External Adverse Neighborhood Factors Influence on Students' Grades 3-6 Schooling Success

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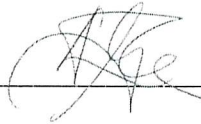
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External Adverse Neighborhood Factors Influence on Students' Grades 3-6 Schooling

Success

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Abstract

As education evolves with the growth of technology, it is crucial to study the impacts of external challenges on student outcomes within the classroom. The goal of the present cross-sectional study is to investigate the relationship between a student's environmental factors and student-peer relationships, academic performance, and engagement, specifically within urban, low-income schools that exist in underserved areas of the community. The following research question is posed: How do external adversities in one's neighborhood impact a student's relationship to their peers and success in school? To learn more about this question, we conducted research in partnership with Butler University, the nonprofit organization, The Fight for Life Foundation, and two participating Indianapolis Public Schools (IPS) with students grade 3 through 6. The mission of this research is to identify the external factors most detrimental to students, allowing schools in areas with high rates of violent crime, unemployment, and poverty, and low levels of education, connectivity at home, and health to provide improved support for students.

The Fight for Life Building Dreams platform aggregates data related to observed student behavior and links the observations to Social and Emotional Learning (SEL) core values. This can be used to measure student engagement and peer relationships in the classroom. To measure academic performance, standardized test scores and term grades for each student are utilized. External community data is derived from SAVI to represent neighborhood factors. Statistical analysis is leveraged to draw connections between patterns in the neighborhood-level data to what is observed in the classroom through the Building Dreams Platform and evaluated though standardized test scores, attendance, and in-class grades to explain academic performance and student engagement.

Few studies have investigated multivariate factors and how they impact academic performance, academic engagement, and peer relationships together. This study investigates the impact of many neighborhood factors on these three outcomes.

Introduction

Student academic and classroom outcomes continue to be influenced by external factors. With new technological integration in schools, this may be a time to gain more insight into which factors are more influential. Hypothesizing that neighborhood adversities may heavily influence schooling success; this formed the research question. The following research question is posed: How do neighborhood adversities directly influence schooling success? A cross-sectional study was undertaken to investigate. Neighborhood adversity variables included poverty, violent crime, unemployment rates, percentage of noninstitutionalized population on Medicaid, percentage of population in households with no computer or internet, percentage of households below the ALICE threshold, percentage of the population age 25 or older with no high school diploma, percentage of individuals with no health insurance, and percentage of population ages 5 and older not proficient in English. Schooling success variables included student-peer relationships, academic performance, and engagement. Data used for the study came from a partnership with Butler University, the nonprofit organization, The Fight for Life Foundation, and two partnering Indianapolis Public Schools (IPS) in an urban midwestern state. The study sample population was 917 K-7 students, with 443 students grades 3-6 used for this study. Student records were removed if they were missing data in any field. The Fight for Life Building Dreams platform aggregates data related to observed student behavior and links the observations to Social and Emotional Learning (SEL) core values. The data used from this platform differentiates this study because each student's engagement and relationships with their peers is quantified. In past studies, engagement has been difficult to quantify because schools do not have a behavior reporting system, but data from the Building Dreams platform provided measures of student engagement and peer relationships in the classroom. To measure academic performance,

standardized test scores and in-class teacher-reported grades for each student were used.

Academic performance can be measured in different ways like GPA or hours spent studying

outside of the classroom, but this study used the two measures that were most accessible.

External neighborhood data, derived from SAVI zip code data, represented the neighborhood

factors. Prior research suggests that peer relationships and academic performance and

engagement outcomes worsen when adversities in the neighborhood increase. Research indicates

that adverse neighborhood factors impact student outcomes in the classroom, which leads to four

hypotheses: adverse neighborhood factors negatively affect (1) student academic outcomes, (2)

student academic engagement, and (3) student-peer relationships, and (4) neighborhood factors

and observable student behaviors are related to academic performance. Few studies of this kind

exist because of the novel availability of data platforms like Building Dreams. Future studies

should focus on more of this kind of analysis to increase knowledge of which neighborhood

adversity factors most influence students' schooling success. This work is only a start with

limitations of small sample in two schools.

Review of Literature

Schools are extensions of the community. Inequities seen in larger community settings

like neighborhoods typically extend into smaller communities such as schools. These inequities

influence students' success within the classroom. Previous studies make claim to the individual

impacts of neighborhood factors on students and schooling success. For instance, the influence

of poverty on peer groups and educational outcomes (South et al., 2003), how violent crime in

the neighborhood influences academic performance, peer relationships, and behavioral problems

(Milam et al., 2010; Cooley-Quille et al., 1995; Hill et al., 1996; Hardaway et al., 2014), the

financial strain and family stress from unemployment (Frasquilho et al., 2016; Wadsworth et al.,

2008), the influence Medicaid has on poverty rates (Sommers & Oellerich, 2018), the negative

school outcomes from not having a computer or Internet at home (Bonacini & Murat, 2022), the

positive effect parent education levels have on student performance (Solem & Vaughan, 2023;

Wang et al., 2020), and the impact of parents who do not speak English or are immigrants has on

student motivation (Vogel et al., 2023). Noticeably absent is the critical investigation of the

impacts of these combined external factors on students' schooling success.

In the current post-COVID era, it is essential to study how academic engagement and

performance is impacted by external factors, specifically in a time when technology and teaching

methods have changed after the shift to remote learning. In a meta-analysis from 39 studies

regarding the impacts of COVID-19 on student achievement, six results were found. The most

notable from the study were that the pandemic depressed student achievement by 0.19 standard

deviations, student achievement did not appear to statistically differ across levels of education,

and 2021 students were not able to recover from the learning deficits caused by COVID-19

school closures in 2020 (Di Pietro, 2023). While this study did not look specifically at the effects

of the COVID-19 pandemic on academic and peer relationship outcomes, these findings

reinforced the need for more research on which external neighborhood factors impact student

outcomes.

Nine neighborhood factors were chosen for this study. These factors were chosen because

they represent the adversities students experience in their neighborhood and they were readily

available through SAVI on the zip code level. Through SAVI, we were able to collect zip code

level data for the 2019-2021 poverty rates, the 2021 violent crime rate, the 2019-2021

unemployment rates of the labor force, the 2019-2021 percentage of noninstitutionalized

population on Medicaid, the 2019-2021 percentage of population in households with no

computer or internet, the 2019-2021 percentage of the population age 25 or older with no high school diploma, the 2019-2021 percentage of individuals with no health insurance, the 2019-2021 percentage of population ages 5 and older not proficient in English, and the 2021 percentage of households below the ALICE threshold. The ALICE threshold is related to poverty, but still indicates that families may struggle to afford necessities students require for school. Most student records from each school included the student's zip code, which could be tied to all nine neighborhood factors.

External factors are often positively correlated in communities (Milam et al., 2010; Wadsworth et al., 2008). Milam and colleagues (2010) hypothesized that neighborhood violence may simply be a proxy for neighborhood disadvantage or poverty. They posited that areas with high rates of neighborhood violence typically include individuals with low socio-economic status (SES). When looking at Indianapolis specifically, in School A's zip code, the unemployment rate was 12%, percentage of households below the ALICE threshold was 76%, and the poverty rate was 30% in 2021. In School B's zip code, the unemployment rate was 6%, percentage of households below the ALICE threshold was 54%, and the poverty rate was 23% in 2021. In all Indianapolis Public Schools, the violent crime rate in 2021 was 19.13 per 1000 population ("Community Profiles," n.d.). This study looks specifically at urban schools within Indianapolis which are more likely to have high rates of poverty. Schools in high poverty areas often have limited resources, high population density, unclean or unstable facilities, and lower academic achievement (Snipes & Casserly, 2004; Hudley, 2013). These conditions make it more challenging for students to learn and grow throughout their time in elementary and middle school.

In the present study, the question answered is: How do adverse neighborhood factors, like crime, poverty, parent education level, access to healthcare, connectivity at home, and unemployment, influence schooling success factors, like peer relationships, academic engagement, and academic performance, and what is the nature of this influence? The following section summarizes the intersection of external neighborhood data specific to the school's zip code, individual student test data based on state standardized tests, and teacher-reported behavior data from an online reporting tool.

Student-Peer Relationships

Schools are social places, and the relationships students have with other students are critical for motivation, adjustment, and cooperation in the academic setting. The results from studies on the effect parents, teachers, and peers have on student's goals and academic performance varies, with some studies contradicting each other. In two studies completed in 2018 and 2019 with a total sample size of 58,037 students, it was found that the quality of the student-peer relationship was most closely related to academic achievement (Yu et al., 2023). Similarly, a different study showed no significant effect on peer support for learning, but highlighted teacher-student relationships as a significant predictor of students' future aspirations and perceptions of schoolwork regarding their cognitive engagement within class (Moreira et al., 2018). Another study found similar results relating to teacher-student relationships where the effect of teacher social support on emotional and cognitive engagement was greater than peer social support as students progressed from middle school to high school (Wang & Eccles, 2012). Parent engagement was also a factor in other studies finding that perceived support from parents was the only type of support that predicted students' academic goal orientations inferring socialization practices at home (Wentzel, 1998). So too were perceived peer goals serving as an

explainer for a larger proportion of variance in students' performance goals (Hemi et al., 2021). For this study, the literature points to the importance of all three variables, parents, teachers, and peers having some influence on students' schooling success but due to data availability, the focus herein is only on student-peer relationships as measured by the student's teacher.

Students interact with their peers at school in both academic and non-academic ways. A study completed by Gremmen and colleagues (2018) shared findings that near-seated peers would influence students' academic engagement and achievement, in the sense of becoming more similar to each other. If the student's friends were academically engaged, they would become more engaged and if the student's friends were not engaged, their engagement levels would decrease. This relates to the finding from Ryan (2001) pointing out that students affiliate with other students who have similar academic characteristics. These studies show that the peer groups that students choose to be a part of at school often influences their behaviors and beliefs about schooling success.

Violence in a student's neighborhood can also impact student-peer relationships. A study by Cooley-Quille and colleagues (1995) found a moderate correlation between high levels of exposure to community violence and impaired social relationships. Looking at more specific behaviors, children who reported they had witnessed instances of homicide, shootings, physical assaults, stabbings, and gang violence, had more behavior problems such as hyperactivity, aggression, and withdrawal (Hill et al., 1996). These behaviors make it more difficult for students to stay engaged in class and can also make it more difficult to maintain healthy relationships in the classroom.

Students develop their social skills through interactions with their peers and teachers at school. When students come from areas of high poverty, their outlook on school may not be as

positive as a student from an area with low poverty. In a study by South and colleagues (2003), moderate support was found for the position that youth from poor communities are exposed to peer groups that devalue educational achievement making them more likely to experience negative educational outcomes. This suggests that attending school in a neighborhood with low socioeconomic status could impact both the student's academic achievement and peer relationships because their social groups do not value education to the same extent. Moreover, for students with low SES that live in areas of high poverty, the school districts they attend also have difficulty retaining highly educated teachers (Caldas et al., 2019). Without teachers to motivate and teach challenging, yet engaging material, students lack the learning skills they need to be successful while taking standardized tests, negatively reflecting the school's and student's overall academic performance.

More extreme examples of negative peer relationships like bullying or victimization have been found to have detrimental effects on students in school. Meyer-Adams & Connor (2008) found that when students are victimized by or contribute to bullying behaviors, it negatively predicts the student's perception of the psychosocial environment, causing them to act aggressively or avoidantly, negatively affecting their ability to participate or succeed in school. It was also found that chronic peer rejection negatively affects the student's classroom participation, impeding their school performance (Ladd et al., 2008). Overall, peer rejection or peer acceptance was found to impact both behavioral and emotional engagement (Fredericks et al., 2004). These associations between peer groups from similar backgrounds and cultures may also have a direct impact on the student's academic performance. Outside factors can influence student behaviors and academic mindset, which is why it is important to see the impact these factors have on student relationships.

Theoretical Framework of Student-Peer Relationships

Students are attracted to similar students, which can be inferred from the homophily principle. Homophily describes the tendency for similar people to come in contact at a higher rate than dissimilar people. In an analysis of the principle by McPherson and colleagues (2001), the homophily principle works among individuals like students where cultural, behavioral, and material information is localized among people with comparable sociodemographic and interpersonal characteristics. Therefore, students from the same socioeconomic status within the same school with similar behaviors and attitudes are more likely to influence each other than students lacking those characteristics or not exhibiting the same behaviors and attitudes.

Academic Performance and Engagement

Academic performance is the objective measure of student performance based on standardized test scores and teacher's grades. Academic engagement is the subjective measure of how a student performs based on the way they think, act, and participate in class (Fredricks et al., 2004). According to Fredricks, Blumenfeld, and Paris (2004), engagement consists of three different categories: behavioral, cognitive, and emotional. Behavioral engagement encompasses participation in academic, social, or extracurricular activities, cognitive engagement refers to the investment and willingness to learn, and emotional engagement includes both positive and negative reactions to teachers, classmates, academics, and school. Some measures of behavioral engagement include student participation in class like asking questions and paying attention. Measures of cognitive engagement include showing a greater level of understanding, problem-solving, and performing an analysis. Emotional engagement is how the student identifies with the school and the interest, boredom, sadness, or happiness they show in class (Fredericks et al., 2004).

Prior research has identified a variety of factors that can impact student academic performance and engagement. Associations between academic achievement and the school's neighborhood were found among urban students and adolescents. However, one study found that neighborhood violence was found to have no association with academic performance when controlling for the self-reported safety when walking to and from school and percent of students receiving free or reduced-price lunch, prompting researchers to suggest that poverty could be more of a predictor of academic achievement than neighborhood violence (Milam et al., 2010). In a study prompted by the temporary transition to remote learning, immigrant background was not directly associated with any student outcome but did indirectly negatively affect extrinsic learning motivation (Vogel et al., 2023). Immigrant parents did not influence outcome, but there was some correlation to engagement. Extrinsic learning motivation is the drive to be engaged because of external rewards, and while the study only specified immigrants, this could be tied to parents not proficient in English. Though indirect, immigrant parents and parents not proficient in English can experience similar adversities, leading to a potential influence on student engagement and academic success within educational settings. In addition to parent proficiency in English, students learning English have found to have better outcomes with at-home parent support. If students are learning English, a study found that parental involvement contributed to positive academic and social-emotional outcomes among English language learners in elementary school (Niehaus & Adelson, 2014). A similar study found that dual language learners who acquire English proficiency later are more likely to struggle academically at the end of elementary school (Winsler et al., 2023). Both of these findings suggest that English proficiency helps students improve their academic outcomes.

