in this paper, we propose that these “pick

3 Pritchard, Mary E and Gregory S. (Gregory Scott) Wilson. "Using Emotional and Social Factors to Predict Student Success." *Journal of College Student Development*, vol. 44 no. 1, 2003, p. 18-28. *Project MUSE*, <https://doi.org/10.1353/csd.2003.0008> and Quílez-Robres, A.; Moyano, N.; Cortés-Pascual, A. Motivational, Emotional, and Social Factors Explain Academic Achievement in Children Aged 6–12 Years: A Meta-Analysis. *Educ. Sci.* 2021, 11, 513. <https://doi.org/10.3390/educsci11090513>

4 Portes, P. R. (1999). Social and Psychological Factors in the Academic Achievement of Children of Immigrants: A Cultural History Puzzle. *American Educational Research Journal*, 36(3), 489-507. <https://doi.org/10.3102/00028312036003489> and Jihyun Lee & Valerie J. Shute (2010) Personal and Social-Contextual Factors in K–12 Academic Performance: An Integrative Perspective on Student Learning, *Educational Psychologist*, 45:3, 185-202, DOI: 10.1080/00461520.2010.493471

5 Burchinal, M. R., Roberts, J. E., Zeisel, S. A., & Rowley, S. J. (2008). Social risk and protective factors for African American children's academic achievement and adjustment during the transition to middle school. *Developmental Psychology*, 44(1), 286–292. <https://doi.org/10.1037/0012-1649.44.1.286>

6 Crisp, G., Taggart, A., & Nora, A. (2015). Undergraduate Latina/o Students: A Systematic Review of Research Identifying Factors Contributing to Academic Success Outcomes. *Review of Educational Research*, 85(2), 249-274. <https://doi.org/10.3102/0034654314551064>

7 Bronwyn E. Becker & Suniya S. Luthar (2002) Social-Emotional Factors Affecting Achievement Outcomes Among Disadvantaged Students: Closing the Achievement Gap, *Educational Psychologist*, 37:4, 197-214, DOI: 10.1207/S15326985EP3704_1

8 James H. McMillan & Daisy F. Reed (1994) At-Risk Students and Resiliency: Factors Contributing to Academic Success, *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 67:3, 137-140, DOI: 10.1080/00098655.1994.9956043

9 Portes, P. R. (1999). *Social and Psychological Factors in the Academic Achievement of Children of Immigrants: A Cultural History Puzzle*. *American Educational Research Journal*, 36(3), 489-507. <https://doi.org/10.3102/00028312036003489>

10 Erik Porfeli, Chuang Wang, Robert Audette, Ann McColl, and Bob Algozzine (2009) Influence of Social and Community Capital on Student Achievement in a Large Urban School District, *Education and Urban Society* 2009 42:1, 72-95

11 Frank M. Kline (1997) The Influence of the Community on a Student's Academic Performance, *Child and Adolescent Psychiatric Clinics of North America*, Volume 6, Issue 3, Pages 607-620, ISSN 1056-4993, [https://doi.org/10.1016/S1056-4993\(18\)30297-9](https://doi.org/10.1016/S1056-4993(18)30297-9). (<https://www.sciencedirect.com/science/article/pii/S1056499318302979>)

12 <https://www.apa.org/pi/ses/resources/publications/education#:~:text=Low%20SES%20and%20exposure%20to,et%20al.%2C%202012>.

13 <https://officialsocialstar.com/blogs/blog/impact-of-social-factors-on-education>

14 <https://www.studysmarter.co.uk/explanations/social-studies/sociology-of-education/social-class-and-education/>

15 <https://fruitofeducation.weebly.com/social-factors-affecting-education.html>

THE LITERATURE

Evidence from previous studies

your parents well” factors, the income and educational status of the parents, are important factors but far more complicated to affect with shorter-term policy interventions. There are, however, opportunities to synthetically create circumstances for young students that mirror those available to children in wealthy, highly educated families and those potential approaches will be explored later as preliminary recommendations.

Refinements of the research on educational status of the parents focus on the mother. Grawe¹⁶ studied the demand for higher education and found that the educational attainment of the mother is a significant predictor of higher education enrollment. The Foundation for Child Development notes the importance of the educational attainment of both parents, but specifically the mother. In their report *Mother’s Education and Children’s Outcomes* they present “economic, health and other hard statistics that clearly demonstrate how children benefit from a higher level of mother’s education. While both parents’ education level impacts a family, the study compared only the mother’s education level and the effects on children for one reason: 96 percent of children live with mothers – either in a home with two parents or a single-parent household with a mother only.”¹⁷

Each of the studies of household economics and parental educational attainment is exploring a specific aspect of social factors of educational success, but with a limited number of social factors. More recently, the inquiries extend to a broader set of social factors, but generally in relationship to success and completion of programs of higher education, not primary. Chamberlain University¹⁸ explores six dimensions of social determinants and their relationship to student success and completion in nursing school, but they argue that the construct is applicable to other programs of higher education.

Closer to home, the Colorado Department of Higher Education’s social determinants of student success program¹⁹ looks at the relationship between health and other factors of well-being and student success.

And, while the social determinant approach slowly is appearing in education research, there is little scholarly research and none that explores a full complement of social factors in relationship to either primary or higher education. Instead, in the years since COVID, private data science firms such as RS21²⁰ have developed models of social determinants of success. These appear to be dedicated to specific school district clients, not part of a cross-sectional researched inquiry, and seem to have faded as the post-pandemic years pass.

While not exhaustive, this search of the literature demonstrates that most of the studies, academic and policy-related, share the following characteristics:

- The unit of analysis is the student. With that lens for analysis, the recommended interventions often are related to the individual. There is an opportunity for another approach to research that considers the broader community as the unit of analysis. This approach lends itself to the consideration of other characteristics that might be amenable to policy intervention and is the approach taken in this research.
- The studies often focus on specific cohorts of students, often stratified by racial/ethnic, socioeconomic, and other learning characteristics such as disabilities. While these studies are important, they do not necessarily apply to broader demographics of students.
- The studies often focus on success in post-secondary education, not primary. There is evidence that

¹⁶ Grawe, Nathan D. *Demographics and the Demand for Higher Education*. 2018. Johns Hopkins University Press.

¹⁷ <https://www.edcor.com/blog/a-mothers-education-level-impacts-her-children/#:~:text=Families%20with%20a%20college%20educated,more%20opportunities%20for%20academic%20success.>

¹⁸ <https://www.chamberlain.edu/about/social-determinants-of-learning>

¹⁹ <https://cdhe.colorado.gov/resources/social-determinants-of-student-success>

²⁰ Social Determinants of Education, COVID-19, and Responding to Student Needs | by RS21 | RS21 Blog | Medium

THE LITERATURE

Evidence from previous studies

interventions, to be effective, need to occur far earlier in a student's academic trajectory – preferably by the middle years of elementary school.

- At best, the existing studies explore a limited basket of social factors, often specific to the student and perhaps extended to the family. There is very little focus on a broader set of community-level factors, such as housing stability, food access, environment, and others that now are recognized as important factors in the more developed social determinants of health literature. Again, this research is designed to broaden the inquiry by including a full complement of social factors.

While the focus of this research is the relationship between a complement of social factors and reading proficiency at the elementary school level, the motivation for that outcome is to provide young students the basis for success – academic or professional – later in life. For this throughline, we rely on the following literature to support the importance of early learning for future endeavors.

