

# Evaluating Lunch Plan Data in the St. Charles School District (SCSD)



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## Abstract

The SCSD is a public school district in St. Charles, with, on average, 4500 students a year. The SCSD is subdivided into an early childhood center, six elementary schools, two intermediate (5-6,7-8) schools, and two high schools. Vocational schools are also within this district but were not included in this report. The SCSD is concerned with the impact of the Covid-19 pandemic on their district's population and on the number of students that needed assistance with lunch. They have asked Lindenwood's 2024-25 PIC Math group to analyze their data from the years 2020-25 and identify any trends. Identifying these trends may help the client understand which areas in the school district are most likely to need financial aid, and which locations were most greatly impacted by the pandemic. So far, the group has analyzed the data to understand the retention rates and distribution of meal statuses and student populations across the 5-year period, as well as using ArcGIS and R programming software to generate various graphs and maps of the SCSD area. We focused our analysis and observations on these key areas employing statistical and data analysis skills to draw our conclusions.

## Meal Status by Population and Distribution

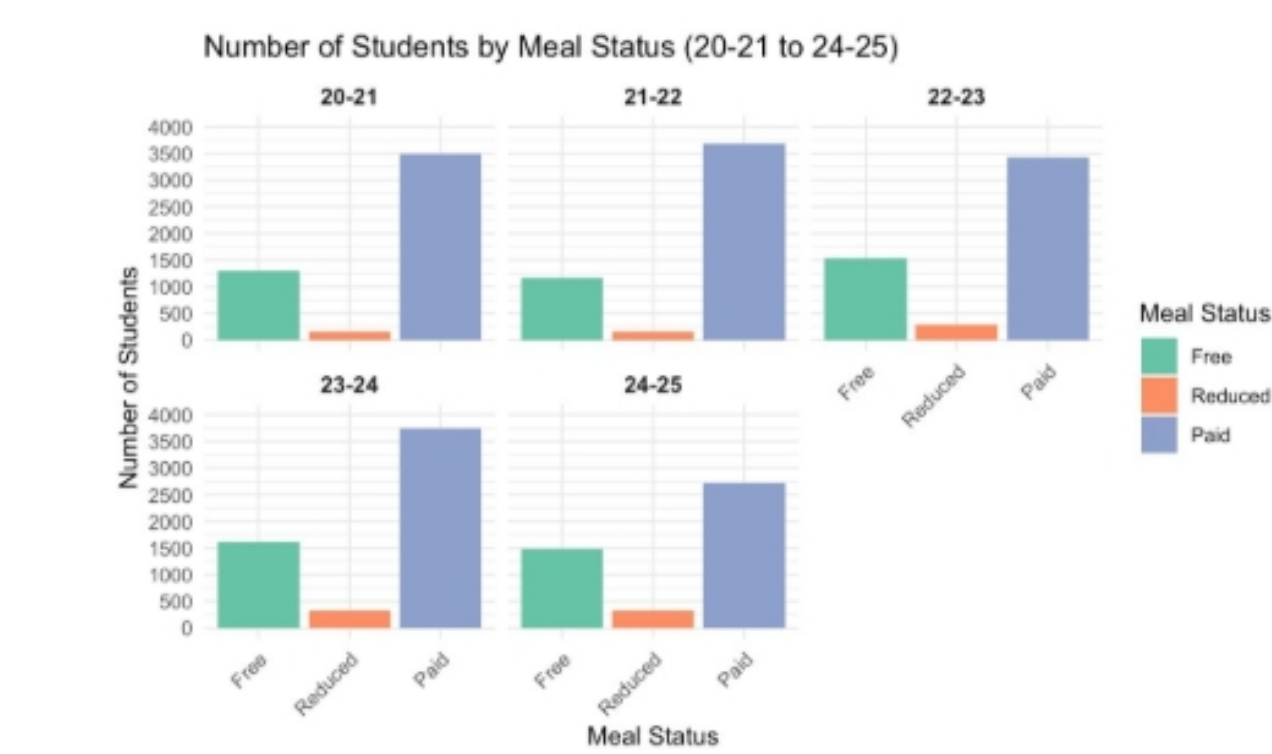