From other research studying engagement, Li and Lerner (2011) found that behavioral and emotional engagement predict academic outcomes for youth. Alexander and colleagues (1993) investigated first graders' classroom behavior and found that students who show good classroom adjustment by engaging in classroom activities establish early learning patterns leading to more academically favorable trajectories. Looking at negative classroom behavior study of 1,013 fourth graders, the hypothesis that both disruptive and inattentive-withdrawn forms of adverse classroom behavior were significantly and substantially related to a decrease in academic performance was proven (Finn et al., 1995). A study by Wang & Eccles (2011) found that as students progress through middle school and then onto high school, behavioral, cognitive, and emotional engagement declines, and overall engagement is positively associated with the student's GPA. These four studies show a positive correlation between engagement and academic performance for students.

Neighborhood violence has many different impacts on student outcomes and performance. In one study with a small threshold for explained variance, exposure to crime and violence in the neighborhood had a greater impact on school outcomes, including problem behaviors and grades, than danger within the school (Bowen & Bowen, 1999). When students do not feel safe in school, the way they interact and learn could be negatively affected. A longitudinal study by Hardaway and colleagues (2014) investigated how anxious/depressed symptoms and delinquent behaviors mediate the relationship between community violence exposure and academic achievement. Researchers in the study found that exposure to violence led to an increase in delinquent behaviors and symptoms of anxiety and depression, but only delinquent behaviors impacted the student's academic performance (Hardaway et al., 2014). This correlation along with similar findings from Masten and colleagues (2005) suggest that

externalizing problems like aggression or disruptive behaviors are more related to academic outcomes than internalizing problems. Externalizing behaviors have been found to impact students' academic achievement, whereas internalizing symptoms may influence students' social competence (Masten et al., 2005; Wadsworth et al., 2008). Exposure to neighborhood violence negatively affects students' perceptions of school and causes problematic behaviors to form, resulting in a negative impact on academic performance.

In addition to an increase in exposure to violence, poverty is also associated with frequent moves or transitions as an additional stressor, affecting children and adolescents (Wadsworth et al., 2008). Unemployment is a factor that drives frequent transitions which should be taken into consideration when researching external neighborhood factors and their impact on students. The overall effect of unemployment levels within the neighborhood on a student's academic performance has not been thoroughly researched, but unemployment within the family is often an indicator of low SES, impacting students' mental health and wellbeing. Unemployment or job loss limits a family's ability to purchase items for school like books and school supplies that are necessary for a child's success in school. When parents are unable to afford items necessary for school because they are not being paid, students will not have the physical materials needed to succeed academically. In a study by Frasquilho and colleagues(2016), changes in family relations due to unemployment were reported to be either positive or negative by bringing the family together or causing increased strain on marital or parent-child relationships. In either case, however, the implications of poverty-related stress on children span beyond access to physical resources. Wadsworth and colleagues (2008) found that poverty-related stress impacts internalizing factors like the child's physical and mental health more than externalizing factors like aggression and delinquency. Researchers concluded that externalizing behaviors could be

directly associated with problematic parenting practices and not influenced by student's experiences with stress.

Stemming from parents' employment, a parent's education level and access to healthcare can have indirect impacts on their children in schools. In a study by Solem and Vaughan (2023), students with at least one college-educated parent were associated with higher levels of persistence in learning, academic self-discipline, and enjoyment of complex problems. Another study by Wang and colleagues (2020) found that increasing an individual's education has positive effects on their next generation's academic performance and non-cognitive outcomes like peer relationships. Many studies use parent education levels as a control to correlate with the student's involvement, academic performance, and future aspirations. If the family's income is also reported, the family's socioeconomic status can be determined for the student. Socioeconomic status affects a family's ability to afford and access healthcare. Providing parents with access to healthcare is an important two-generation strategy that can boost children's long-term outcomes. In a literature review on student's school attendance and good health, completed by numerous pediatricians, a cascade effect was found stemming from parent education and health levels. The research found that poor school performance by students is associated with poor adult health outcomes stemming from the parental feelings of lack of control and social support because they are less likely to find fulfilling jobs because of their lower educational attainment. (Allison et al., 2019). This research project shows how connected parent health and education levels are to student outcomes. In the preferred model used in a study by Sommers & Oellerich (2018), the model found that Medicaid reduces the poverty rate by 0.7 percentage points among non-institutionalized individuals, which is equivalent to 2.1 million children, adults, and elderly individuals nationally. When a family is covered by insurance, they do not

have to pay for unexpected medical bills which can put a major financial strain on a family. Additionally, the Center for Disease Control and Prevention states that healthy students are better learners (CDC, 2022). Overall, parental unemployment, poverty, and little health insurance coverage or education negatively affects their child's experiences in school, and the present study seeks to find correlation between overall neighborhood levels of unemployment and its effect on students.

When the COVID-19 pandemic forced schools to shut down, the lack of internet and a computer at home had negative effect on students' ability to learn from home. A study looking into the educational resources students need to succeed found that students lacking a computer for schoolwork and an internet connection scored significantly below their peers in their planned time of staying in school (Bonacini & Murat, 2022). A different study found that having access to technology at home significantly increased student learning hours by at least 16% (Ogundari, 2023). Even without the pandemic, students still need to have computer and internet access at home to complete homework and projects. A systemic literature review found that in studies looking at the effects of COVID on education, there were universal concerns for inequities in technology access and parental support for traditionally marginalized students (Huck & Zhang, 2021). Academic performance was found to be negatively impacted when students came from adverse households, especially when the internet was not readily available, and parents could not be there to support their children.

Overall, while there is a substantial amount of evidence looking at individual external neighborhood factors, there is a gap in research that looks at all nine variables together and how they impact student-peer relationships, academic engagement, and academic performance. Crime, poverty, ALICE, Medicaid, no internet, no high school diploma, no health insurance,

English proficiency, and unemployment statistics are easily accessible, and because these neighborhood factors have measurable impacts on students' wellbeing based on prior research, we seek to correlate this neighborhood data with internal school data. The goal of this study is to understand the relationship between these external neighborhood factors and their influence on student outcomes like academic performance, academic engagement, and student-peer relationships.

Methods

Data Collection

For this correlational study, external neighborhood factors were based on the students' neighborhoods. This data was collected from SAVI, a program of The Polis Center at IUPUI, and confirmed by SimplyAnalytics, a web-based mapping and analytics application. The school-based data was acquired for the fall 2023 semester at two urban, low-income Indianapolis public grade schools of similar size, which will be denoted as School A and School B. After removing records with missing student information, School A had 118 students grades 3-6 from primarily the 46218 and 46219 zipcodes, and School B had 325 students grades 3-6 primarily from 46201 and 46203. At School A, 4.9% of students were at or above proficiency in their iRead and iMath scores. At School B, 8.4% were at or above proficiency for iRead scores and 7.3% were at or above proficiency for iMath scores. In IPS, the average iRead proficiency score was 19.8%, and the average iMath proficiency score was 19.6%. In Indiana, the average iRead proficiency score was 39.7% and the average iMath proficiency score was 41.2%. School A and School B were both significantly lower for iRead and iMath proficiency scores in IPS and the state. These schools were chosen because of their adverse neighborhood factors and wide adoption of the Fight for Life Building Dreams social-emotional learning platform throughout all grades within

the school. All data provided by the schools and through the Building Dreams platform was deidentified with randomized identification numbers.

For this research, we partnered with the Fight for Life Foundation (FFLF) to analyze data from urban and low-income public schools. We compared that to the crime, poverty, education, connectivity, health, and unemployment characteristics of each school's surrounding communities. The Fight for Life Foundation is an Indianapolis non-profit organization whose mission is to equip underserved youth with the social and emotional qualities for success. The curriculum developed by the foundation builds on the core values of Social Emotional Learning to help students develop social awareness, relationship skills, and self-awareness. Using a unique gamification system, school educators and staff can collect student behavioral data while providing tools to implement intervention plans through the foundation's Building Dreams platform. When the program is implemented throughout the school, patterns can be identified, and problem areas can be addressed more quickly, reducing the workload on educators or administrators while providing targeted support to the students in need. By bringing awareness to behavioral issues and trends, the Building Dreams curriculum is tailored to support students with the skills they need to manage their peer relationships and social-emotional health. Widespread implementation of this curriculum can provide the data required to demonstrate that social-emotional learning in communities of adversities can make a difference in student outcomes (Bowen et al., 2022). Through the Building Dreams platform, 17,314 data points were collected by teachers and administrators for 118 students grades 3-6 from School A in the fall 2023 semester. 17,494 Building Dreams data points were collected by teachers and administrators for 325 students grades 3-6 from School B in the fall 2023 semester.

Measures Describing Neighborhoods

For this study, we chose to look at crime, poverty, parent education, connectivity, availability of health insurance, and unemployment rates within the neighborhood and zip codes of the school. SAVI is an online information system with statistics and databases that collects data on Indianapolis. It allows users to break down their searches into block groups, townships, or zip codes for even more detailed insights into neighborhood trends. We utilized the violent crime rate, unemployment rate, percentage of households with no computer or internet, percentage of the noninstitutionalized population on Medicaid, percentage of households below the ALICE threshold, percentage of the population with no high school diploma age 25 or older, percentage of population with no health insurance, percentage of population ages five and older not proficient in English, and poverty rates over the past three years for these areas by zip code. SimplyAnalytics also provided population data based on block groups and zip codes. Measures of poverty and unemployment are cross-referenced with the data from SAVI for these specific areas.

Student-Peer Relationships and Academic Engagement Metrics

The Building Dreams platform collects teacher-reported data on each student throughout the day. These records reported overall classroom behavior based on one of the ten core values of SEL. The core values of SEL, as outlined by the Building Dreams curriculum, are reported negatively or positively by teachers and administrators. Academic engagement statistics were collected based on in-class participation or individual behaviors, with each student averaging 4.2 reports per day. The statistics school staff record is gamified based on football terminology. For example, a positive record of an SEL core value is reported by school staff as a first down, whereas a negative record is reported as a sack. Extra points and flags are reports for individualized behavior unrelated to the ten core values. In extreme cases, students are placed in

the red zone when they receive a sack that requires them to be removed from the class. To determine how well students interact with others, in-class participation is more heavily weighted to emphasize the importance of peer relationships. All teachers and staff within these schools undergo a training process on observing and reporting positive and negative behaviors through the Building Dreams platform.

Indicator	Core Values
Cognitive Engagement	Student takes initiative and is willing to cooperate
Emotional Engagement	Student is focused in class
Individual Behavioral Engagement	Student is enthusiastic in class
	Student completes assignments per expectations on time
	Student follows directions
	Student is accountable for their actions
	Student respects and cares for all physical settings
Behavioral Engagement- Peer Relationships	Student respects one another's space
	Student speaks respectfully, cooperates, and shares
	Student has positive relationships

Table 1. Engagement and relationship indicators for SEL core values

The core values of SEL measure behavioral, emotional, and cognitive engagement and interactions with peers, both positively and negatively. Teachers use an online portal to select behaviors that students exhibit. As outlined in Table 1, each SEL core value indicates behavioral, emotional, or cognitive engagement or peer relationships. According to the teacher, the mark for cognitive engagement is that the student takes initiative and is willing to cooperate. Teachers can record students as being focused within the class for emotional engagement. Behavioral engagement has several measures: enthusiastic within the class, complete assignments per expectations on time, follows directions, respect and care for all physical settings, and are accountable for their actions. Lastly, peer relationships are measured by the labels of positive relationships, respect for one another's space, and speaking respectfully, cooperate, & share.

Measures Describing Academic Performance

Standardized test scores from School A, covering subjects in reading and math were collected along with in-class grades in English-Language Arts (ELA), reading and math from the fall 2023 semester to represent academic performance. Only in-class grades in ELA, reading, and math from the fall 2023 semester at School B were used to indicate academic performance. The standardized test scores from School A and in-class scores from Schools A and B were provided by the school administration and deidentified before use.