The relationship between third grade reading proficiency and later in life academic and other success

The research establishing the relationship between specific social determinants and early reading proficiency does not establish a throughline to higher education and later in life success. For this we rely on the findings relating third grade reading proficiency and future success. A sampling of those findings are as follows:

- The Annie E Casey Foundation's Kids Count 2010 focused on the relationship between reading proficiency and later in life success. "Failure to read proficiently is linked to higher rates of school dropout, which suppresses individual earning potential as well as the nation's competitiveness and general productivity."²¹
- Research released in 2010 by the University of Chicago finds a relationship between early reading proficiency and graduation rates and higher education attendance. "Using third grade national percentile rankings on the Iowa Tests of Basic Skills (ITBS) to place a focus cohort of 26,000 Chicago Public Schools (CPS) students into below (0-24th national percentile), at (25th-74th national percentile) and above grade level (75th-100th national percentile) groupings, we find correlational evidence that students who were at and above grade level in third grade graduate and attend college at higher rates than their peers who were below grade level in third grade."²²
- A study released in 2011 at the American Educational Research Association convention found support for both the relationship between early reading and later success and the impact that poverty (household income) contributes. "A student who can't read on grade level by 3rd grade is four times less likely to graduate by age 19 than a child who does read proficiently by that time. Add poverty to the mix, and a student is 13 times less likely to graduate on time than his or her proficient, wealthier peer."²³
- A research blog from Ball State University in 2021 presents the strongest statement about the relationship with later in life employment success. "Experts tell us a child's ability to read at grade level by third grade is the single greatest predictor of future success, because this is when they transition from learning to read to reading to learn. Any Education Major or Faculty Member can tell you that when a child falls behind in reading, they risk falling further behind in every subject. Students who struggle with this basic skill have a much harder time making the grades to be able to graduate by the time they get to high school. This, in turn, makes finding gainful employment exceedingly more difficult."²⁴

²¹ https://ed.psu.edu/sites/default/files/inline-files/Anne%20E%20Casey%202010%20Early%20Warning%20Special_Report_Executive_Summary.pdf
(page 1)

²² https://www.chapinhall.org/wp-content/uploads/Reading_on_Grade_Level_111710.pdf.

²³ <https://www.edweek.org/teaching-learning/study-third-grade-reading-predicts-later-high-school-graduation/2011/04>

²⁴ <https://commcenter.bsu.edu/message/why-is-reading-on-grade-level-by-3rd-grade-so-important>

RESEARCH APPROACH

As laid out above, this research is built on the proposition that later in life success, both academic and professional, is related to early learning, particularly third grade reading competency. Without the timeseries data to follow a student from early childhood interaction with social factors through to third grade reading scores and then to later in life performance, we rely on the literature to establish the relationship between third grade reading and later in life success, academic or professional. The focus of this research, then, is upstream. We explore the opportunities to affect early reading proficiency and thus student readiness. Specifically, what is the relationship between social factors and third grade reading, at the community rather than the individual student level?

Methodologically this research builds on an approach CFC has used for social determinants research in the past, implemented to explore the relationship between dimensions of social determinants of health and health outcomes. While the application of social determinants to health is widely recognized as a prominent approach, the social determinants framework is far less applied to other social outcomes. This application to student success employs the same methodology we deployed for health outcomes to reading proficiency.

The dependent variable for this research is third grade reading proficiency as measured in all public schools in Colorado and reported at the school level by the Colorado Department of Education. We characterize success in reading at the third grade level by the share of third graders who score proficient or above. Since the geographic level of analysis is the census tract and not the school district, we associate public elementary schools to the census tracts by taking the average of the three closest schools to the centroid of the tract.

To assess the relationship between third grade reading and a basket of social determinants we explore the association with 43 independent variables, individually and combined into 12 dimensions of social factors. The twelve dimensions are the following:

- Classroom
- Early Childhood Education
- Economic
- Employment Opportunity
- Environment
- Food
- Health
- Health Care
- Household
- Housing
- School Finance
- Social

RESEARCH APPROACH

In the model, described in more detail below, the individual variables are combined into an overall index of social factors and additionally indexed into specific dimension scores for each of the 12 dimensions. This hierarchical approach, depicted in Figure 2, allows the analysis of the relationship between third grade reading and social factors at three levels: the overall social factors score, the 12 dimensions, and the 43 individual variables. The variables populating each dimension are displayed in Figure 3.

Figure 2. Model hierarchy

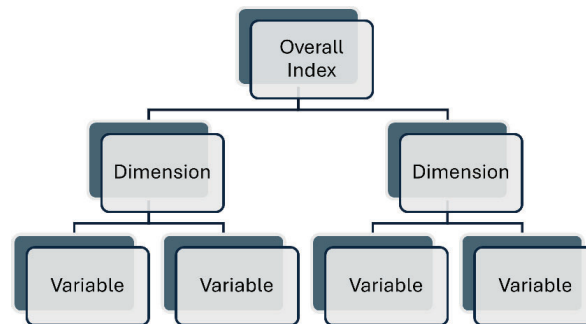


Figure 3. Variables populating each dimension

Classroom <ul style="list-style-type: none"> • Pupils per teacher • Maximum student mobility in classroom • Average student mobility in classroom • Average teacher salary • Average teacher turnover 	Early Childhood Education <ul style="list-style-type: none"> • Percent attending preschool • ECE slots per child • ECE facilities per child 	Economic <ul style="list-style-type: none"> • Percent Free and Reduced Lunch • Median family income • Change in percent of HHs above 2x poverty • Gini coefficient
Employment Opportunity <ul style="list-style-type: none"> • Percent of HHs with a working mother • Percent employed • Percent of pop over 25 with Bachelors or more 	Environment <ul style="list-style-type: none"> • Walkability index • Share impervious surface • Share covered with tree canopy • Environment exposure score 	Food <ul style="list-style-type: none"> • Price of a banana • Percent of children with access to healthy food • Not receiving SNAP
Health <ul style="list-style-type: none"> • Years of potential life lost • Health perception score based on YPLL • Self reported good health • Self reported good mental health 	Health Care <ul style="list-style-type: none"> • Percent of children insured • Health facilities per capita 	Household <ul style="list-style-type: none"> • Share of u18 population who moved in prior year • Percent of children with access to internet and computer • Percent of HHs with no access to a car • Percent of households headed by a single parent
Housing <ul style="list-style-type: none"> • Share of HHs cost burdened • Percent of children doubled up • Percent of housing affordable to median income HH 	School Finance <ul style="list-style-type: none"> • Override funding total • Override funding per pupil • Average per pupil funding • Total per pupil funding 	Social <ul style="list-style-type: none"> • Percent connected youth • Share of voting age pop registered • Adult English proficiency • Child English proficiency

RESEARCH APPROACH

Developing the data model: Detailed methodology

Development of the index. The overall index and the subindices of the dimensions are calculated by taking the arithmetic average of the standard scores of the individual variables. Each variable is equally weighted in the indices and the variables are distributed close to equally in number across the multiple dimensions. This is intentional in design so that in the overall index no one variable or category of variable dominates. In this way the overall index is a broad cross-dimensional representation of the multiple individual factors. All variables enter the index in the direction hypothesized to vary positively with reading proficiency. For example, the food assistance variable as measured by the share receiving SNAP benefits is entered into the model as share not receiving SNAP.

Dependent variable. As noted above, the dependent, or policy variable for this study is third grade reading proficiency. We measure third grade reading proficiency as the share of third graders who score proficient or above.

Geography and unit of analysis. The geography and unit of analysis for the analysis is the census tract. The majority of the variables populating the model are from the American Community Survey (ACS) which reports data by census tracts as a standard geography. For the variables for which the raw data are not reported by census tract, the variable is mapped to the tract using a recognized methodology, relating the native geography for the variable to the centroid of the tract. As noted above for the dependent variable, all school related variables are mapped to the census tract by averaging the three closest schools to the centroid of the tract. This approach was applied to other school related variables as well. The model contains data for 1230 census tracts in Colorado, drawn off the 2010 vintage tract map. Tracts with no housing units or with housing units that did not contain children were eliminated from the analysis.

From a macro perspective, the unit of analysis for this model is the census tract. Ultimately all correlations and regressions are run using the 1230 census tracts as cross-sectional data. However, on a micro level, the individual variables within the tract measure both household and person level data as well as some other variables that are spatially derived. Ultimately each of these variables is turned into a standard score measuring the individual census tract's score in relation to the statewide average.

Data vintage. All data are 2019 vintage or anchored to 2019. For the data elements that are from the ACS, the 5-year survey used is the one ending in 2019 (2015-2019 5-year estimates). There are more current data available for the independent variables, but the dependent variable of third grade reading is significantly distorted and, in many cases, suppressed during the COVID affected years of 2020 and 2021. Given that 2019 was the latest non-distorted data available for the dependent variable for which there are ACS data as well, this model has not yet been updated for the most recent reading data. With the release of the 2022 5-year ACS estimates, the model can be updated in a future iteration of the analysis.