Figure 1. Meal Status vs Number of Students by Year

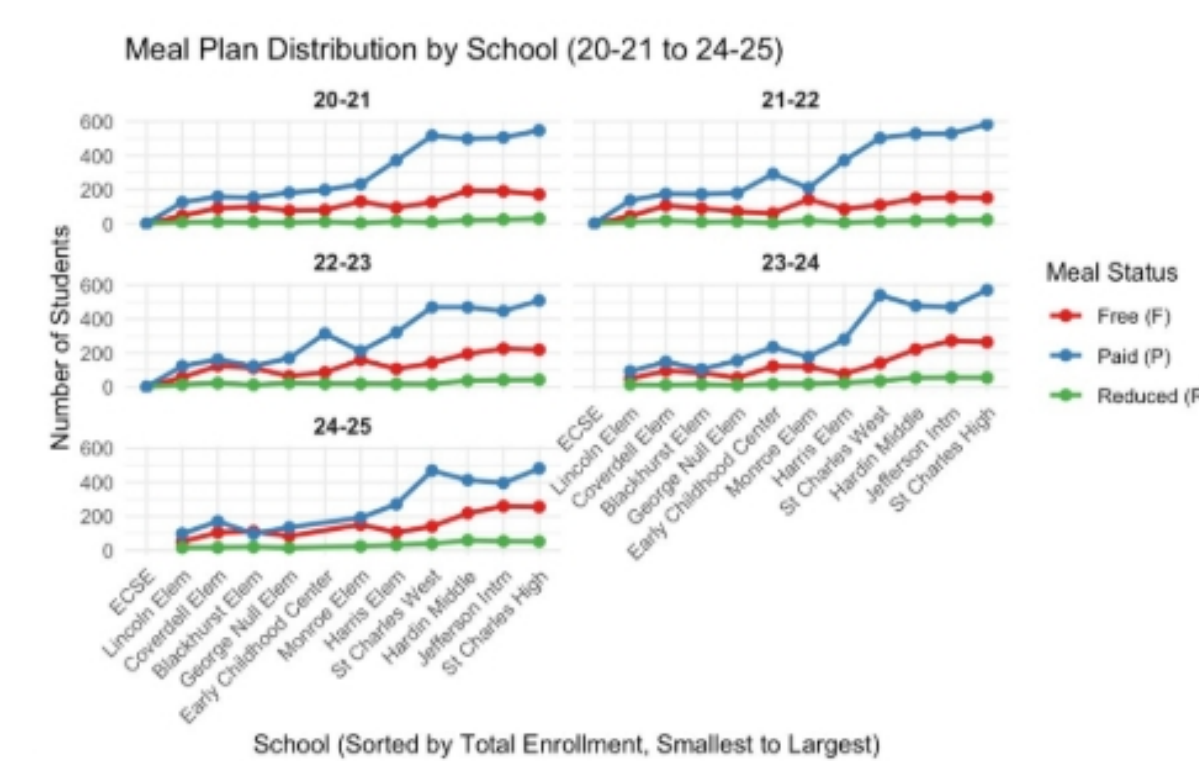


Figure 2. Meal Plan Distribution by Schools

## Insight on Grade Meal Plan Distribution

**Paid Students in the Majority:** In each year, the Paid bar is the tallest, reflecting that Paid students (S+P) make up the largest group (e.g., 3499 in 2020-21, 3744 in 2023-24). However, the Paid count drops significantly in 2024-25 to 2724, a decrease of 1020 students (27.24% drop), aligning with the overall 20.3% enrollment drop.

**Free Students Increase in Count Until 2023-24:** The Free bar grows from 1301 in 2020-21 to 1620 in 2023-24, then slightly decreases to 1483 in 2024-25. Despite the count drop, Free students become a larger proportion of the total in 2024-25 (32.70%).

**Reduced Students Grow Steadily:** The Reduced bar, the shortest in each year, grows steadily from 149 in 2020-21 to 329 in 2023-24, then remains nearly stable at 328 in 2024-25, reflecting increased eligibility over time (from 3.01% to 7.23%).

**2024-25 Enrollment Drop:** The 2024-25 subplot shows a noticeable decrease in all bars, especially Paid, due to the 20.3% enrollment drop (from 5693 to 4535 students). Paid students were the most likely to leave (58.41% retention), while Free (65.19%) and Reduced (81.16%) students were more likely to stay.