School Characteristics

Two urban IPS schools with students grades 3-6 were used for this study. Controls for this study included the students' gender, race/ethnicity, age, and school level, as seen in Figure 1, Figure 2, Figure 3, and Figure 4.
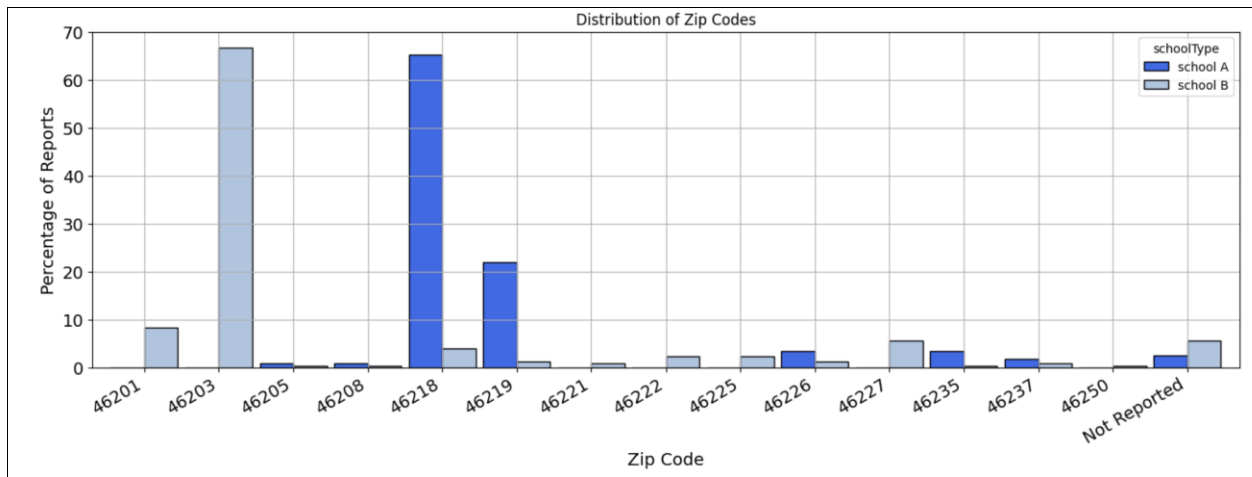

Figure 1. Grouped bar chart displaying the distribution of zip codes between School A and School B
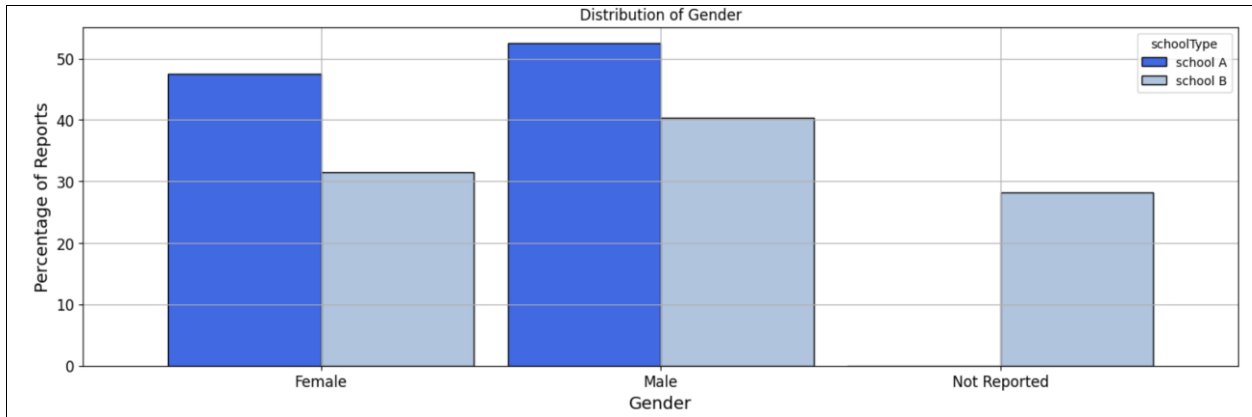
Figure 2. Grouped bar chart displaying the distribution of gender between School A and School B
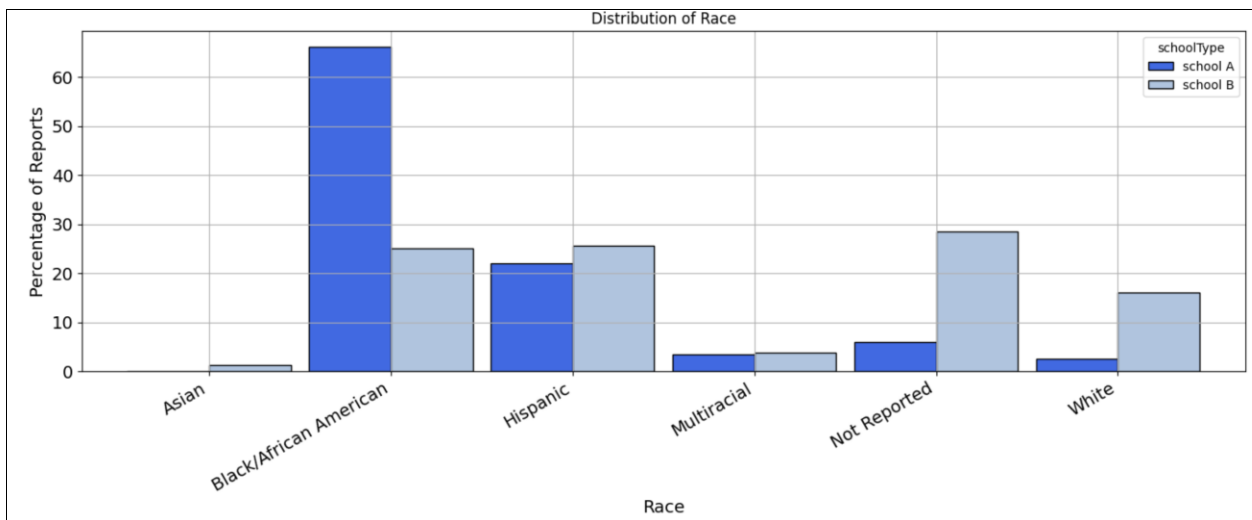

Figure 3. Grouped bar chart displaying the distribution of race between School A and School B
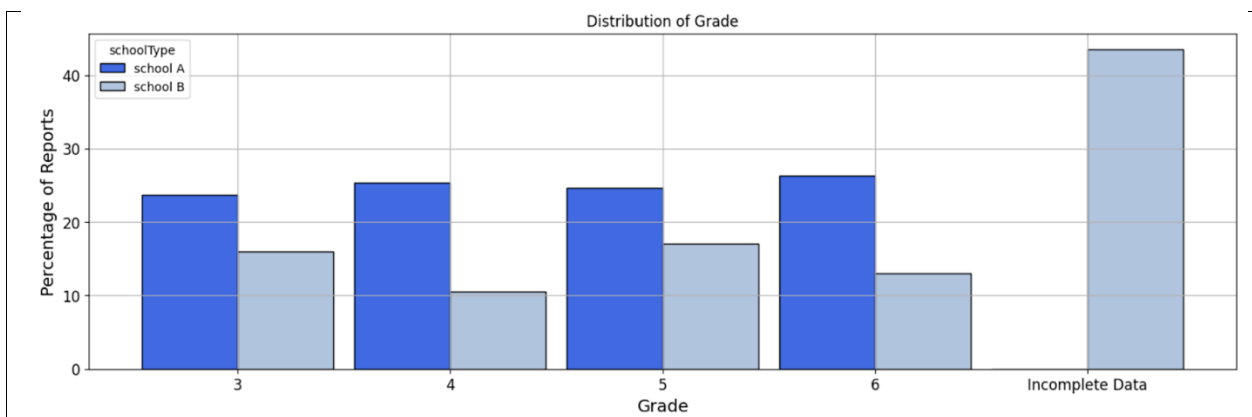

Figure 4. Grouped bar chart displaying the distribution of grade level between School A and School B

As seen in Figure 1, the majority of the zip codes for students attending School A came

from 46218 and 46219, while School B's students came from the 46201 and 46203 zip code. For

both schools, there were more records recorded for male students than female students, however, School B had 141 students whose gender was unidentified, as seen in Figure 2. In Figure 3, we see that both schools have a large black/African American and Hispanic population. The average of population of students by race that are black in zip codes 46218 and 46219 is 45% compared to School A where 66% of students are black. The population has an average of 11% Hispanic, while the school has 22% of students identifying as Hispanic. In School B, rates of black and Hispanic populations were higher than the average of populations by race in 46201 and 46203. The average black population in both zip codes was 22% and the average Hispanic population was 13%. In School B had 24% of students identify as black and 25% of students identify as Hispanic. Figure 4 shows that the distribution of grade is distributed relatively equally.

In addition to demographic breakdown by student at each school, engagement data by race, gender, and grade level is displayed below in Figure 5, Figure 6, Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, and Figure 12. For both schools, students following directions, which represents individual behavioral engagement in both sacks and first downs, and students focusing and doing their best work as an indicator of emotional engagement in first downs are the most recorded behaviors across race, gender, and grade level.
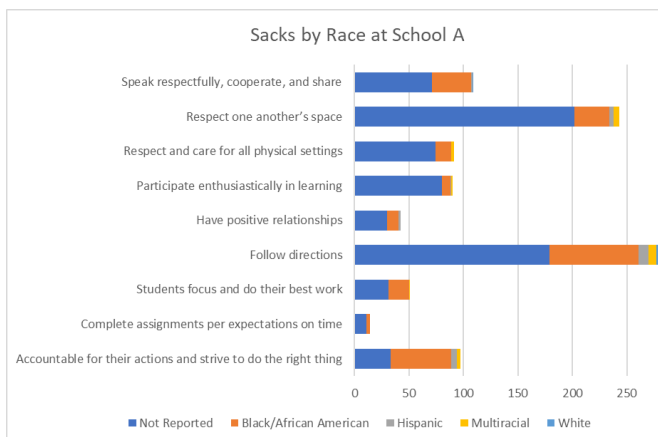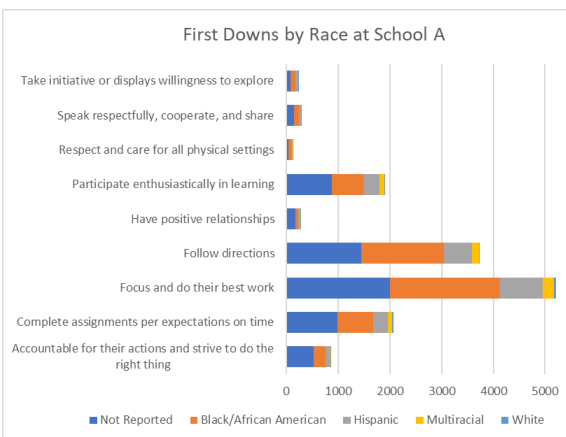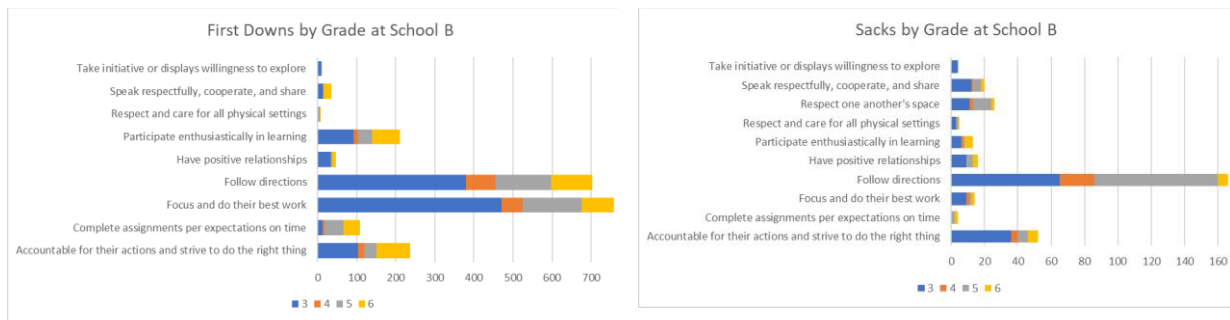
Figure 5. Positive (a) and Negative (b) Engagement and Peer Relationship Indicators by Race at School A
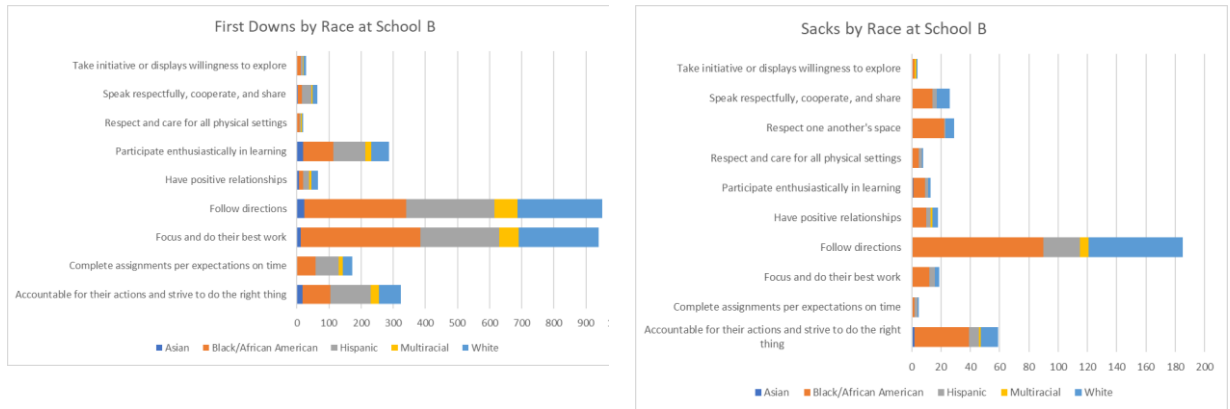
a.   b.

Figure 6. Positive (a) and Negative (b) Engagement and Peer Relationship Indicators by Race at School B
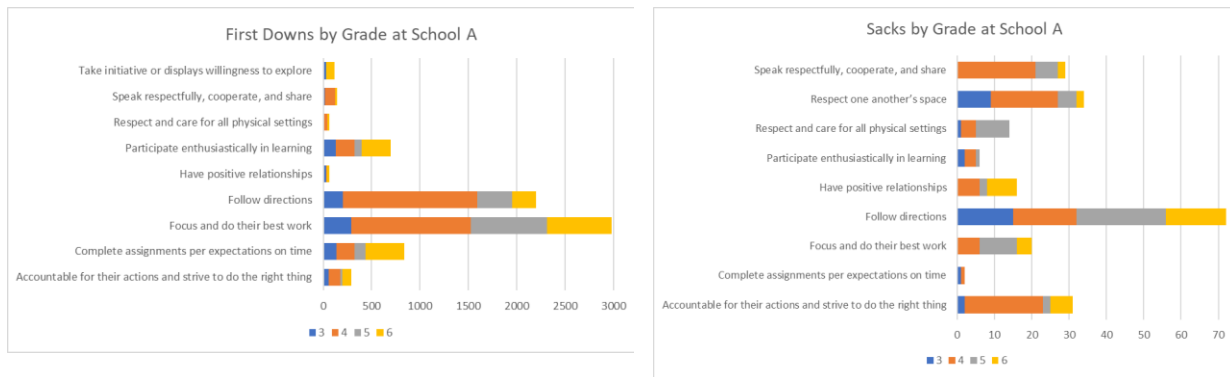
a.   b.