Analytic approach

This research employs a hybrid analytic approach that pairs a quantitative analysis of the data model with selected interviews with key school district personnel and other education experts designed to corroborate or further illuminate the quantitative findings. The quantitative analysis consists of correlation assessments and regression findings exploring the relationship between the overall index, the multiple dimensions and the individual variables and reading proficiency. The interviews were conducted remotely and began with a brief presentation of the high-level findings and a series of questions, leaving ample opportunity for other open-ended input from the district. For this initial release of the research, the interviews are intended to contextualize the findings rather than serve as a full complement of qualitative data for analysis. A second phase of this research designed to solicit more comprehensive district-level feedback and to develop policy recommendations is scheduled for later in 2024 and into 2025.

RESEARCH APPROACH

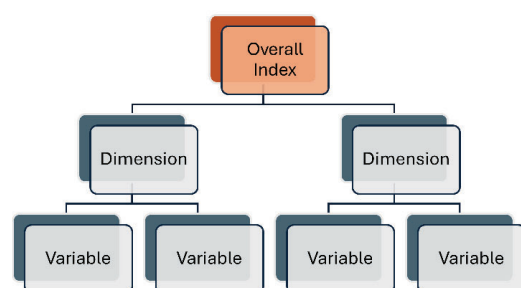
Quantitative analysis. Consistent with the nested structure of the data model, the quantitative analysis is progressive in nature with each subsequent analysis exploring the relationship between reading proficiency and increasingly discrete levels of the data. The first and broadest analyses are bivariate correlations between the overall index and reading proficiency followed by multivariate correlations between the dimensions and reading scores. We further explore the relative magnitude of the relationship between the twelve dimensions and reading using regression analysis. Since the dimension variable scores are stated in standard z-scores, regression coefficients may be easily interpreted for not only statistical significance but also for the relative contribution of each dimension to reading proficiency and the relative rankings of the dimensions.

While the dimensions provide broad context and some direction for policy intervention, ultimately it is the individual variables that best provide insight for potential policy interventions. To assess the relationship between the individual variables and reading proficiency we use both correlation and regression analysis. The correlation analysis allows for the inclusion and calculation of each variable with reading outcomes. However, since many of the variables in the data model are multicollinear, the regression will not solve when all variables are included in the model. To assess the best regression model, we employ a stepwise regression technique and allow the algorithm to select the variables that best fit a model predicting reading success. We recognize the technical criticisms of employing a stepwise technique, particularly with respect to significance of the variables, and for this reason we supplement the baseline quantitative analysis with first person accounts from school district officials and education experts. This informal feedback is designed to vet the reasonableness of the quantitative model findings. Combining first person expertise and verification with the quantitative findings lends to confidence in the research results.

The analysis, and associated findings presented here, are designed to proceed from broad to increasingly specific. Consistent with that approach, the first finding establishes the overall relationship between the index of all social factors and early academic success. While that finding provides the warrant to proceed to a deeper exploration of what social factors matter, it does not in and of itself provide a roadmap for policy intervention. For that, we follow on with increasingly granular findings related to specific dimensions of social determinants and finally to the specific social factor variables most associated with early reading proficiency

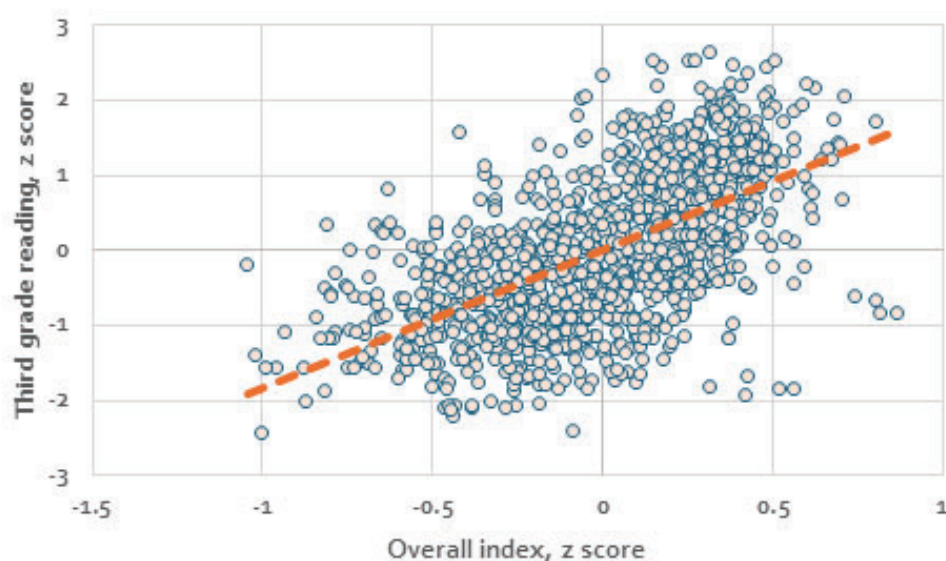
The following section details the findings. Following the presentation of the findings, we more deeply explore the factors most highly associated with reading and conclude with preliminary recommendations and next steps.

Finding 1. Third grade reading performance is positively related to an index of social determinants



At the top of the data hierarchy is the overall index of all social determinant variables. The variables are indexed by the simple average of their standard scores and all variables enter the model in the direction hypothesized to vary positively with reading scores. To be consistent with the proposition that social determinants are associated with student performance, the relationship between the index of social determinants and third grade reading should be positive. As figure 4 shows, the index of social determinants is positively related to third grade reading scores.

Figure 4. Scatterplot of third grade reading vs. overall index of social determinants

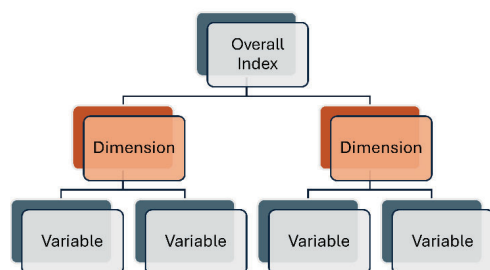


A simple regression of third grade reading against the index shows that just over one third of the variation in the standard scores of third grade reading is explained by the standard score of the overall index.

Figure 5. Regression results: Overall index vs. third grade reading

Dependent Variable: DV_3RD_GR_READING_ZS				
Method: Least Squares				
Date: 12/01/23 Time: 15:52				
Sample: 1 1230				
Included observations: 1230				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.23E-05	0.022718	0.000980	0.9992
OVERALL_INDEX	1.834285	0.068957	26.60034	0.0000
R-squared	0.365564	Mean dependent var		-5.69E-05
Adjusted R-squared	0.365048	S.D. dependent var		0.999883
S.E. of regression	0.796746	Akaike info criterion		2.385063
Sum squared resid	779.5392	Schwarz criterion		2.393379
Log likelihood	-1464.814	Hannan-Quinn criteria		2.388192
F-statistic	707.5780	Durbin-Watson stat		1.020458
Prob(F-statistic)	0.000000			

Establishing the relationship between the overall index of social factors and academic performance is an important first step in concluding that social factors matter. However, the relationship with the overall index does not lend itself well to recommendations for policy intervention because it does not specifically identify the individual dimensions and factors that most impact academic performance. The next findings detail the relationships between the dimensions and specific factors and the follow-on discussion explores the most highly correlated factors.

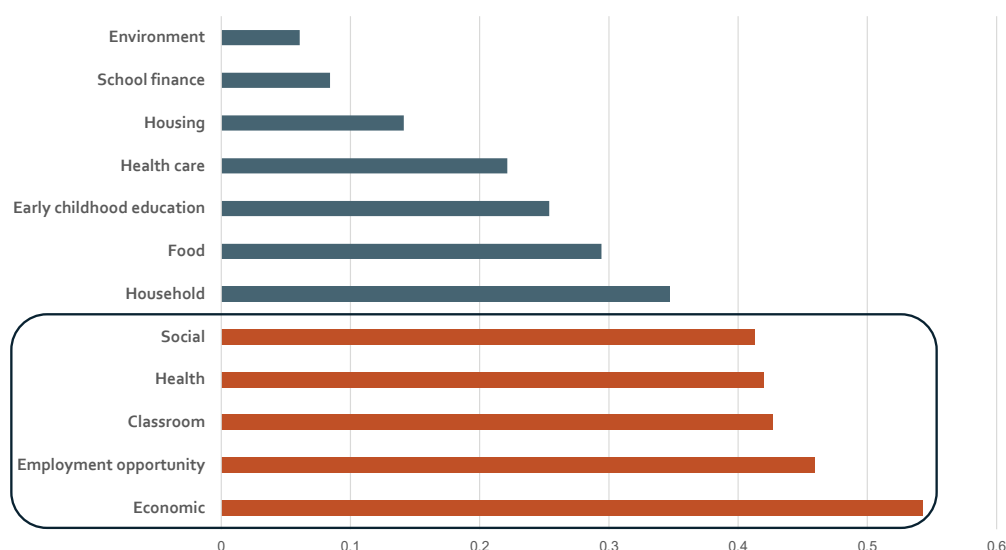


Finding 2. Correlation and regression analyses of the relationship between the dimensions and third grade reading identify social, classroom and economic as most consistently highly associated with reading performance.