## Exploring Meal Status Distribution with GIS

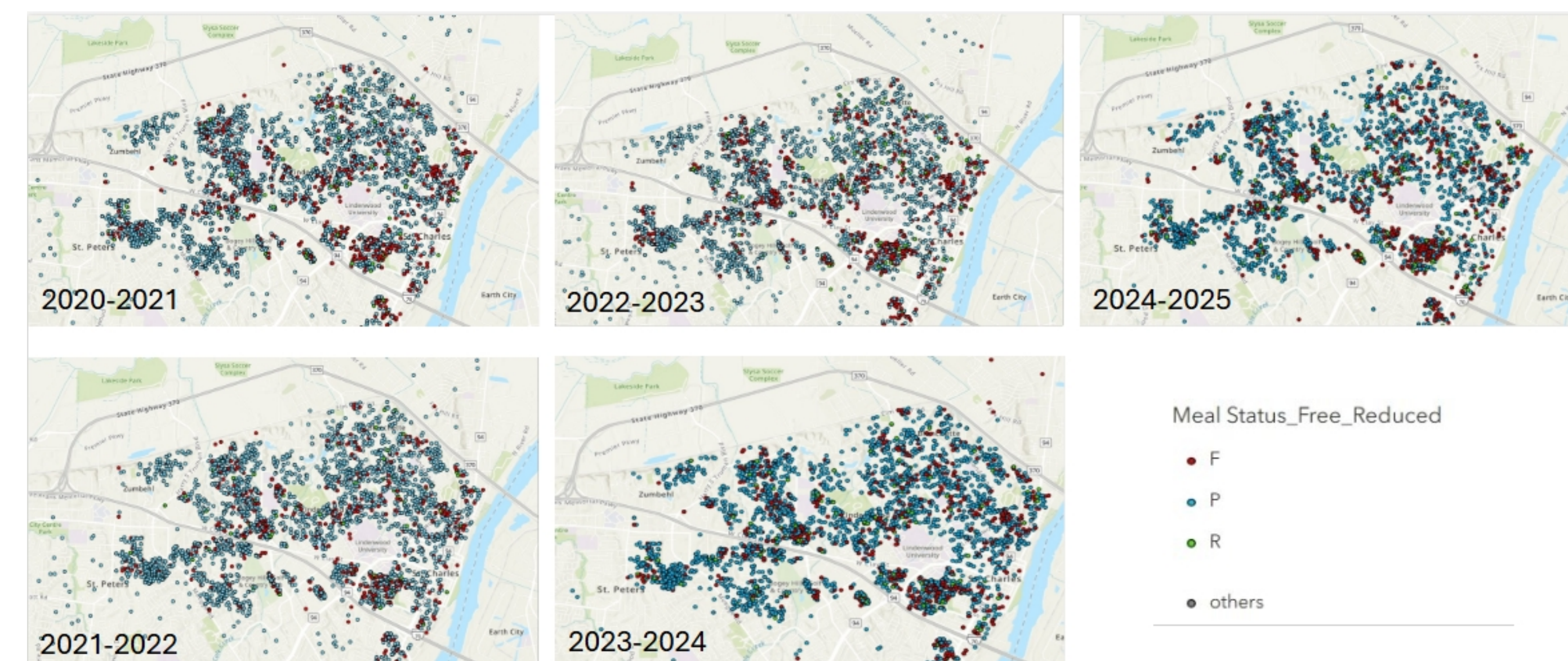


Figure 3. ArcGIS Mapping

## District Lines for the SCSD

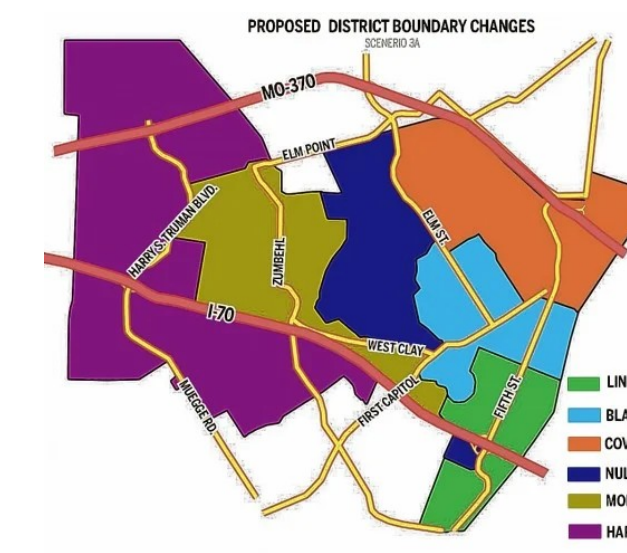


Figure 4. SCSD District Lines

## Analysis of GIS Mapping

**Reference:** Note that Figure 4 was obtained from stltoday.com

**School vs Meal Status:** In 2021-22, large clusters of Free meal recipients appeared in central and southern parts of St. Charles, mainly within the lines of Blackhurst Elementary, Lincoln Elementary, and Monroe Elementary, indicating these may be lower-income neighborhoods. These areas showed signs of economic strain following the Pandemic. By 2023-2025, there is a noticeable increase in Paid (P/S) meal statuses, indicating partial economic recovery. However, many red clusters remain, especially in the same high-need zones, revealing persistent inequality. Throughout all the years, the regions with the highest concentrations of free and reduced meals remained largely consistent, suggesting structural issues in food access and income disparities. The use of graduated symbol sizes in each map effectively shows where the highest densities of affected students are located, helping stakeholders target interventions.