Figure 7. Positive (a) and Negative (b) Engagement and Peer Relationship Indicators by Grade Level at School A
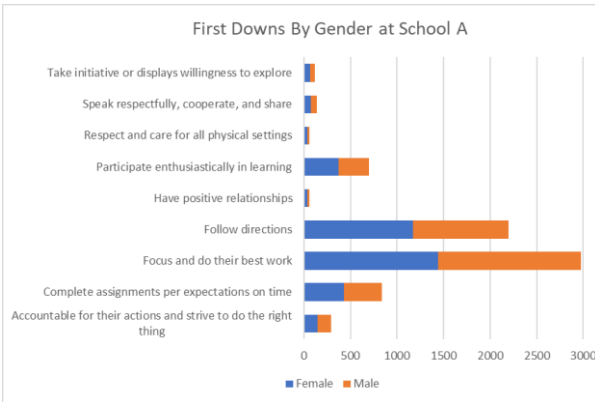

a.   b.

Figure 8. Positive (a) and Negative (b) Engagement and Peer Relationship Indicators by Grade Level at School B

Figure 9. Positive (a) and Negative (b) Engagement and Peer Relationship Indicators by Gender at School A

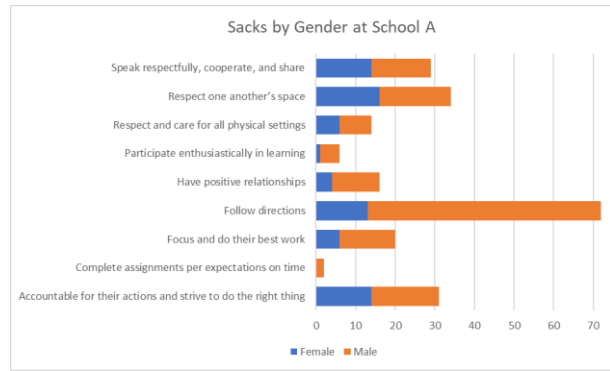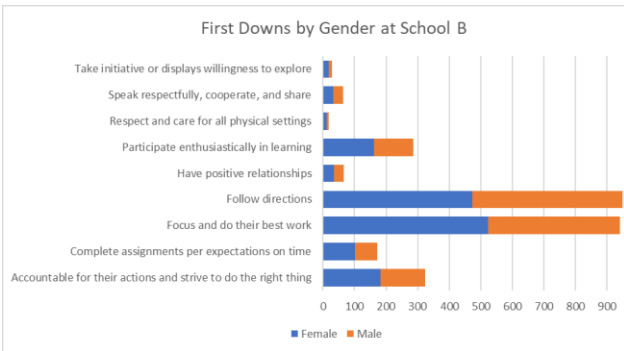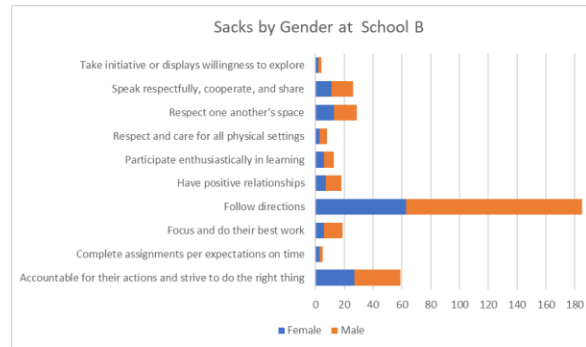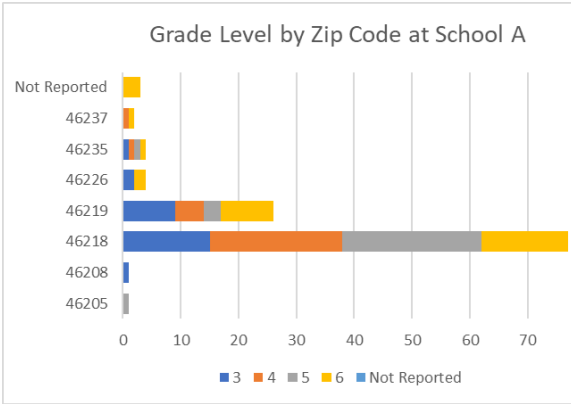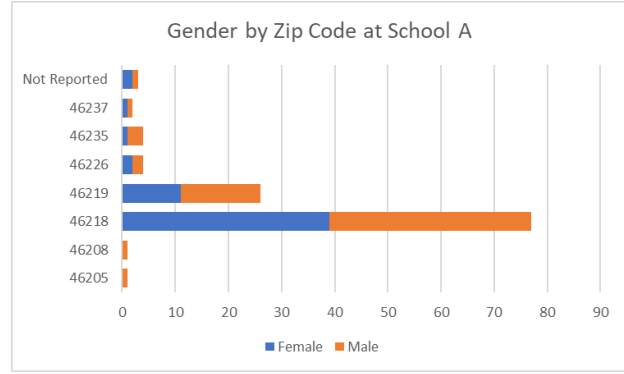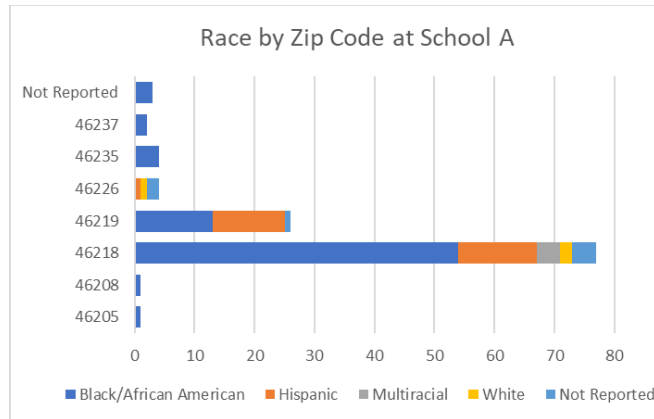**Figure 10.** Positive (a) and Negative (b) Engagement and Peer Relationship Indicators by Gender at School B

a.

b.

c.

Figure 11. Distribution of Grade Level (a), Gender (b), and Race (c) at School A by Zip Code
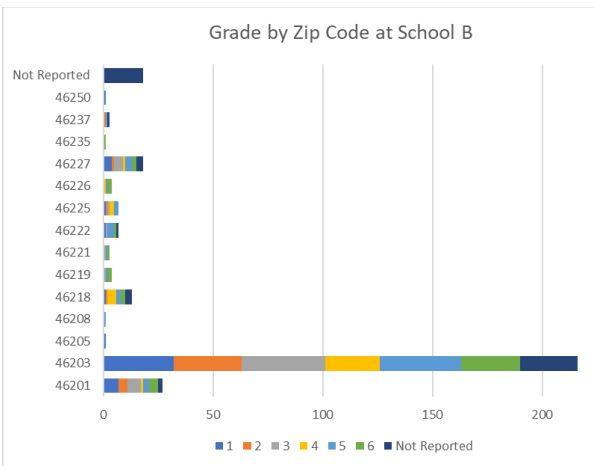
a.
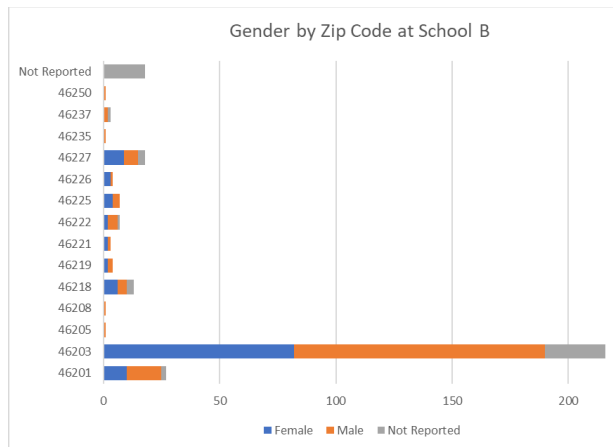
b.
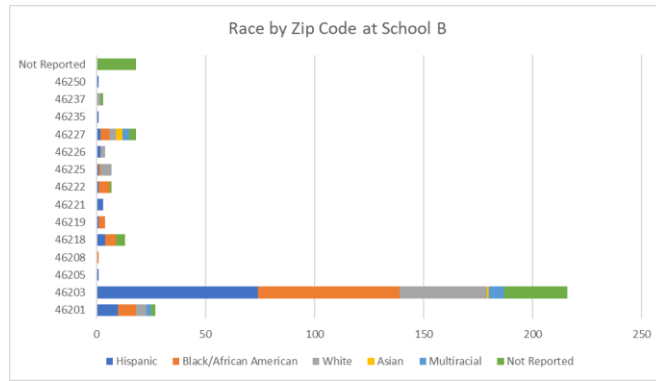
c.

Figure 12. Distribution of Grade Level (a), Gender (b), and Race (c) at School B by Zip Code

Methodology

Exploratory Factor Analysis

The proposed methodology utilizes exploratory factor analysis for identifying latent variables that can hypothesize how the observed variables of classroom data reported by teachers, neighborhood data by zip code retrieved from SAVI, and student test scores reported by the school are connected.

Prior to performing factor analysis, the dataset must be evaluated to determine if the data is suitable for factor analysis. There are two methods to check the sampling adequacy: the Bartlett sphericity test and the Kaiser-Meyer-Olkin (KMO) test. The Bartlett sphericity test determines whether the observed variables intercorrelate at all using the observed correlation matrix against the identity matrix. The null hypothesis (H0) assumes that no correlation is present among the variables. We want to reject this null hypothesis because factor analysis aims at explaining the variation due to correlation among the variables. If the p test statistic value is less than 0.05, we can decide that the correlation is not an identical matrix and correlation is present among the variables with a 95% confidence level. The program returns the chi-square value and the associated p-value for the test. If the test is found statistically insignificant with a

p-value greater than 0.05, factor analysis should not be employed. Where det(R) is the

determinant of the correlation matrix and p is the number of variables, Bartlett sphericity can be

calculated as follows:

$$Bartlett_n = -1 \times (n - 1 - (\frac{(2p+5)}{6}) \times ln(det(R)) \tag{1}$$

The KMO criterion is a statistic that represents the degree to which each observed

variable is predicted, without error, by the other variables in the dataset. r_{ij} is the correlation

between the variable in question and another variable, and u_{ij} is the partial correlation. This is a

function of the squared elements of the image matrix which is the span of the vectors of the

linear transformation compared to the squares of the original correlations, as calculated in (2).

$$KMO_j = \frac{\Sigma_{i \neq j} r_{ij}^2}{\Sigma_{i \neq j} r_{ij}^2 + \Sigma_{i \neq j} u_{ij}^2} \tag{2}$$

KMO values range between 0 and 1, and a KMO less than 0.5 is considered inadequate. Larger

proportions are expected as the KMO value represents more correlation present among the

variables thereby allowing factor analysis to take place.

The first step of exploratory factor analysis is to extract a set of factors from a dataset.

These factors are almost always orthogonal and are ordered according to the proportion of the

variance of the original data that the factors explain. To make the interpretation of the factors that

are considered relevant, the first selection step is generally followed by a rotation of the factors

that were retained. Rotating the factors maximizes and minimizes the entire set of factor

loadings. To make the location of the axes fit the actual data points better, the axes are rotated to

make the factors easier to interpret. The rotation method Varimax searches for a rotation of the

original factors such that the variance of the loadings is maximized, which amounts to maximizing,

$$v = \Sigma(q_{j,l}^2 - \overline{q_{j,l}^{-2}})^2,$$ (3)

with $q_{j,l}^2$ being the squared loading of the jth variable on the l factor, and $\overline{q_{j,l}^{-2}}$ being the mean of the squared loadings. For varimax, a simple solution indicates that each factor has a small number of large loadings and many small loadings. This is the sample variances of the standardized loadings for each factor summed over the k factors.

Before preforming factor analysis, the multivariate statistical method of exploratory factor analysis (EFA) is performed to identify the underlying structure of observed neighborhood, classroom, and test score variables without any prior knowledge of how many factors exist or how they might be related. The goal is to identify a smaller number of factors that account for the correlations among all the variables relating to each student. EFA does not aim to confirm the hypothesis that neighborhood factors have a positive impact on the students' academic engagement and performance.
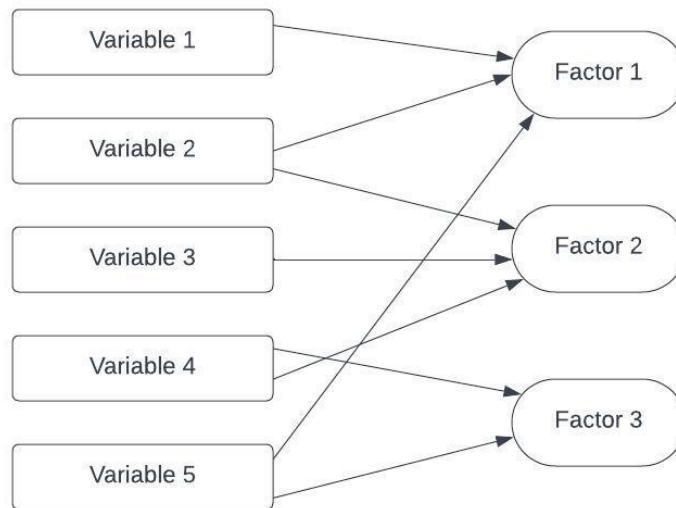
Figure 13. Overview of Exploratory Factor Analysis

After fitting the data to the EFA model, the number of factors to utilize is selected using the number of components that have eigenvalues greater than one. Eigenvalues represent the amount of variance in the observed variables that is explained by each factor. The first component explains the most variance, and the last component explains the least. The number of factors is confirmed by the Scree Plot which plots the eigenvalue by the component number and contains just enough factors to account for the important covariation among measured variables.

Confirmatory Factor Analysis

Once the number of factors is determined, confirmatory factor analysis is leveraged to identify patterns among observed variables and to explain these patterns in terms of a smaller number of unobserved, latent variables known as factors. Latent variables are inferred from the observed variables and cannot be measured directly, as seen in Figure . They are not subsets of the original variables. To simplify the complex dataset in this experiment, the latent variables that explain the correlations among observed variables reduce the dimensionality and identify which observed variables are most strongly related. The statistical model for confirmatory factor expressed mathematically is

$$X = \Lambda\eta + \epsilon, \tag{5}$$

where X is the vector of observed variables, Λ is the matrix of factor loadings, representing the relationships between the observed variables and the latent factors, η is the vector of latent factors, and ϵ is the vector of error terms or residuals.