The relationship between the individual dimensions and reading proficiency can be assessed with both bivariate and multivariate techniques. The bivariate correlations between each of the dimensions and reading scores do not account for the interrelationships between the twelve dimensions themselves and how those interrelationships potentially impact the relationship with reading. However, the correlations do provide a preliminary means of assessing the singular dimensions that are most highly associated

with reading performance. The bivariate correlations between the individual dimensions and reading identify social, health, classroom, employment opportunity and economic as the most highly correlated dimensions (correlation coefficient greater than .4).

Figure 6. Dimension correlations with third grade reading



The bivariate correlations identify the strongest one on one relationship with reading while holding all other dimensions constant. However, the relationship between dimensions of social factors and reading proficiency does not occur in a vacuum. Further, while the dimensions are measured separately and with different data indicators, there is a real-world interrelatedness between the dimensions and the variables used to quantify the dimension indices. A regression equation using the twelve individual dimension scores as the vector of independent variables better accounts for those interrelationships and further isolates the dimensions significantly related to reading performance.

The regression outcome below shows the variation in the twelve dimensions of social factors explaining just under 45 percent of the variation in third grade reading proficiency. Since the dimension indices and the dependent variable are stated as standard scores, all regressors are stated in the same units, allowing for direct comparison. The coefficients on the individual dimensions can be compared and ranked for order and magnitude of association. Further, the regression analysis allows for an assessment of the dimensions for their statistically significant relationship with reading proficiency. Finally, all regressor dimensions are entered into the model such that their relationship with third grade reading is positive. Therefore, we hypothesize that all dimensions will have positive coefficients.

Six individual dimension scores were statistically related to reading proficiency. They are Classroom, Early Childhood Education, Economic, Health, Housing and Social. Of those, the three dimensions of Social, Classroom and Economic are consistent with the dimensions highly associated with reading in the bivariate correlations and with the addition of Housing have the largest coefficients, meaning that changes in the scores for those dimensions are associated with the largest changes in reading standard scores. Notably, Economic Opportunity, the dimension containing the educational attainment of the adults in the tract (presumably the parents) was not significant. This likely is because there is too high a correlation between the education variable in the Economic Opportunity dimension and the median income variable in Economic dimension, forcing the multivariate regression analysis to assign the relationship to only one of those dimensions.

Figure 7. Regression results: Dimensions vs. third grade reading

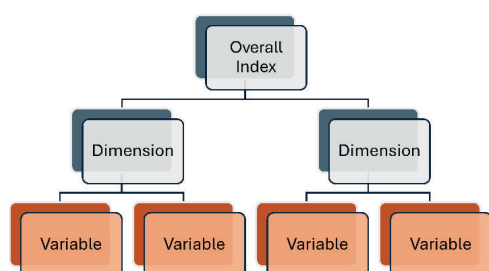
Dependent Variable: DV_3RD_GR_READING_ZS				
Method: Least Squares				
Date: 12/01/23 Time: 15:31				
Sample: 1 1230				
Included observations: 1230				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CLASSROOM	0.341267	0.042985	7.939228	0.0000 *, **, ***
ECE	0.164700	0.029774	5.531691	0.0000 *
ECONOMIC	0.595912	0.051202	11.63841	0.0000 *, **, ***
EMP_OPP	0.035262	0.043929	0.802712	0.4223
ENV	0.013830	0.033796	0.409211	0.6825
FOOD	-0.044923	0.045501	-0.987306	0.3237
HC	0.047518	0.032476	1.463176	0.1437
HEALTH	0.157896	0.042250	3.737200	0.0002 *
HOUSEHOLD	0.004494	0.045571	0.098611	0.9215
HOUSING	0.212676	0.053670	3.962684	0.0001 *, **
SCHOOL_FIN	0.003309	0.036990	0.089461	0.9287
SOCIAL	0.278947	0.040635	6.864747	0.0000 *, **, ***
C	4.50E-05	0.021327	0.002109	0.9983
R-squared	0.445898	Mean dependent var	-5.69E-05	
Adjusted R-squared	0.440434	S.D. dependent var	0.999883	
S.E. of regression	0.747954	Akaike info criterion	2.267561	
Sum squared resid	680.8320	Schwarz criterion	2.321620	
Log likelihood	-1381.550	Hannan-Quinn criteria	2.287900	
F-statistic	81.61223	Durbin-Watson stat	1.109492	
Prob(F-statistic)	0.000000			

* Significant at $p < .05$

** Highest associations with third grade reading

*** Consistent with the findings from the bivariate correlations

While the dimensions provide a preliminary guide to the major classes of factors associated with reading proficiency, they still remain obtuse with respect to policy recommendations. Ultimately, the associations between individual variables and reading success are most likely to identify interventions designed to improve performance. The next sections and the discussion that follows identifies the individual social factors most associated with reading proficiency.



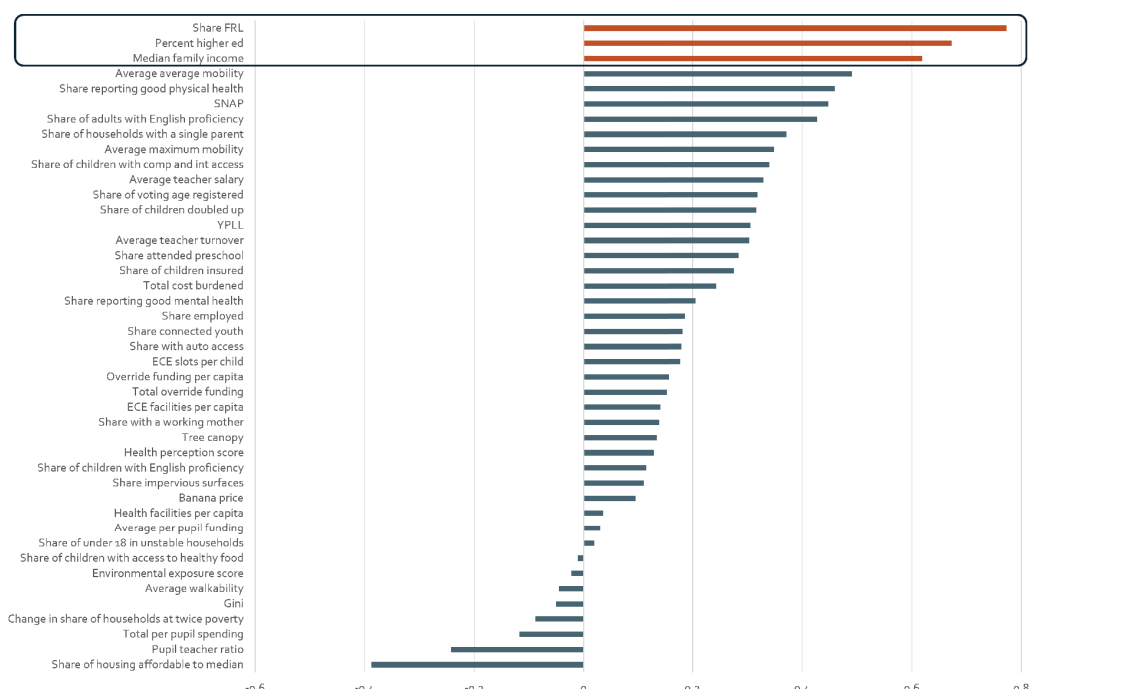
Finding 3. Unrestricted stepwise regression identified ten social factors as significantly associated with third grade reading. Eight of the factors are from dimensions highly correlated with academic performance. Eight of the ten factors remain significant in a more restricted stepwise specification.

As was the case with the analysis of the dimensions, the association between the individual social factors and academic performance can be assessed with both bivariate correlations and multivariate regression approaches.