## Meal Status Retention

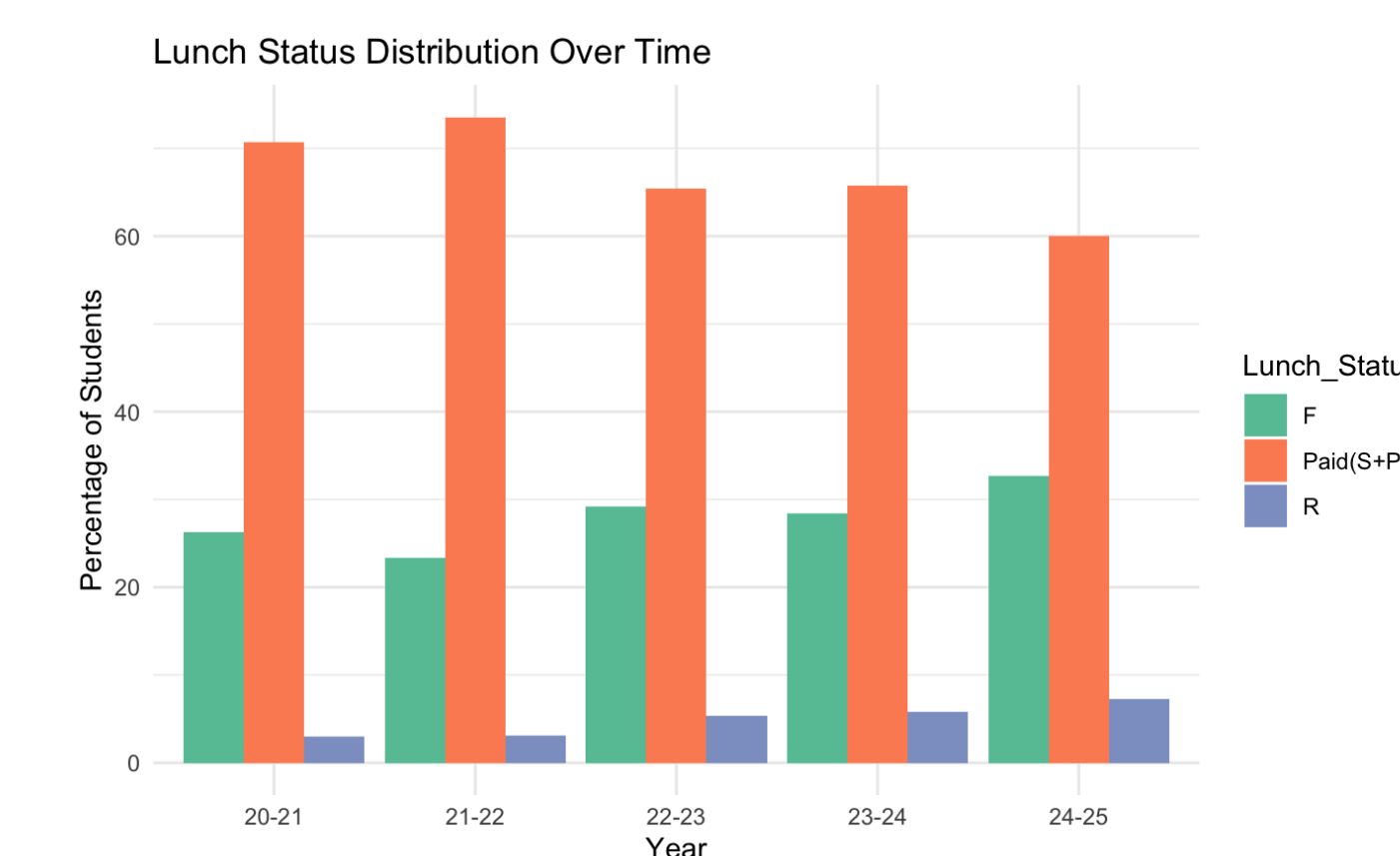


Figure 5. Meal Status Retention Rates by Year