Structural Equation Modeling

After validating the latent variables using CFA, Structural Equation Modeling (SEM) is used to validate the results from EFA. SEM is a statistical model that extends factor analysis and can be used to understand and identify the causal associations between latent and observed variables. The model specification stage is the most important part, where the researcher shows how the latent variables are related to one another based on EFA results, the researcher's experience, and accumulated knowledge. For this research, School A was used to establish the model. The model was tested using data from School B and the process was repeated where data from School A was tested from a model derived from School B. Model estimation involves combining the indicators of the measurement model to form composite variables. The composite variables are assumed to be comprehensive representations of the constructs, and, therefore, valid proxies of the conceptual variables being examined. Using these proxies as input, SEM applies ordinary least squares regression with the objective of minimizing the error terms of the constructs. The logic of the SEM approach is that all the indicators' variance should be used to estimate the model relationships, focusing on the prediction of the dependent variables.

Factor Measures

The sufficiency test calculates statistics under the null hypothesis that the selected number of factors is sufficient. Using the parameter of the number of observations in the input data that the factor analyzer was fit with, the sufficiency test returns the test statistic, the degrees of freedom, and the p-value of the test.

Factor loadings range from -1 to 1 and are the contributions of each variable to each factor. Values close to 1 and -1 indicate a higher correlation between the factor and the variables. Values close to 0 indicate that the factor has a lower influence on the variable. Loadings are simply correlations with the unobserved factors. Factor loadings less than 0.3 are suppressed and

removed. For example, two variables like poverty and iRead scores, may have correlation values of 0.33 and -0.47, respectively, within Factor 1 and negligible correlations with the other factors.

The factor variance information includes the sum of squared loadings, proportional variance, and cumulative variance for each factor. The sum of squared loadings is used to determine the value of a particular factor. A factor is worth keeping if the sum of squared loading is greater than 1. Proportional variance is the variance explained by a factor out of the total variance. Cumulative variance is the cumulative sum of proportional variances of each factor, as seen below in (6). For example, the 7 factors together explain 77.6% of the total variance in School A.

$$\sigma^2 = \frac{\Sigma (\chi - \mu)^2}{N} \tag{6}$$

Results

Different combinations of observed variables were used to create different scenarios for use with exploratory factor analysis in order to determine whether there was a correlation between neighborhood factors, student peer relationships, academic performance, and academic engagement. To first determine the relation between variables within each school, correlation matrices were created to compare Building Dreams Criteria, academic scores, and neighborhood factors as seen below in Figure 13, Figure 14, Figure 15, Figure 16, Figure 17, and Figure 18. Each graph is broken down into two of the three data categories within each school to improve the visualization.
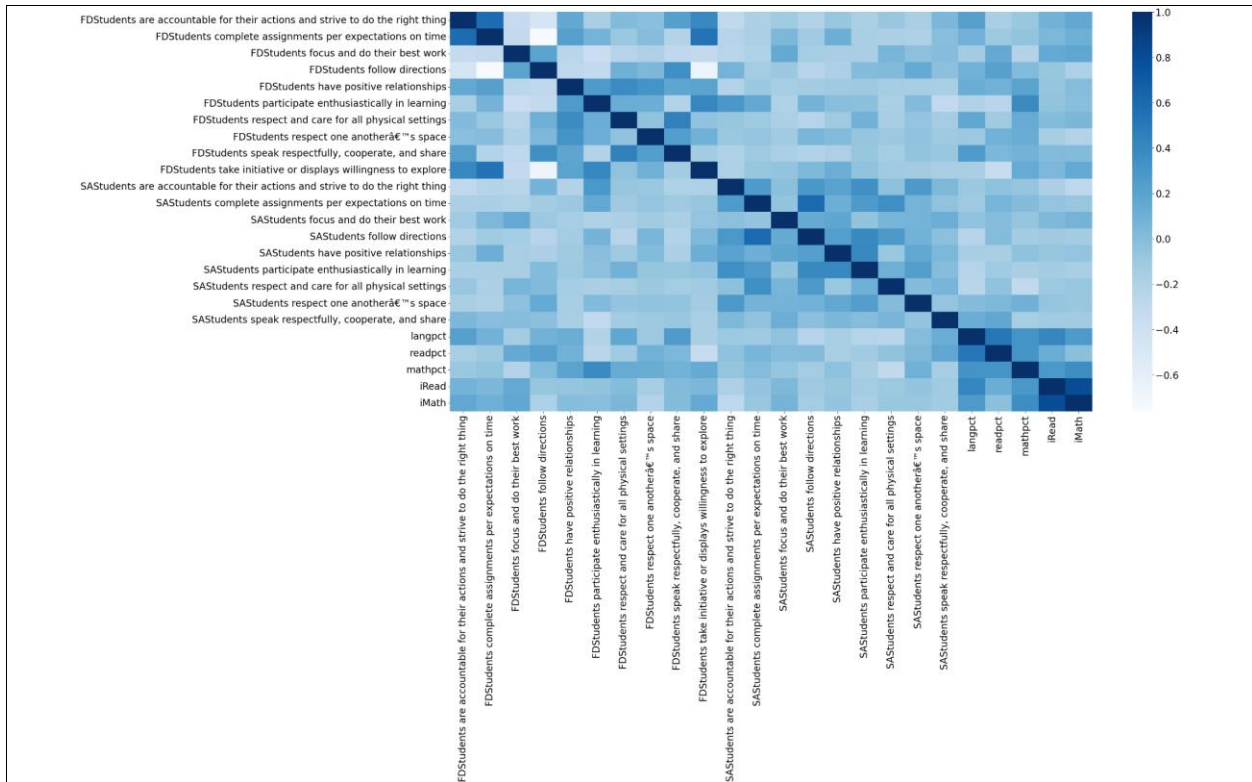
Figure 13. Correlation Matrix of Building Dreams Criteria and Academic Scores in School A
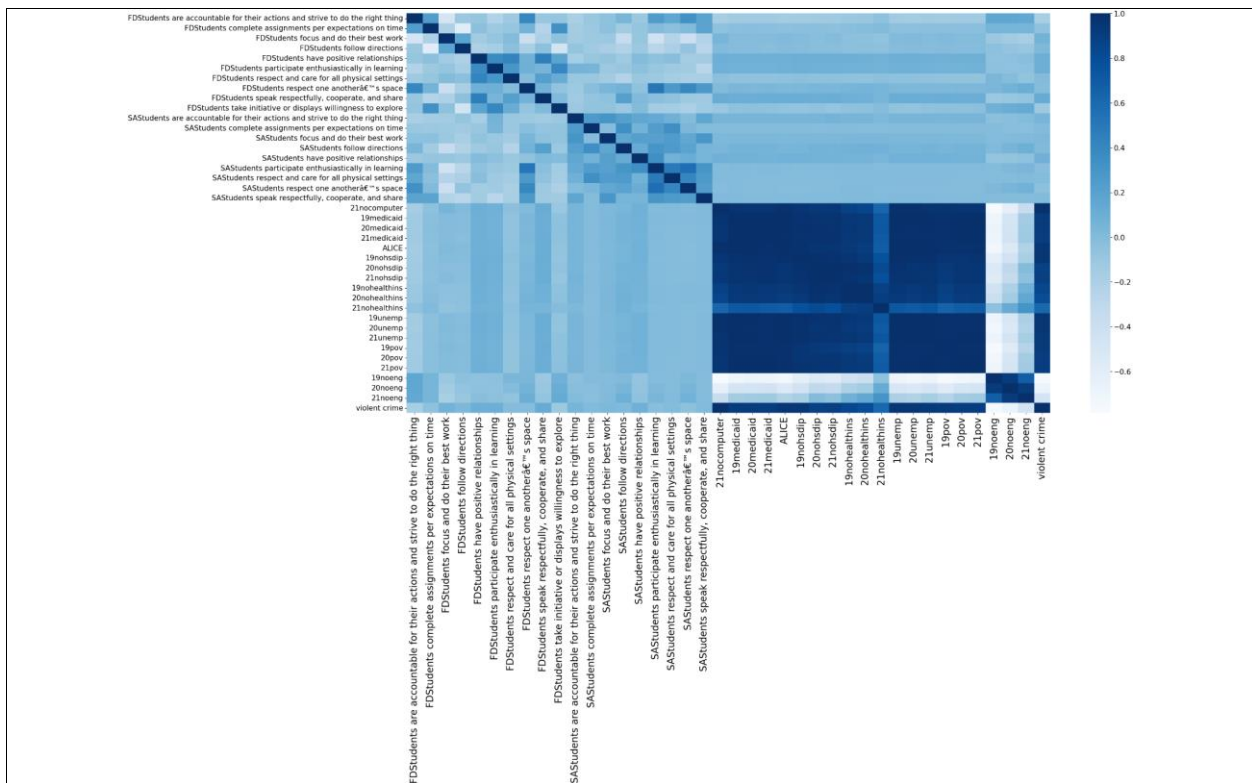
Figure 14. Correlation Matrix of Building Dreams Criteria and Neighborhood Factors in School A
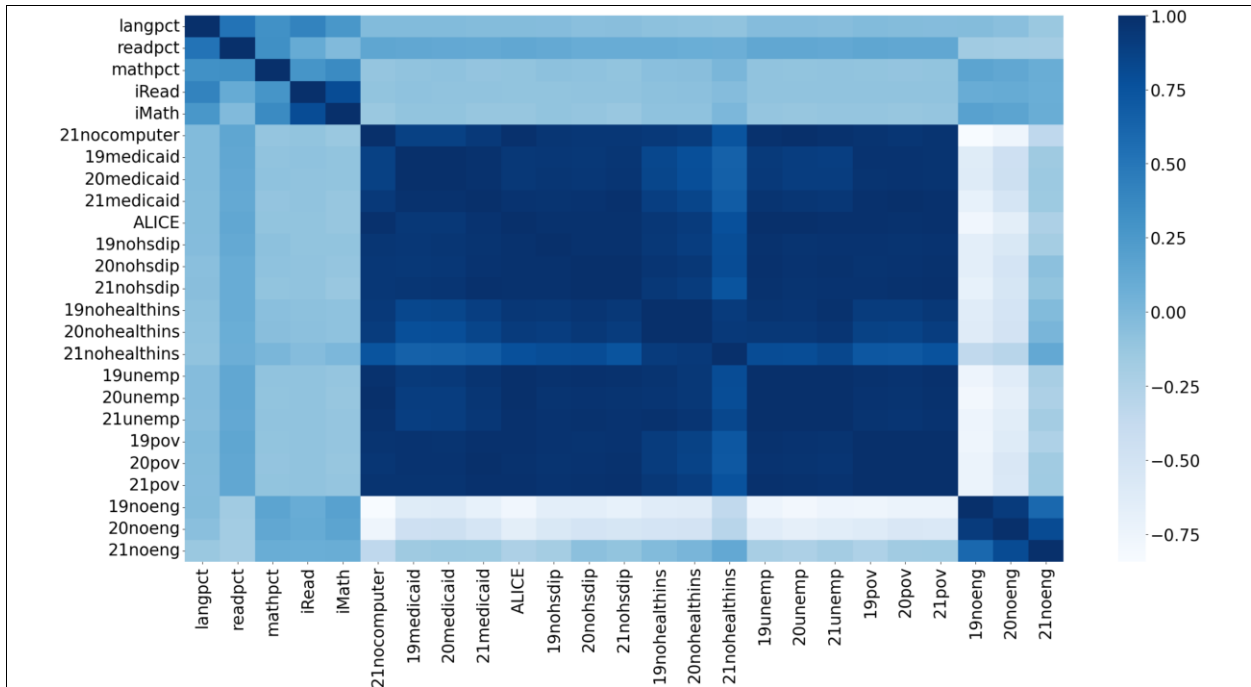
Figure 15. Correlation Matrix of Academic Scores and Neighborhood Factors in School A
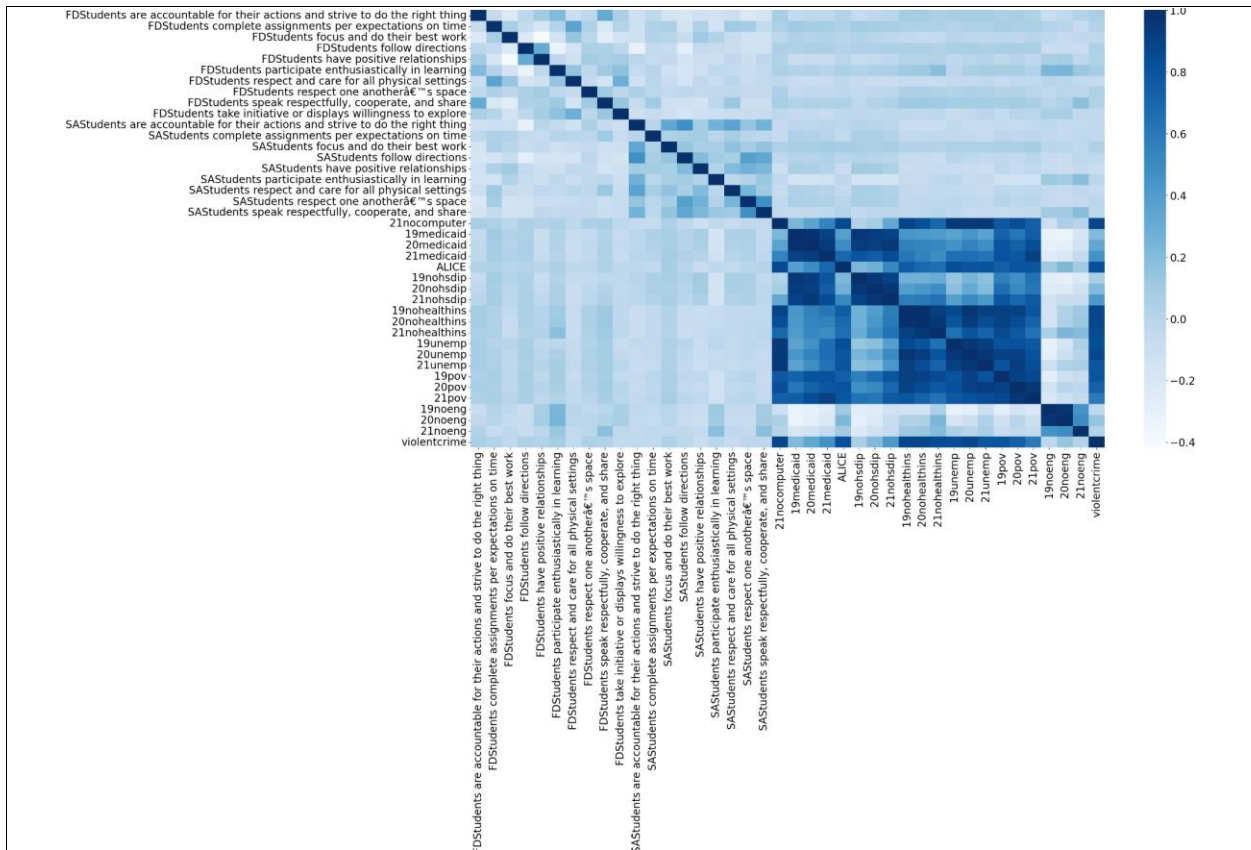
Figure 16. Correlation Matrix of Building Dreams Criteria and Neighborhood Factors in School B
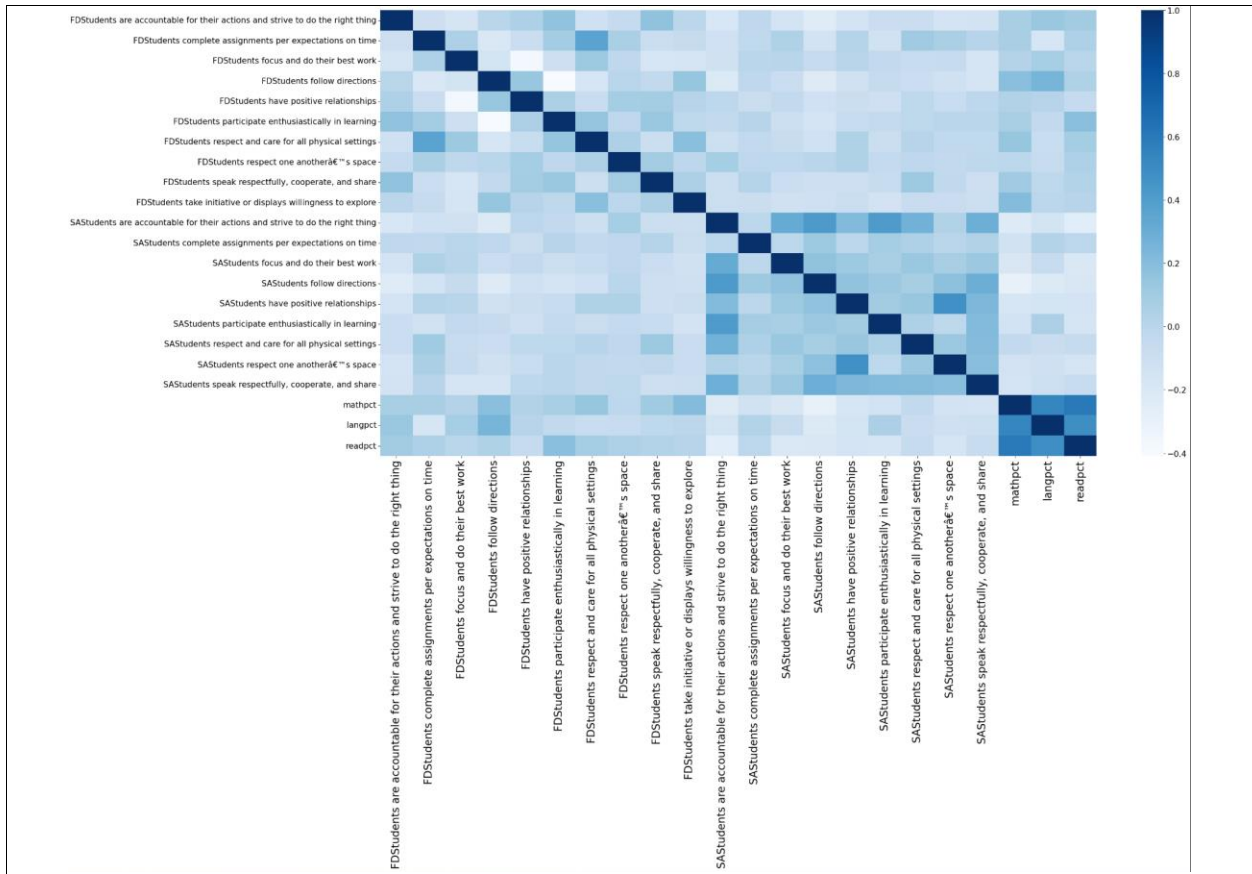
Figure 17. Correlation Matrix of Building Dreams Criteria and Academics in School B
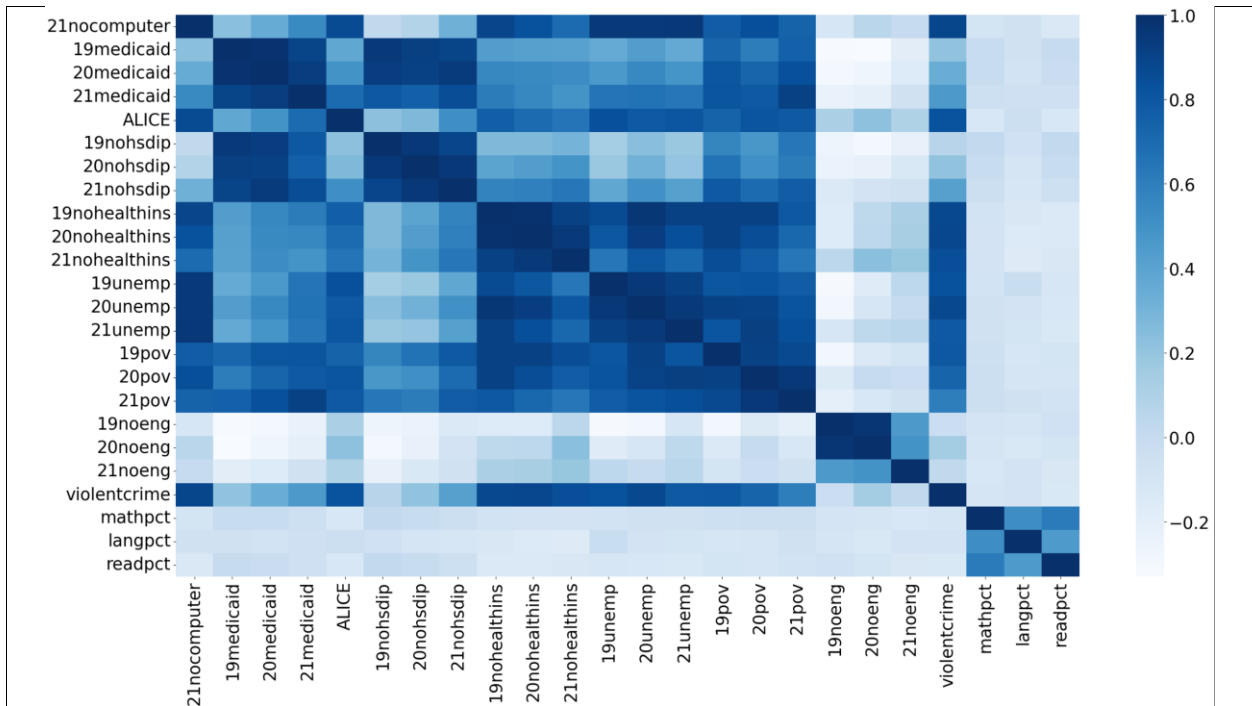
Figure 18. Correlation Matrix of Neighborhood Factors and Academics in School B