We present the results from both approaches but rely more on the findings from the regression which accounts for the interrelatedness of the multiple social factors. Nevertheless, the bivariate correlations provide important context for the exploration of individual factors.

The bivariate correlation analysis identifies three variables as particularly highly correlated with academic performance. Consistent with much of the educational research, these variables are those that measure the income and education level of the student households. In this analysis, the most highly correlated variable was the share of students NOT eligible for free and reduced lunch (a clear proxy for income), closely followed by the share of adults with a higher education degree and median family income. These “pick your parents well” variables will emerge as highly significant in the regression analysis as well and serve as a continuing reminder that working to improve socioeconomic conditions in all households remains a powerful strategy for improving academic outcomes. However, as we note below, these variables require multigenerational approaches to poverty alleviation and largely are beyond more immediate policy responses focused on the school, individual family or student. For that reason, it is important to explore other more immediately addressable factors. The regression findings that follow identify factors more amenable to immediate policy response.

Figure 8. Individual variable correlations with third grade reading



Regression findings: A note on model specification

At its base, this model explores 43 variables across 12 dimensions for association with early learning. Many of these variables trend together. For example, generally there exists a high correlation between income and education and certainly there exists a high correlation between income and any of the other income adjacent variables such as free and reduced lunch eligibility and qualifying for SNAP, the federal Supplemental Nutrition Assistance Program. Because of the high correlations between many of the variables in the model, a regression equation cannot solve using the full complement of social determinant variables. Given that we had no or little a priori theory hypothesizing the relative strength of the association between most of the social determinant variable and reading proficiency, we opted to use a stepwise regression to select the model rather than hand select which variables to include in the regression.

Stepwise regression is a technique that deploys an automatic procedure to selecting, from a universe of variables, those which best fit a model. The advantage of this approach is that the algorithm selects the best fit model in cases with large regressor options. However, stepwise regression is not without its critiques, particularly with respect to the statistical significance of, in this case, the social factors.

Stepwise regression at times overfits a model, selecting for inclusion variables that are not statistically significant. One recommended fix is to limit the selection of variables to those whose significance exceeds that of a spurious variable included by chance alone. To address the critique of stepwise techniques, we report findings from the unrestricted model and then follow with those from a model programmed with the mitigation criteria. In general, the results vary only modestly between the two specifications, resulting in findings that are largely consistent across both models.

Regression findings: Significant associations between social factors and third grade reading

The unrestricted stepwise regression identifies ten variables as significantly associated with third grade reading. Nine of the variables have the expected positive sign (all variables were entered into the models with a hypothesized positive relationship with reading proficiency) and the tenth variable, working mother, carries a negative association. We included working mother in the discussion of significantly associated variables with the correct sign because the relationship between working mothers and student outcomes is in debate in the literature, and likely dependent on the socioeconomic status of the mother, the motivation for working, and they type of employment.

Figure 8 displays the unrestricted regression output and identifies the following as variables significantly associated with reading performance. Variables are listed in order of the magnitude of their association. Since all variables enter the model as standard scores (z scores), those with the highest coefficients have the largest standard score association with third grade reading proficiency. (in-depth discussion of the highly associated variables follows the presentation of all regression results).

- Share of students eligible for free and reduced lunch (PER_FRL)
- Share of adults with a bachelor's degree or higher (PER_HIGH_EDU)
- Average student churn in the classroom (AVG_AVG_MOB)
- Share of housing affordable to the median income (PER_AFF_HU)
- Override funding (OVER_FUNDING)
- Total per pupil funding (TOTAL_PP)
- Early childhood education facilities per child (ECE_FAC_PERCAP)
- Score relating health perceptions to life expectancy (HEALTH PERCEPTION SCORE)
- Share of adults registered to vote (SHARE_VOTAGE_ADJ)
- Share of households with a working mother (PER_WORKING_MOM)

Figure 9. Unrestricted stepwise regression output, regressors sorted by association with third grade reading

Dependent Variable: DV_3RD_GR_READING				
Method: Stepwise Regression				
Date: 12/01/23 Time: 16:06				
Sample: 1 1230				
Included observations: 1230				
Number of always included regressors: 1				
Number of search regressors: 44				
Selection method: Stepwise forwards				
Stopping criterion: p-value forwards/backwards = 0.5/0.5				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.04E-05	0.015699	-0.000665	0.9995
PER_FRL	0.6534	0.03047	21.44425	0*
PER_HIGH_EDU	0.255438	0.035261	7.244294	0*
AVG_AVG_MOB	0.252809	0.056183	4.499715	0*
PER_AFF_HU	0.069441	0.031964	2.172484	0.03*
OVER_FUNDING	0.065675	0.027975	2.347607	0.0191*
TOTAL_PP	0.052627	0.019956	2.637176	0.0085*
ECE_FAC_PERCAP	0.049755	0.018027	2.759976	0.0059*
HEALTH PERCEPTION SCORE	0.042321	0.01981	2.136412	0.0328*
PER_ADULT_ENG	0.041527	0.023869	1.739818	0.0821
AVG_SALARY	0.03953	0.026258	1.505423	0.1325
SHARE_VOTAGE_ADJ	0.039369	0.019046	2.067005	0.0389*
MED_FAM_INC	0.035543	0.037128	0.957329	0.3386
PER_SINGLE_PAR	0.030497	0.023874	1.277406	0.2017
PER_CHILD_COMP_INT	0.025347	0.019031	1.331903	0.1831
PER_CHILD_INS	0.017153	0.017366	0.987735	0.3235
PER_UNSTABLE_U18	0.013823	0.018121	0.762814	0.4457
PER_CHILD_ENG	-0.013046	0.017728	-0.735871	0.462
AVG_TURNOVER	-0.018813	0.023368	-0.805085	0.4209
IMP_SUR_COV	-0.025952	0.027596	-0.94045	0.3472
PER2X_POV_CHG	-0.026895	0.01683	-1.598042	0.1103
AV_PP	-0.031093	0.020801	-1.494778	0.1352
FAC_PERCAP	-0.032053	0.017317	-1.850963	0.0644
TOTAL_CB	-0.036429	0.02279	-1.598458	0.1102
OVER_FUND_PP	-0.03851	0.030694	-1.254617	0.2099
PER_WORKING_MOM	-0.047741	0.01808	-2.640535	0.0084**
ENV_EXP	-0.0499	0.027143	-1.838419	0.0662
GOOD_HEALTH	-0.074077	0.031019	-2.388087	0.0171
NOT_SNAP	-0.093508	0.027623	-3.385141	0.0007
PER_EMP	-0.096136	0.021313	-4.510706	0
AVG_MAX_MOB	-0.153513	0.051773	-2.965114	0.0031
R-squared	0.704205	Mean dependent var		-5.69E-05
Adjusted R-squared	0.696804	S.D. dependent var		0.999883
S.E. of regression	0.550568	Akaike info criterion		1.669149
Sum squared resid	363.4475	Schwarz criterion		1.798058
Log likelihood	-995.5267	Hannan-Quinn criter.		1.717649
F-statistic	95.14923	Durbin-Watson stat		1.23882
Prob(F-statistic)	0			

* Significant at p<.05 and correct sign

** Significant at p < .05 and sign open to interpretation

FINDINGS

As noted above, stepwise regressions have been criticized for overfitting models; that is a bias for leniency in finding statistical significance of regressors. One technique to mitigate this overfitting is to impose a more restrictive criteria for significance on the model specification. When we applied this mitigation factor to the regression, eight of the ten significant factors remained significant, and one factor not found to be significant in the unrestricted model was significant under the alternative specification. As the following list and regression output demonstrate, the findings are only modestly different when correcting for potential overfitting of the model.

The following are the factors that remain significant under the model with the mitigation criteria.

- Share of students eligible for free and reduced lunch (PER_FRL)
- Share of adults with a bachelor's degree or higher (PER_HIGH_EDU)
- Average student churn in the classroom (AVG_AVG_MOB)
- Share of housing affordable to the median income (PER_AFF_HU)
- Total per pupil funding (TOTAL_PP)
- Score relating health perceptions to life expectancy (HEALTH PERCEPTION SCORE)
- Share of adults registered to vote (SHARE_VOTAGE_ADJ)
- Share of households with a working mother (PER_WORKING_MOM)

In a slight change from the unrestricted model, override funding for schools is no longer significant; however, total per pupil funding retains significance. As discussed in more detail in the discussion that follows, much of the variation in per pupil funding is a result of override funding approved in the district. The more restrictive specification retains the finding that funding levels are positively associated with reading performance even while the override component does not retain significance.