In these correlation matrixes, we see how each variable is related to the other on a numeric scale. For both schools, academic indicators and neighborhood factors have high correlations. Negatively observed behavior from both schools is also related, but not as strongly as neighborhood or academic data.

a. b.
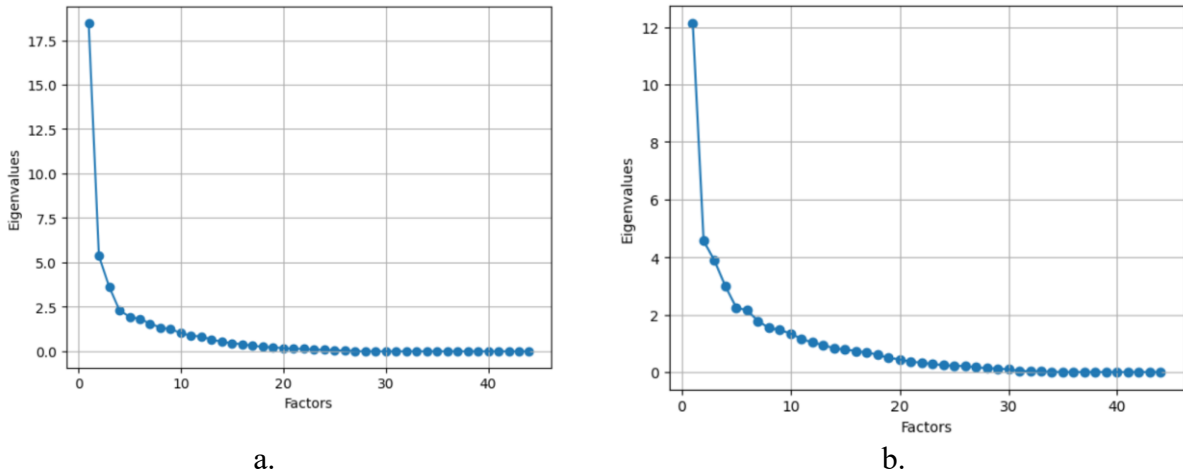
Figure 19. Scree plots for school A (a) and school B (b)

Figure 19(a) and Figure 19(b) provide a visualization of the Scree plot from exploratory factor analysis for both schools, determining the number of factors the factor analysis model is trained with. In the plots shown for School A and School B, there are 11 eigenvalues above 1, with the first factor absorbing the most variance. This determines the number of factors to be used in the factor analysis model. Once the number of factors is passed to the model, the factor loadings and variances are calculated to determine the underlying patterns in the data. Below, Table 2 displays each variable given to the model, including the type, the category, the variable name used in Table 3 and Table 4, the description of what the data means, and the source the data came from. These variable names will be used in Table 3 and Table 4 to describe which observed variables make up each factor loading.

Type	Type Category	Variable Name	Description	Source
Academic	In-Class Grade	AC1	Student language grade, as a percentage, for the fall 2023 semester	School A & B
Academic	In-Class Grade	AC2	Student read grade, as a percentage, for the fall 2023 semester	School A & B
Academic	In-Class Grade	AC3	Student math grade, as a percentage, for the fall 2023 semester	School A & B
Academic	Standardized Test Score	AC4	Student iRead for the fall 2023 semester	School A & B
Academic	Standardized Test Score	AC5	Student iMath for the fall 2023 semester	School A & B
Neighborhood	Violent crime	COM1	2021 violent crime rate by zip code	SAVI
Neighborhood	Connectivity at Home	COM2	2021 percentage of population in households with no computer or internet by zip code	SAVI
Neighborhood	Health	COM3	2019 percentage of noninstitutionalized population on Medicaid by zip code	SAVI
Neighborhood	Health	COM4	2020 percentage of noninstitutionalized population on Medicaid by zip code	SAVI
Neighborhood	Health	COM5	2021 percentage of noninstitutionalized population on Medicaid by zip code	SAVI
Neighborhood	Poverty	COM6	2021 percentage of households below the ALICE threshold by zip code	SAVI
Neighborhood	Education	COM7	2019 percentage of the population age 25 or older with no high school diploma by zip code	SAVI
Neighborhood	Education	COM8	2020 percentage of the population age 25 or older with no high school diploma by zip code	SAVI
Neighborhood	Education	COM9	2021 percentage of the population age 25 or older with no high school diploma by zip code	SAVI
Neighborhood	Health	COM10	2019 percentage of individuals with no health insurance by zip code	SAVI
Neighborhood	Health	COM11	2020 percentage of individuals with no health insurance by zip code	SAVI
Neighborhood	Health	COM12	2021 percentage of individuals with no health insurance by zip code	SAVI
Neighborhood	Unemployment	COM13	2019 unemployment rate of the labor force by zip code	SAVI
Neighborhood	Unemployment	COM14	2020 unemployment rate of the labor force by zip code	SAVI
Neighborhood	Unemployment	COM15	2021 unemployment rate of the labor force by zip code	SAVI
Neighborhood	Poverty	COM16	2019 poverty percentage by zip code	SAVI
Neighborhood	Poverty	COM17	2020 poverty percentage by zip code	SAVI
Neighborhood	Poverty	COM18	2021 poverty percentage by zip code	SAVI
Neighborhood	Education	COM19	2019 percentage of population ages 5 and older not proficient in English by zip code	SAVI
Neighborhood	Education	COM20	2020 percentage of population ages 5 and older not proficient in English by zip code	SAVI
Neighborhood	Education	COM21	2021 percentage of population ages 5 and over not proficient in English by zip code	SAVI
FFL	Behavioral engagement-individual	FD1	First Down- Students are accountable for their actions and strive to do the right thing	Building Dreams
FFL	Behavioral engagement-individual	FD2	First Down- Students complete assignments per expectations on time	Building Dreams
FFL	Emotional engagement	FD3	First Down- Students focus and do their best work	Building Dreams
FFL	Behavioral engagement-individual	FD4	First Down- Students follow directions	Building Dreams
FFL	Behavioral engagement-peer relationships	FD5	First Down- Students have positive relationships	Building Dreams
FFL	Behavioral engagement-individual	FD6	First Down- Students participate enthusiastically in learning	Building Dreams
FFL	Behavioral engagement-individual	FD7	First Down- Students respect and care for all physical settings	Building Dreams
FFL	Behavioral engagement-peer relationships	FD8	First Down- Students speak respectfully, cooperate, and share	Building Dreams
FFL	Cognitive engagement	FD9	First Down- Students take initiative or displays willingness to explore	Building Dreams
FFL	Behavioral engagement-individual	SA1	Sack- Students are accountable for their actions and strive to do the right thing	Building Dreams
FFL	Behavioral engagement-individual	SA2	Sack- Students complete assignments per expectations on time	Building Dreams
FFL	Emotional Engagement	SA3	Sack- Students focus and do their best work	Building Dreams
FFL	Behavioral engagement-individual	SA4	Sack- Students follow directions	Building Dreams
FFL	Behavioral engagement-peer relationships	SA5	Sack- Students have positive relationships	Building Dreams
FFL	Behavioral engagement-individual	SA6	Sack-Students participate enthusiastically in learning	Building Dreams
FFL	Behavioral engagement-individual	SA7	Sack- Students respect and care for all physical settings	Building Dreams
FFL	Behavioral engagement-peer relationships	SA8	Sack- Students respect one another's space	Building Dreams
FFL	Behavioral engagement-peer relationships	SA9	Sack- Students speak respectfully, cooperate, and share	Building Dreams

Table 2. Observed variables in each factor of the factor analysis model

Factor 1	**COM1**, **COM2**, **COM3**, **COM4**, **COM5**, **COM6**, **COM7**, **COM8**, **COM9**, **COM10**, **COM11**, **COM12**, **COM13**, **COM14**, **COM15**, **COM16**, **COM17**, **COM18**, COM19, COM20
Factor 2	FD1, **FD2**, FD3, **FD4**, FD6, **FD9**, AC2
Factor 3	FD3, FD5, FD7, **FD8**, AC1, AC3
Factor 4	COM12, COM19, **COM20**, **COM21**
Factor 5	AC1, AC3, **AC4**, **AC5**
Factor 6	SA6, SA7, AC3
Factor 7	FD4, FD5, FD6, FD7, SA8
Factor 8	FD3, SA1, SA9
Factor 9	**SA3**, SA4
Factor 10	SA5, AC1

Table 3. School A Observed Variables within each of the ten factors created through EFA. Bolded variables have a magnitude of 0.8 or greater

Factor 1	COM1, **COM2**, COM3, COM4, COM5, **COM6**, COM9, **COM10**, COM11, COM12, **COM13**, **COM14**, **COM15**, COM16, **COM17**, COM18
Factor 2	**COM3**, **COM4**, COM5, **COM7**, **COM8**, **COM9**, COM12, COM16, COM17, COM18
Factor 3	FD6, **COM19**, **COM20**, COM21
Factor 4	**SA1**, SA3, SA5, SA6
Factor 5	FD4, SA4, SA8, AC1, AC2, AC3
Factor 6	AC2, AC3, **AC4**, **AC5**
Factor 7	FD5, FD9, COM21, AC2
Factor 8	FD1, FD2, FD7
Factor 9	COM1, COM11, COM12
Factor 10	FD3, FD6, AC2
Factor 11	SA5, SA9, COM21
Factor 12	FD8, SA7

Table 4. School B Observed Variables within each of the twelve factors created through EFA. Bolded variables have a magnitude of 0.8 or greater

School A	Factor	p-value	School B	Factor	p-value
21nocomputer	F0	-	21nocomputer	F0	-
19medicaid	F0	0	19medicaid	F0	0
20medicaid	F0	6.92E-10	20medicaid	F0	0
21medicaid	F0	0	21medicaid	F0	0
ALICE	F0	0	ALICE	F0	0
21nohsdip	F0	0.003852	21nohsdip	F0	1.18E-09
19nohealthins	F0	0	19nohealthins	F0	0
20nohealthins	F0	0.999846	20nohealthins	F0	0
21nohealthins	F0	0.977982	21nohealthins	F0	0
19unemp	F0	0	19unemp	F0	0
20unemp	F0	0	20unemp	F0	0
21unemp	F0	0	21unemp	F0	0
19pov	F0	0	19pov	F0	0
20pov	F0	0	20pov	F0	0
21pov	F0	0.840799	21pov	F0	0
violent_crime	F0	0.990706	violentcrime	F0	0
19medicaid	F1	-	19medicaid	F1	-
20medicaid	F1	0.005468	20medicaid	F1	0
21medicaid	F1	0.650289	21medicaid	F1	0
21nohsdip	F1	0.009389	21nohsdip	F1	0
21nohealthins	F1	0.003226	21nohealthins	F1	0.000304
19pov	F1	0.054063	19pov	F1	0
20pov	F1	0.175223	20pov	F1	0
21pov	F1	0.558161	21pov	F1	0
19nohsdip	F1	0.002044	19nohsdip	F1	0
20nohsdip	F1	0.002032	20nohsdip	F1	0
FDStudents participate enthusiastically in learning	F2	-	FDStudents participate enthusiastically in learning	F2	-
19noeng	F2	0.011534	19noeng	F2	7.55E-05
20noeng	F2	0.0123	20noeng	F2	7.93E-05
mathpct	F3	-	mathpct	F3	-
readpct	F3	0.718213	readpct	F3	2.05E-05
iMath	F3	7.11E-06	iMath	F3	1.84E-06
iRead	F3	8.96E-07	iRead	F3	2.66E-06
SAStudents are accountable for their actions and strive to do the right thing	F4	-	SAStudents are accountable for their actions and strive to do the right thing	F4	-
SAStudents focus and do their best work	F4	0.631982	SAStudents focus and do their best work	F4	0.000735
SAStudents have positive relationships	F4	0.814637	SAStudents have positive relationships	F4	0.00039
SAStudents participate enthusiastically in learning	F4	0.063207	SAStudents participate enthusiastically in learning	F4	9.63E-08
mathpct	F5	0.506087	mathpct	F5	3.03E-06
FDStudents follow directions	F5	-	FDStudents follow directions	F5	-
SAStudents follow directions	F5	0.175997	SAStudents follow directions	F5	1.78E-05
SAStudents respect one another's space	F5	0.101443	SAStudents respect one another's space	F5	0.026444
langpct	F5	0.001453	langpct	F5	5.36E-08
readpct	F6	0.071973	readpct	F6	0.111138
FDStudents have positive relationships	F6	-	FDStudents have positive relationships	F6	-
FDStudents take initiative or displays willingness to explore	F6	0.053861	FDStudents take initiative or displays willingness to explore	F6	0.003411
21noeng	F6	0.082464	21noeng	F6	0.003094
FDStudents are accountable for their actions and strive to do the right thing	F7	-	FDStudents are accountable for their actions and strive to do the right thing	F7	-
FDStudents complete assignments per expectations on time	F7	3.04E-09	FDStudents complete assignments per expectations on time	F7	0.030041
FDStudents respect and care for all physical settings	F7	0.163412	FDStudents respect and care for all physical settings	F7	0.013882
20nohealthins	F8	-	20nohealthins	F8	-
21nohealthins	F8	0.963125	21nohealthins	F8	0
21pov	F8	0.963058	21pov	F8	4.22E-09
violent_crime	F8	0.963062	violentcrime	F8	3.34E-06
SAStudents have positive relationships	F9	-	SAStudents have positive relationships	F9	-
21noeng	F9	0.880178	21noeng	F9	0.03838
SAStudents speak respectfully cooperate and share	F9	0.819668	SAStudents speak respectfully cooperate and share	F9	0.035079
FDStudents speak respectfully cooperate and share	F10	-	FDStudents speak respectfully cooperate and share	F10	-
SAStudents respect and care for all physical settings	F10	0.106702	SAStudents respect and care for all physical settings	F10	0.202804

Table 5. School A and B Factor Comparison from SEM

In exploratory factor analysis, unobserved, latent variables create commonalities between the observed data and categorize the data into fewer variables. Both School A and School B have latent variables made up of similar observed variables. When running SEM on both schools, 11 factors are created, as seen in Table 5. *School A and B Factor Comparison from SEM*. Factors 1, 2, and 9 both consist of solely neighborhood factors, and can be defined as neighborhood adversity. Poverty from 2019-2021 was not as significant in Factor 2 from School A, but the poverty measures were still listed as observed variables in the factor from EFA. Factor 3 consisted of neighborhood and engagement variables. This factor represents the relationship of students that are from areas of low English proficiency and their ability to participate enthusiastically in class. When proficiency increases, enthusiastic participation also increases. Factor 4 represents students' math and reading success. In-class reading grades were not as significant at School A, but iRead scores were to follow the factor label. In Factor 5 labelled negative classroom engagement, consists of negative behavioral indicators. School B has four significant indicators of negative classroom engagement, while School A only has one indicator for student accountability. Factor 6 indicates student respect and in-class grades. When students follow directions and respect each other, language grades increase in both schools and math grades increase in School B. Factor 7 ties neighborhood, peer relations, engagement, and academic outcomes together into one factor. For both School A and School B, in-class reading percentage had a p-value above 0.05, decreasing its significance. However, it was still listed within the factor after EFA for School B. This factor shows the connection between in-class reading grades, cognitive engagement, peer relationships, and 2021 levels of English proficiency in the neighborhood. Factor 8 represents individual behavioral engagement. Factor 10 draws a relationship between peer relationships and 2021 proficiency in English. Lastly, Factor 11

represents student respect. There are differences in each observed variable's significance with each factor between the two schools. This could be due to the way teachers report student behavior, but it gives schools valuable information over the ways they can improve engagement within the classroom. The bullet points below outline the differences between the schools' factors.

- 2020 and 2021 population with no health insurance, 2021 poverty rate, and 2021 violent crime rates not significant in School A but are for School B in Factor 1.

- 2021 population on Medicaid and 2019-2021 poverty rates not significant for Factor 1 at School A.

- In-class reading grade not significant in Factor 4 at School A.

- Three of the four negative behavioral indicators at School A are not significant for Factor 5, but are for School B.

- Math percentage and both negative behavioral indicators are not significant in School A for Factor 6.

- The cognitive engagement indicator and 2021 neighborhood proficiency in English are not significant at School A in Factor 7.

- The positive indicator for student respect and care for physical setting at School A in Factor 8 is not significant.

- 2021 neighborhood proficiency in English and the negative indicator for students speaking respectfully are not significant in School A for Factor 10.

	1	2	3	4	5	6	7	8	9	10
Sum of Squared Loadings	17.94	4.35	2.73	2.46	2.04	1.55	1.52	1.41	1.38	0.69
Proportional Variance	0.408	0.099	0.062	0.056	0.046	0.035	0.035	0.032	0.031	0.016
Cumulative Variance	0.408	0.507	0.569	0.625	0.671	0.706	0.741	0.773	0.804	0.820

Table 6. School A Factor Analysis Variances

	1	2	3	4	5	6	7	8	9	10	11	12
Sum of Squared Loadings	9.87	5.76	2.41	2.22	2.20	2.19	1.85	1.77	1.32	1.10	1.10	0.98
Proportional Variance	0.224	0.131	0.055	0.050	0.05	0.05	0.042	0.040	0.030	0.025	0.025	0.022
Cumulative Variance	0.224	0.355	0.410	0.460	0.51	0.56	0.602	0.643	0.673	0.698	0.723	0.745

Table 7. School B Factor Analysis Variances

The best performing model consisted of the combination of observed variables that produced the highest KMO value and highest cumulative variance. Both schools had a Bartlett sphericity score of 0. In Table 6, School A's KMO values and cumulative variance were 0.62 and 82.0%, respectively. In *Table 7*, School B's KMO value was 0.56 and the cumulative variance was 74.5%. With KMO values above 0.5 and 82% of the data explained in School A explained by the data and 74.5% of the data in School B explained by the data, these tests are significant.

Discussion

While there is a multitude of research on the impacts of different neighborhood factors on student peer relationships (South et al., 2003; Caldas et al., 2019; Cooley-Quielle et al., 1995), academic performance (Hardaway et al., 2014; Wang et al., 2020; Milan et al., 2010), and academic engagement, (Wadsworth et al., 2008; Solem and Vaughan, 2023; Vogel et al., 2023) individually, there is a lack of research that looks at many specific neighborhood factors like poverty, unemployment, connectivity at home, parent education level, access to healthcare, and

violence and how they all relate to academic performance as determined by standardized test scores and in-class subject scores, and academic engagement and peer interaction determined by teacher recordings of student behavior in class based on the Fight for Life SEL criteria. Our work identifies how all the external neighborhood factors impact the student's internal experience in school. The factor analysis model indicated that the factors created accounted for 82.0% of the variance of schooling success for students in School A and 74.5% of the variance of schooling success for students in School B. The findings indicate only that our data found some correlation between adverse neighborhood factors and grade 3-6 students' schooling success when examining neighborhood, relationship, academic, and engagement data.

In this study, all four hypotheses were found to be significant. Factor 3 represents the relationship of students that are from areas of low English proficiency and their ability to participate enthusiastically in class, Factor 6 indicates student respect in the classroom and in-class grades, Factor 7 ties neighborhood, peer relations, engagement, and academic outcomes together into one factor, and Factor 10 draws a relationship between peer relationships and 2021 proficiency in English. From these four factors, we see overlap of neighborhood, academic, engagement, and peer relationships.

This study has some limitations that should not go unmentioned. Academic performance data was observed at the school for only one year, limiting the study to a cross-sectional analysis. In School B, there were too few recorded behaviors in the First Down—Respect for one another's space category. Once this measure was deleted in School B, it was also deleted in School A to match the two schools to each other. At School B, standardized test scores were only given for students grades three through seven. School A included student records for grades Kindergarten through two, but these were deleted to match School B. The study was also

correlative because students nor staff were surveyed, meaning no causal conclusions could be made. As with many behavioral studies, concluding from just a few outside factors may not directly impact the student's behaviors, but those overlying factors could cause their home life to be more adverse, negatively affecting their behavior in school. There are also many other external factors where data could relate to the student's behavior in class, but this data at the zip code level was not available. Additionally, there are ongoing efforts to standardize how the data is reported, but implementation across schools is different, creating some inconsistencies. However, the Building Dreams platform has developed over several years and all staff and teachers must participate in a rigorous training program with yearly updates, to meet the accuracy and consistency standards that allow us to use the data in our analysis. The two schools in this study are the most proactive in their recordings and training on the Building Dreams platform.