The final difference between the restricted and unrestricted specifications is in the early childhood education (ECE) variable that achieved significance. We included in the model two ECE related variables, the slots per appropriate aged children and the facilities per appropriate aged children. The reason for the inclusion of both variables was to recognize that slots alone do not make the service accessible; the spatial distribution of those slots matters as well. In practical terms, a number of slots all available in one centrally located facility can be a different community asset than that same number of slots spread across multiple facilities distributed spatially across a neighborhood.

In the two specifications of the regression, different ECE variables emerged as significant. The unrestricted model found the number of facilities per capita to be significant. In the restricted model, it was slots that were significantly associated with reading performance. At the highest level, though, the model specifications demonstrate that access to early childhood education is positively associated with third grade reading performance.

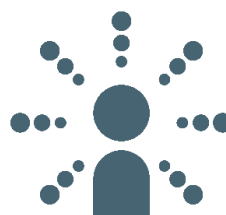
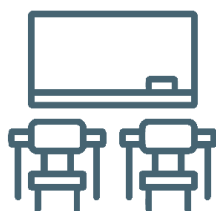


Figure 10. Restricted stepwise regression output, regressors sorted by association with third grade reading

Dependent Variable: DV_3RD_GR_READING				
Method: Stepwise Regression				
Date: 05/24/24 Time: 13:24				
Sample: 1 1230				
Included observations: 1230				
Number of always included regressors: 1				
Number of search regressors: 44				
Selection method: Stepwise forwards				
Stopping criterion: t-stat forwards/backwards = 1.8/1.8				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.67E-05	0.015766	-0.001058	0.9992
PER_FRL	0.664235	0.028394	23.39317	0 * , ***
PER_HIGH_EDU	0.309753	0.027556	11.24067	0 * , ***
AVG_AVG_MOB	0.249538	0.055184	4.521905	0 * , ***
PER_AFF_HU	0.056664	0.025761	2.199596	0.028 * , ***
TOTAL_PP	0.055326	0.019275	2.870309	0.0042 * , ***
SHARE_VOTAGE_ADJ	0.044202	0.018136	2.437279	0.0149 * , ***
ECE_SLOTS_PERCAP	0.04364	0.017651	2.472357	0.0136 *
HEALTH_PERCEPTION SCORE	0.040963	0.019177	2.135989	0.0329 * , ***
PER_WORKING_MOM	-0.042734	0.017139	-2.493295	0.0128 ** , ***
AV_PP	-0.04804	0.01901	-2.52705	0.0116
IMP_SUR_COV	-0.049824	0.025817	-1.929848	0.0539
ENV_EXP	-0.063899	0.023963	-2.66656	0.0078
NOT_SNAP	-0.06708	0.025858	-2.594193	0.0096
GOOD_HEALTH	-0.075252	0.030097	-2.500358	0.0125
PER_EMP	-0.098613	0.020333	-4.849926	0
AVG_MAX_MOB	-0.147559	0.051306	-2.876035	0.0041
R-squared	0.698169	Mean dependent var		-5.69E-05
Adjusted R-squared	0.694188	S.D. dependent var		0.999883
S.E. of regression	0.552938	Akaike info criterion		1.666583
Sum squared resid	370.863	Schwarz criterion		1.737275
Log likelihood	-1007.948	Hannan-Quinn criter.		1.693179
F-statistic	175.3632	Durbin-Watson stat		1.214871
Prob(F-statistic)	0			

* Significant at $p < .05$ and correct sign

** Significant at $p < .05$ and sign open to interpretation

*** Consistent with unrestricted stepwise regression findings

DISCUSSION

Factors significantly associated with third grade reading

The restricted regression specification identified eight factors as significantly and positively associated with third grade reading proficiency. Furthermore, a ninth factor, working mother, was significant but did not carry the hypothesized positive relationship. While other factors also were significant but with the wrong sign, we include working mother due to the potential ambiguity in the hypothesized relationship. That is, should the presence of a working mother be positively or negatively associated with academic performance? The case can and is made for either and likely depends on the specifics of the work in which the working mother is engaged. The working mother variable likely is conflated by the highly significant variables measuring income and education levels of the parents. That is, working mothers in high income, high education households likely are associated with academic performance of young learners. Working mothers in more economically challenged households, particularly those who are working multiple jobs with extended hours likely are associated with reduced academic performance. Given the negative relationship in the model, this research suggests that the latter effect predominates. However, more research specifically designed to explore the relationship between working mothers and academic performance is needed to better understand the relationships.

With that further explanation of the working mother variable, the significant factors for this analysis nest into the significant or highly correlated dimensions as depicted in the table in Figure 11. The organization of the table in Figure 10 serves as the basis for the discussion that follows.

Figure 11. Significant factors nested into significant dimensions

Significant or highly correlated with reading dimension(s)	Significant factors
Economic Economic Opportunity*	Share of students eligible for free and reduced lunch Share of adults with a bachelor's degree or higher Share of households with a working mother ****
Classroom	Average student churn in the classroom
Health	Score relating health perceptions to life expectancy
Housing **	Share of housing affordable to the median income
Social	Share of adults registered to vote
***	Total per pupil funding (School finance) *** Early childhood slots per child under 5 (ECE) ***

* Highly correlated with reading proficiency but not significant in regression due to high levels of collinearity with economic

** Housing not among the most highly correlated dimensions with reading proficiency but is significant in the regression analysis

*** These factors were significant in the restricted regression but not from dimensions that were found to be either significant or highly correlated with reading proficiency

**** Significant but with the opposite sign from research hypothesis

Education and income related factors. The first and most highly scoring set of social factors to emerge as significantly associated with reading proficiency are those related to the income and educational attainment of the households in the census tract. Specifically, the *share of students eligible for free and reduced lunch (FRL)* and the *share of adults with a bachelor's degree* emerged as the most highly associated with reading proficiency at the third grade level. Household income did not emerge as significant because it is highly correlated with the FRL variable which is serving as a proxy for household income.

DISCUSSION

Factors significantly associated with third grade reading

The literature, both academic and grey, is replete with papers and studies establishing the findings that students from higher income and more educated households perform better academically. The findings from this research, with data from the census tract level of analysis rather than the student, are consistent with those findings. While there is no consensus on why income and parental education are so highly associated with student performance, studies identify the following explanations:

- Parental expectations
- Parental involvement in both the schools and the child's learning activities
- The ability for the family to provide outside educational support
- The quality of the schools in wealthier, more educated areas
- Higher student participation in extracurricular activities and other after school enrichment activities

It is important to note that policies directly related to increasing household income and education attainment often require a multi-generational approach and take time to result in increases in student performance. However, a greater focus on the "why" related to household income and education provides candidates for policy interventions that have the potential to result in improvements in student performance without requiring multi-generational timeframes. We return to potential policy interventions later in the recommendations section of this study.

Classroom related factor. Classroom dynamics often are cited as highly related to student performance. Within the classroom, there are multiple dynamics at play including class size, teacher turnover, teacher salary and student churn – all of which were included as social factors in this research. Only **student churn** emerged as significant in its relationship with third grade reading.

The Colorado Department of Education collects data and reports on two measures of churn: the mobility rate and the mobility incidence rate.¹ The mobility rate is defined as the unduplicated count of grade K-12 students who moved into or out of the district in the school year divided by the total number of K-12 students that were part of the same membership base at any time during the school year. The important distinction here is the unduplicated nature of this measure. If the same student matriculates in and out of the classroom multiple times in an academic year, that churn is counted only once. The base model run in this study uses the unduplicated mobility rate under the assumption that it is the most conservative measure.

The alternative measure reported by the Colorado Department of Education is the mobility incidence rate. This measure is defined as the duplicated count of grade K-12 students who moved into or out of the district in the school year divided by the total number of K-12 students that were part of the same membership base at any time during the school year. In this measure, if the same student churns multiple times during an academic year, each incidence is counted. By definition, the mobility incidence rate must be equal to or greater than the mobility rate. As a result, alternative models run with the more aggressive mobility incidence rate also demonstrated that measure of churn to be associated with reading proficiency. To smooth out outlier years and/or schools, we applied the churn variable to census tracts by first taking the four year (2016-2019) average rate for each school and then assigning the tract with the value equal to the average of the four-year average of the three closest schools to the centroid of the tract.

DISCUSSION

Factors significantly associated with third grade reading

Figure 12. Depiction of mobility calculation in the model



Step 1: For each school, CFC used the average/maximum for the school over the period 2016-2019 and assigned that value to the school

Used the 4-year period to help offset the impact of a potential outlier year



Step 2: Used the average of the value assigned to each school for the three closest schools to the centroid of the census tract

Both the research and the experts with whom we spoke offered potential causes of the churn in classrooms, with consensus that the underlying dynamics are multi-faceted. There is near agreement that housing instability is a significant contributor but not the sole factor. Other causes include family or household instability due to unstable relationships or behaviors among the members of the household; bullying; anxiety and other mental health pressures on young students; students in the foster care system; natural causes of migration such as in agricultural or military households as well as those that result from employment mobility of the parents; and other forms of truancy. It is important to note that the data vintage for this study predates COVID and the pandemic era shutdowns. The evidence nationally is that chronic absenteeism did increase in the wake of the pandemic though the expected duration and the underlying causes remain a matter of investigation and analysis.² Regardless of the cause, there is ample evidence that classroom churn negatively affects not only the churning student but all students in the classroom.³

Health related factor. In the health dimension, the factor that emerged as significant is a variable that measures the congruence or lack thereof of self-reported health status and a proxy for a more quantitative measure of health such as life expectancy. This factor is a derived variable that the Colorado Futures Center has begun incorporating into our social factors work. In this study we refer to this variable as **health perception score**.

The health perception score is measured as the difference between the standard score of self-reported health status and the standard score of years of potential life lost (YPLL), based on a life expectancy of 65. The larger the positive difference between those scores, the potentially more optimistic outlook in the community. Alternatively, we interpret a large negative difference between the scores as a potential indication of community malaise – a portrait of a community that assesses its health status more negatively than the life expectancy data demonstrate. The association between this variable measuring the perception of the adults in the community and student performance at the primary school level is an indicator that intergenerational trauma might be affecting learning in the community of young students.

There is consideration in the literature of the impact of intergenerational trauma. In the North American context,

² Wallace-Well, David. Why Children are Missing More School Now. New York Times, June 5, 2024. Accessed at <https://www.nytimes.com/2024/06/05/opinion/covid-school-attendance-pandemic-closings.html> on June 10, 2024.

³ Gruman DH, Harachi TW, Abbott RD, Catalano RF, Fleming CB. Longitudinal effects of student mobility on three dimensions of elementary school engagement. Child Dev. 2008 Nov-Dec;79(6):1833-52 and Student Mobility: How It Affects Learning (edweek.org)

DISCUSSION

Factors significantly associated with third grade reading

intergenerational trauma has been explored as a barrier to educational success in Native American communities.⁴ Similar research explored intergenerational trauma and post-secondary educational outcomes in Aboriginal communities, with a focus on the trauma experienced by the students themselves, rather than previous generations.⁵ In recognition of the two generation impacts, a 2020 thesis at the University of South Carolina explored and found a weak relationship between the adverse childhood experience (ACE) scores of parents and the literacy development of children in elementary school.⁶

Housing related factor. The significant housing related factor is the *share of housing affordable to the median income* in the census tract. Presumably, the larger the share of housing affordable to the median, the greater the opportunity for housing stability. Given the findings on classroom churn and the perception from school district officials that a large cause of churn is housing instability, it is reasonable to conclude that housing that is affordable is associated with student performance.

Social related factor. A single social factor was significantly associated with reading proficiency for third graders, the *share of adults registered to vote*. The share of adults registered to vote was included in the model as a proxy for social capital in the community. In the context of this research the most reasonable hypothesis is that this proxy of social capital extends to involvement in other community institutions including the local schools. The role of social capital in academic performance remains an open debate, with the literature providing mixed findings.

In a 2011 article, Plagens⁷ traces the history of the theory of social capital and presents the concept as a potential explanation for variations in student performance in otherwise similar school settings. Plagens' work follows earlier research that finds that community social capital is associated with academic performance⁸ but precedes other work finding little or no association.⁹ Related, but not at the elementary school level, networks of social capital among university students were found to be directly related to academic performance at the post-secondary level.¹⁰ This research, with the community rather than the student as the unit of analysis, suggests that social capital is positively associated with academic performance among elementary aged students in Colorado.

Factors not related to overall significant dimensions. Two variables emerged as significant that were not connected to dimensions that were highly correlated with third grade reading. From the school finance dimension, *total per pupil funding* was significantly associated with third grade reading proficiency. From the early childhood education dimension, the *number of ECE slots per the number of children under the age of five* also was significant.

Total per pupil spending. School finance is largely equalized in Colorado with only marginal variation in the base per pupil allocation across districts. Most of the variation in school spending comes from override levies, which voters in

4 Reed, Thomas. "Intergenerational Trauma and Other Unique Challenges as Barriers to Native American Educational Success." Research Anthology on Racial Equity, Identity, and Privilege, edited by Information Resources Management Association, IGI Global, 2022, pp. 1005-1024. <https://doi.org/10.4018/978-1-6684-4507-5.ch054>

5 Gaywsh, Rainey and Elaine Mordoch. Situating Intergenerational Trauma in the Education Journey. IN Education. Vol. 24 No. 2 (2018): Autumn 2018

6 Banaszak, Paige Lee. Academic Impacts of Intergenerational Trauma: Assessing the Relationship Between ACE Scores of Parents and the Language and Literacy Development of Their Elementary-Aged Children. Master's Thesis, University of South Carolina. 2023.

7 Plagens, Gregory K. "Social Capital and Education: Implications for Student and School Performance." *Education and Culture*, vol. 27, no. 1, 2011, pp. 40-64. *JSTOR*, <https://www.jstor.org/stable/10.5703/educationculture.27.1.40>. Accessed 7 June 2024.

8 Yongmin Sun, The Contextual Effects of Community Social Capital on Academic Performance, *Social Science Research*, Volume 28, Issue 4, 1999, Pages 403-426.

9 Gamoran, A., Miller, H. K., Fiel, J. E., & Valentine, J. L. (2021). Social Capital and Student Achievement: An Intervention-Based Test of Theory. *Sociology of Education*, 94(4), 294-315. <https://doi.org/10.1177/00380407211040261>

10 Pincince, Matthew (2020) "Effects of Social Capital on Student Academic Performance," *Perspectives*: Vol. 12, Article 3. Available at: <https://scholars.unh.edu/perspectives/vol12/iss1/3>

DISCUSSION

Factors significantly associated with third grade reading

the district have the authority to authorize. With an override levy added to the base funding, variation will result in total per pupil funding.

In the unrestricted regression model, both override and total per pupil spending were significant. In the restricted specification, only total per pupil spending exceeded the threshold for significance. Regardless, this study provides evidence that levels of funding are associated with academic performance.

It is reasonable to question whether it is the funding levels per se or whether the funding level is enough associated with household wealth and income capacity in the district to argue that the correlation is spurious- that the true association is with community income levels.

On visual observation, it is reasonable to hypothesize that household income might be an intervening variable in the relationship between school funding and academic performance. As a group, the largest override districts in 2019 (the vintage of this study) are located in the higher income Denver metro area and I25 corridor. However, the variation among those override districts, and the fact that the highest override levies are not in the overall highest income districts, results in a weak correlation between override funding and median household income. The bivariate correlation between median household income in the district and override funding is just over .25.

Notably, the correlation between total per pupil funding and median household income is slightly negative, reflecting the base formula which augments funding challenged districts. While some of the relationship between school finance and academic performance may be due to the income profile of the district, there remains evidence that beyond that intervening variable, funding levels matter.

Early childhood education slots per under five population. The research is replete with studies documenting the relationship between the availability and accessibility of early childhood education and later academic performance.¹¹ This research adds to the evidence that access to early childhood education matters. In the census tract model, the tracts with more slots available to preschool aged children have higher levels of third grade reading proficiency. To better argue the association with the same cohort of students, the slot data should have been lagged at least three years. However, data limitations did not allow for that specification. Nevertheless, assuming the relative level of slots did not change dramatically across the communities in Colorado in the years leading up to 2019, this study lends support to the importance of access to early childhood education for later reading proficiency.