Overall, this study explored the impact of neighborhood factors on grade three through six student relationships with peers, academic performance, and in-class engagement within urban, low-income schools that exist in underserved areas of the communities. This study was the first of its kind to relate student engagement and peer relationship data from the Building Dreams platform, academic performance from standardized test scores and in-class grades, and neighborhood factors on the zip code level. While not proven, significant support was found for the hypotheses that adverse neighborhood factors negatively affect student academic outcomes, student academic engagement, and student-peer relationships, and neighborhood factors and observable student behaviors are related to academic performance.

Future Work

In this work, we analyzed a semester's worth of data in two schools within Indianapolis. Future work could focus on the implications of other academic indicators or Fight for Life criteria. It could also include more than one semester or add more IPS schools to the study. To break down the study even more, the study could just focus on FFL indicators and how they impact student attendance, grades, and test scores.

References

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First-grade classroom behavior: Its short- and long-term consequences for school performance. *Child Development*, *64*(3), 801–814. https://doi.org/10.2307/1131219

Allison, M., Elliott, A., Lerner, M., De Pinto, C.D., Beers, N.S., Gibson, E.J., Gorski, P., Kjolhede, C., O'Leary, S.C., Schumacher, H., Weiss-Harrison, A. (2019). The link between school attendance and good health. *Pediatrics*, *143*(2). https://doi.org/10.1542/peds.2018-3648

Bonacini, L., Murat, M. (2022). Beyond the COVID-19 pandemic: Remote Learning and Education Inequalities. *Empirica, 50(1)*, 207-236. https://doi.org/10.1007/s10663-022-09556-7

Bowen, F., Gentle-Genitty, C., Siegler, J., & Jackson, M. (2022). Revealing underlying factors of absenteeism: A machine learning approach. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.958748

Bowen, G. L., & Van Dorn, R. A. (2002). Community violent crime rates and school danger. *Children & Schools*, *24*(2), 90–104. https://doi.org/10.1093/cs/24.2.90

Bowen, N. K., & Bowen, G. L. (1999). Effects of crime and violence in neighborhoods and schools on the school behavior and performance of adolescents. *Journal of Adolescent Research*, *14*(3), 319–342. https://doi.org/10.1177/0743558499143003

Caldas, S. J., Gómez, D. W., & Ferrara, J. A. (2019). A comparative analysis of the impact of a full-service community school on student achievement. *Journal of Education for Students Placed at Risk*, *24*(3), 197–217. https://doi.org/10.1080/10824669.2019.1615921

Centers for Disease Control and Prevention. (2022). Healthy Schools: Health and Academics. CDC. https://www.cdc.gov/healthyschools/health_and_academics/index.htm

Chen, G. (2008). Communities, students, schools, and school crime. *Urban Education*, *43*(3), 301–318. https://doi.org/10.1177/0042085907311791

Cooley-Quille, M. R., Turner, S. M., & Beidel, D. C. (1995). Emotional impact of children's exposure to community violence: A preliminary study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *34*(10), 1362–1368. https://doi.org/10.1097/00004583-199510000-00022

Di Pietro, G. (2023). The impact of Covid-19 on student achievement: Evidence from a recent meta-analysis. *Educational Research Review*, *39*, 100530. https://doi.org/10.1016/j.edurev.2023.100530

Dubow, E. F., Edwards, S., & Ippolito, M. F. (1997). Life stressors, neighborhood disadvantage, and resources: A focus on inner-city children's adjustment. *Journal of Clinical Child Psychology*, *26*(2), 130–144. https://doi.org/10.1207/s15374424jccp2602_2

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-

based Universal Interventions. *Child Development*, *82*(1), 405–432.

https://doi.org/10.1111/j.1467-8624.2010.01564.x

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac
Iver, D. (1993). Development during adolescence: The impact of stage-environment fit on
young adolescents' experiences in schools and in families. *American Psychologist*, *48*(2),
90–101. https://doi.org/10.1037/0003-066x.48.2.90

Farahmand, F. K., Grant, K. E., Polo, A. J., Duffy, S. N., & DuBois, D. L. (2011). School-Based
mental health and behavioral programs for low-income, urban youth: A systematic and
Meta-analytic review. *Clinical Psychology: Science and Practice*, *18*(4), 372–390.
https://doi.org/10.1111/j.1468-2850.2011.01265.x

Finn, J. D., Pannozzo, G. M., & Voelkl, K. E. (1995). Disruptive and inattentive-withdrawn
behavior and achievement among fourth graders. *The Elementary School Journal*, *95*(5),
421–434. https://doi.org/10.1086/461853

Frasquilho, D., de Matos, M. G., Santos, T., Gaspar, T., & Caldas de Almeida, J. M. (2016).
Unemployment as a source of mental distress to individuals and their family: Unemployed
parents' perceptions during the economic recession. *International Journal of Social
Psychiatry*, *62*(5), 477–486. https://doi.org/10.1177/0020764016650469

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the
concept, state of the evidence. *Review of Educational Research*, *74*(1), 59–109.
https://doi.org/10.3102/00346543074001059

Fundamentals of sel. CASEL. (n.d.). Retrieved April 8, 2023, from

https://casel.org/fundamentals-of-sel/

Gremmen, M. C., van den Berg, Y. H. M., Steglich, C., Veenstra, R., & Dijkstra, J. K. (2018).
The importance of near-seated peers for elementary students' academic engagement and
achievement. *Journal of Applied Developmental Psychology*, *57*, 42–52.
https://doi.org/10.1016/j.appdev.2018.04.004

Hardaway, C. R., Larkby, C. A., & Cornelius, M. D. (2014). Socioemotional adjustment as a
mediator of the association between exposure to community violence and academic
performance in low-income adolescents. *Psychology of Violence*, *4*(3), 281–293.
https://doi.org/10.1037/a0036375

Hawkins, J. D., Kosterman, R., Catalano, R. F., Hill, K. G., & Abbott, R. D. (2008). Effects of
social development intervention in childhood 15 years later. *Archives of Pediatrics &
Adolescent Medicine*, *162*(12), 1133–1141. https://doi.org/10.1001/archpedi.162.12.1133

Hemi, A., Madjar, N., & Rich, Y. (2021). Perceived peer and teacher goals: Relationships with
students' academic achievement goals. *The Journal of Experimental Education*, *91*(1),
145–165. https://doi.org/10.1080/00220973.2021.1906199

Hill, H. M., Levermore, M., Twaite, J., & Jones, L. P. (1996). Exposure to community violence
and social support as predictors of anxiety and social and emotional behavior among
African American children. *Journal of Child and Family Studies*, *5(4)*, 399–414.
https://doi.org/10.1007/bf02233862

Huck, C., Zhang, J. (2021). Effects of the COVID-19 pandemic on K-12 education: A systematic literature review. *Educational Research and Development Journal, 24(1)*, 53-84.

Hudley, C. (2013, May). *Education and urban schools*. The SES Indicator. Retrieved April 10, 2023, from https://www.apa.org/pi/ses/resources/indicator/2013/05/urban-schools

Ladd, G. W., Herald-Brown, S. L., & Reiser, M. (2008). Does chronic classroom peer rejection predict the development of childrens classroom participation during the grade school years? *Child Development*, *79*(4), 1001–1015. https://doi.org/10.1111/j.1467-8624.2008.01172.x

Lee, J.-S. (2013). The relationship between student engagement and academic performance: Is it a myth or reality? *The Journal of Educational Research*, *107*(3), 177–185. https://doi.org/10.1080/00220671.2013.807491

Li, Y., & Lerner, R. M. (2011). Trajectories of school engagement during adolescence: Implications for grades, depression, delinquency, and substance use. *Developmental Psychology*, *47*(1), 233–247. https://doi.org/10.1037/a0021307

Masten, A. S., Roisman, G. I., Long, J. D., Burt, K. B., Obradović, J., Riley, J. R., Boelcke-Stennes, K., & Tellegen, A. (2005). Developmental cascades: Linking academic achievement and externalizing and internalizing symptoms over 20 years. *Developmental Psychology*, *41*(5), 733–746. https://doi.org/10.1037/0012-1649.41.5.733

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in Social

Networks. *Annual Review of Sociology*, *27*, 415–444.

https://doi.org/10.1146/annurev.soc.27.1.415

Meyer-Adams, N., & Conner, B. T. (2008). School violence: Bullying behaviors and the

Psychosocial School Environment in Middle Schools. *Children & Schools*, *30*(4), 211–

221. https://doi.org/10.1093/cs/30.4.211

Milam, A. J., Furr-Holden, C. D., & Leaf, P. J. (2010). Perceived school and neighborhood

safety, neighborhood violence and academic achievement in Urban School Children. *The*

Urban Review, *42*(5), 458–467. https://doi.org/10.1007/s11256-010-0165-7

Moreira, P. A. S., Dias, A., Matias, C., Castro, J., Gaspar, T., & Oliveira, J. (2018). School

effects on students' engagement with school: Academic performance moderates the effect

of school support for learning on students' engagement. *Learning and Individual*

Differences, *67*, 67–77. https://doi.org/10.1016/j.lindif.2018.07.007

Niehaus, K. & Adelson, J. (2014). School support, parental involvement, and academic and

social-emotional outcomes for English language learners. *American Educational Research*

Journal, *51*(4), 810-844. https://doi.org/10.3102/0002831214531323

Ogundari, K. (2023). Student access to technology at home and learning hours during COVID-19

in the U.S. *Educational Research for Policy and Practice*, 1–18.

https://doi.org/10.1007/s10671-023-09342-7

Ryan, A. M. (2001). The peer group as a context for the development of young adolescent

    motivation and achievement. *Child Development*, *72*(4), 1135–1150.

    https://doi.org/10.1111/1467-8624.00338

SAVI. (2023). About Us. https://www.savi.org/about-us/

SAVI. (n.d.) Community profiles. https://profiles.savi.org/

Snipes, J. C., & Casserly, M. D. (2004). Urban school systems and education reform: Key

    lessons from a case study of large urban school systems. *Journal of Education for Students*

    Placed at Risk, *9*(2), 127–141. https://doi.org/10.1207/s15327671espr0902_3

Solem, M., & Vaughan, P. (2023). Reducing inequality in student outcomes in U.S. geography

    education: The importance of understanding student attitudes. *Education Sciences, 14*(1),

    https://doi.org/10.3390/educsci14010009

Sommers, B.D., & Oellerich, D. (2013). The poverty-reducing effect of Medicaid. *Journal of*

    Health Economics, 32, 816-832. https://doi.org/10.1016/j.jhealeco.2013.06.005

South, S. J., Baumer, E. P., & Lutz, A. (2003). Interpreting community effects on youth

    educational attainment. *Youth & Society*, *35*(1), 3–36.

    https://doi.org/10.1177/0044118x03254560

Thompson, T., & Massat, C. R. (2005). Experiences of violence, post-traumatic stress, academic

    achievement and Behavior Problems of Urban African-American children. *Child and*

    Adolescent Social Work Journal, *22*(5-6), 367–393. https://doi.org/10.1007/s10560-005-

    0018-5

Vogel, S. N. T., Stang-Rabrig, J., McElvany. N. (2023). The importance of parents for key

    outcomes among socio-economically disadvantaged students: Parents' role in emergency

    remote education. *Social Psychology of Education, 26(6)*, 1565-1591.

    https://doi.org/10.1007/s11218-023-09801-2

Wadsworth, M. E., Raviv, T., Reinhard, C., Wolff, B., Santiago, C. D. C., & Einhorn, L. (2008).

    An indirect effects model of the association between poverty and child functioning: The

    role of children's poverty-related stress. *Journal of Loss and Trauma*, *13*(2-3), 156–185.

    https://doi.org/10.1080/15325020701742185

Wang, M.-T., & Eccles, J. S. (2011). Adolescent behavioral, emotional, and cognitive

    engagement trajectories in school and their differential relations to educational success.

    Journal of Research on Adolescence, *22*(1), 31–39. https://doi.org/10.1111/j.1532-

    7795.2011.00753.x

Wang, M. T., & Eccles, J. S. (2012). Social Support Matters: Longitudinal effects of social

    support on three dimensions of school engagement from middle to high school. *Child

    Development*, *83*(3), 877–895. https://doi.org/10.1111/j.1467-8624.2012.01745.x

Wang, W., Dong, Y., Liu, X., Bai, Y., Zhang, L. (2020). The effect of parents' education on the

    academic and non-cognitive outcomes of their children: Evidence from China. *Children

    and Youth Services Review, 117*, 105307-105218.

    https://doi.org/10.1016/j.childyouth.2020.105307

Wentzel, K. R. (1998). Social relationships and motivation in middle school: The role of parents,

    teachers, and peers. *Journal of Educational Psychology*, *90*(2), 202–209.

    https://doi.org/10.1037/0022-0663.90.2.202

Winsler, A., Rozell, N., Tucker, T. L., & Norvell, G. (2023). Earlier mastery of English predicts

    5th Grade academic outcomes for low-income dual language learners in Miami,

    USA. *Bilingualism: Language and Cognition*, *26*(5), 910–

    923. https://doi.org/10.1017/S136672892300007X

The Polis Center. (n.d.). *What we do*. https://polis.iupui.edu/what-we-do/

Yoshikawa, H., Aber, J. L., & Beardslee, W. R. (2012). The effects of poverty on the mental,

    emotional, and behavioral health of children and youth: Implications for prevention.

    American Psychologist, *67*(4), 272–284. https://doi.org/10.1037/a0028015

Yu, X., Wang, X., Zheng, H., Zhen, X., Shao, M., Wang, H., & Zhou, X. (2023). Academic

    achievement is more closely associated with student-peer relationships than with student-

    parent relationships or student-teacher relationships. *Frontiers in Psychology*, *14*.

    https://doi.org/10.3389/fpsyg.2023.1012701