¹¹ See for example the blogs at <https://www.apu.apus.edu/area-of-study/education/resources/why-is-early-childhood-education-important-for-children/> and <https://learningpolicyinstitute.org/topic/early-childhood-education>.

POLICY IMPLICATIONS

And preliminary recommendations

The intention of this project is to explore student readiness, largely for post-secondary education. We rely on the proposition that interventions are most effective if they occur far earlier than at the post-secondary stage of a student's educational pursuits. The existing research clearly finds that reading proficiency at the elementary school level is highly correlated with academic and professional success later in life. We rely on this literature and explore the association between social factors early in a student's educational pursuits and reading proficiency at the third grade level. The research is designed specifically to help identify potentially effective interventions while students are younger.

We recognize that those most well-positioned to offer research guided interventions are those closest to a student's academic pursuits. For this reason, we first and most strongly recommend a second phase of this project to reach out to educators, school officials, education and other policymakers and other education leaders and researchers to share the findings and engage in a robust conversation and process to identify interventions. It currently is our intention to convene this second phase in the fall of 2024.

Additionally, each of the dimensions and significant factors identified in this research warrants additional dedicated study. This research was designed to survey the full complement of factors and identify those potentially highly related to performance. Now that those factors are identified, each of them should be the focus of more dedicated exploration, both for the nuances in their relationship with academic performance and for a deeper consideration of potentially effective interventions.

Notwithstanding the global recommendations outlined above, the current study consistently identified specific dimensions and factors as highly associated with academic performance. Combining these findings with a preliminary review of the literature and selected interviews with education experts leads to the following preliminary recommendations for further consideration and refinement. Organized by dimension, they are:

Income and education related

- Many studies support the finding that children in wealthy and highly educated families perform better in school. In an ideal world, all children would live in higher income and education families. The state should continue to invest in and implement programs of poverty alleviation and making educational opportunities available to all adults.
- Recognizing that poverty alleviation programs can take generations to work, schools and community organizations should work to replicate the opportunities that wealthier and more educated families provide to children, particularly around learning supports and participation in extracurricular activities.
 - Schools and other community organizations should explore opportunities to provide the sort of learning support that wealthier families are providing privately. This can include opportunities for tutoring outside school, reading support programs, after school academic related clubs and other learning supports that publicly replicate the supports that children from wealthier families are receiving from their parents.
 - Make extracurricular activities available, accessible and attractive to all students and when necessary, expand access to financial support in the cases where the fees or other expenses are a barrier to participation.

POLICY IMPLICATIONS

And preliminary recommendations

Classroom churn related

- School districts should identify and acknowledge high churn classrooms and allocate supportive resources to those high churn classrooms. One school official with whom we spoke noted that the schools recognize churn but essentially treat it as just one of the challenges facing the teacher in the classroom. This same official noted that districts should be more proactive to dedicate additional resources to those classrooms.
- Ensure that parents know that in most cases Colorado school districts allow a student to remain in the school/class even if the family moves out of the boundary of the school. Explore potential for providing support for the family to retain the child's school placement through the academic year. This may include assistance with transportation, if needed, or other supports.
- Address the importance of attendance with parents. This research from before COVID as well as the emerging post-pandemic evidence are lending increasing support to the importance of consistent attendance even as there are data supporting that absenteeism has increased after COVID and has not yet returned to pre-pandemic levels. There remains debate over the causes of the increased absenteeism, but regardless of the causes school districts should be emphasizing the importance of consistent attendance on the academic performance of all students in the classroom.
- In cases when churn is unavoidable, better records management and data transfer systems will allow teachers to better understand the capacities and learning levels of churning students. One district mentioned that the teacher often knows nothing about students churning into the classroom. Taking the time to get to know the capabilities of new students takes time and attention away from other students in the classroom. Better access to previous academic records would provide some baseline information to the teacher receiving new students during the academic year.
- In Finland, teachers remain with a cohort of students for up to six years. Colorado schools, particularly those with high levels of churn, can explore this model, keeping the same teacher with a cohort through multiple grade levels. This allows the teacher to be better acquainted with the students in the cohort and provides an element of stability in the face of churn.
- School officials consistently pointed to housing stability as a root cause of churn. Additional housing affordability related recommendations will be discussed below, but it is important to note that external housing related circumstances might be affecting churn. For example, one district outside Colorado identified apartment promotions as a contributor – families would move mid-year in order to take advantage of promotions. Colorado officials should be aware of similar exogenous circumstances and seek ways to ameliorate them. In the case of the out of state district, the schools worked with the apartment association to coordinate promotions over the summer months and reduce the incentive to move mid academic year.
- Bullying, panic attacks and other anxiety related conditions were identified as causes of chronic absenteeism. Schools should continue to invest in programs to identify and eliminate bullying and continue to provide and increase mental health supports for students.

POLICY IMPLICATIONS

And preliminary recommendations

Health perception related

- Recognize the role of intergenerational trauma and specifically its impacts on younger generations. Explicitly address intergenerational trauma in mental health programs at schools.
- Raise up and emphasize community assets and positive improvements in the standard of living in communities that may be living with intergenerational trauma. Some of the negative perceptions may be amenable to change through community campaigns, and it is possible that increasing optimism will translate into better outcomes, particularly for younger generations.
- Some of the differences in self-reported health assessment and life expectancy may be associated with chronic disease and disability. Recognize that students may be living in households struggling with the pressures of disease and disability and provide additional supports to those families.

Housing related

There is near unanimity that housing instability is a major contributor to student churn, and further that housing affordability is a major cause of housing instability. A 2023 [Colorado Futures Center research](#) release highlighted the significant affordable housing challenge for Colorado families with incomes of \$75,000 or less. As other CFC research shows, many of these households are turning to strategies such as [doubling up](#), essentially a form of hidden homelessness, to address housing instability. Undoubtedly, the housing instability among these lower income households is contributing negatively to student performance. Apart from strategies to raise Colorado families out of poverty, concentrated efforts to provide stable housing to the most housing challenged are highly likely to have positive impacts on student performance.

- Colorado policymakers should continue to explore and implement any and all options to expand access to affordable housing, particularly with a focus on the most vulnerable households - those at the \$75,000 income level or below.
- Many of the Coloradans living at the economic margin are in renter households. Policymakers should continue efforts to support renter residents, particularly those at risk of eviction.
- In many cases school districts are the owners of currently vacant land. Some districts have begun to explore developing that land with housing, often targeted at teachers and other district employees. Those efforts should continue and expand. Additionally, districts can consider making stable housing available to others in the community, particularly those in the lowest income households.

Social related

- The existing research and this study both suggest that social connections and social capital are positively associated with student performance. Schools and other community organizations should recognize this relationship and explore opportunities to be catalysts for social connections in the community.

POLICY IMPLICATIONS

And preliminary recommendations

School funding related

- There is evidence from this research that funding matters in student performance. The state should continue efforts to fully fund schools and individual districts should consider this finding with respect to their ability to authorize override funding.
- Funding and churn related. There is an opportunity to tie funding increments to highly churning districts and classrooms.
 - The General Assembly recently revised the school funding formula to recognize districts with specific challenges. Future revisions to the funding formula should recognize the impacts of churn on student performance and dedicate additional funding to districts experiencing high levels of churn.
 - Districts should allocate existing and any incremental funding to supporting classrooms experiencing high levels of churn.

Early Childhood Education related

- In the years since the 2019 vintage of this study, the state and some municipalities have made significant efforts to provide universal access to early childhood education. These programs should be maintained and expanded when possible.

CONCLUSION

This first of its kind study explores the relationship between a full complement of social factors and student success as measured by third grade reading proficiency. Third grade reading proficiency has been demonstrated as highly associated with future academic and professional success. Interventions early in a student's academic progression can change the trajectory.

Unlike many other studies of student success, this research uses the local geography as the unit of analysis. Because of this, the significant factors and potential interventions can be implemented at the local community level – making the recommendations perhaps more easily amenable to state and local policy.

We have identified ten factors across multiple dimensions as significantly associated with reading proficiency. Further, we suggest interventions, along those significant dimensions, that hold promise for positively affecting student reading performance. But most importantly, we look forward to the on-going conversations, investigations and policy interventions that this baseline research can catalyze.