## Grade/Population Distribution and Retention

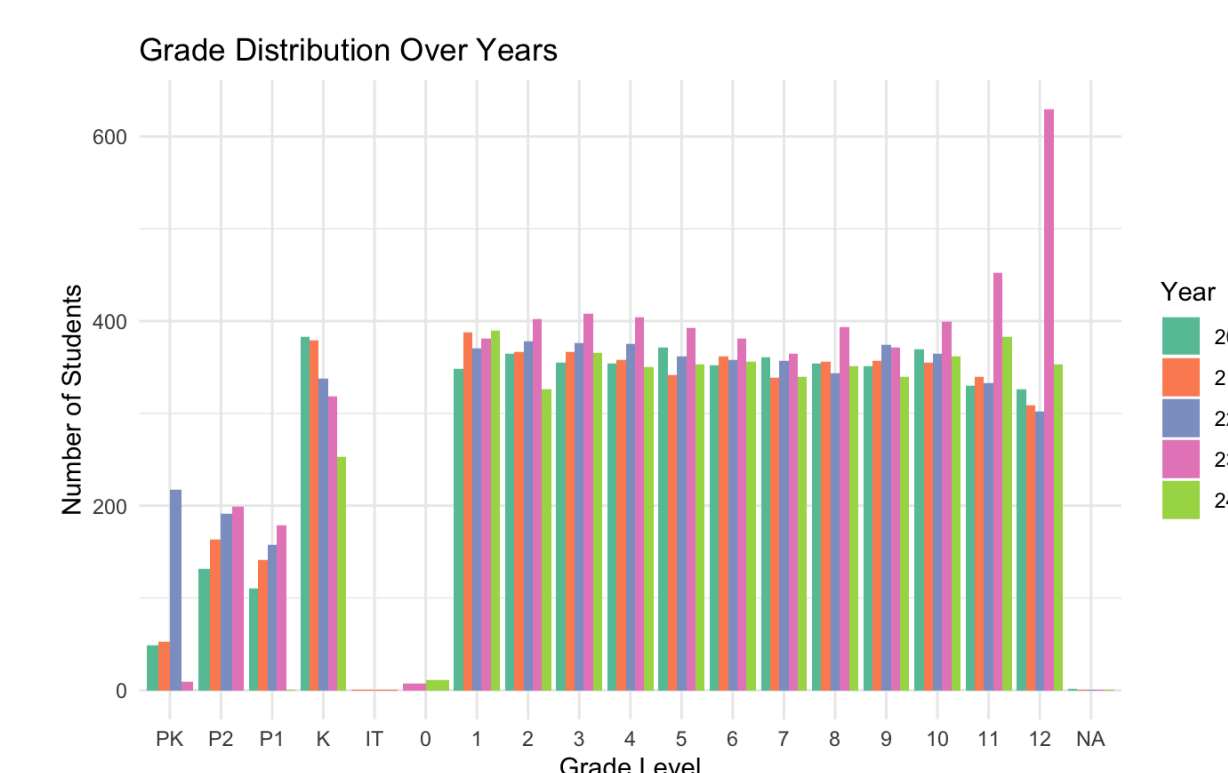


Figure 6. Grade Level Distribution by Year

Year	Total Students
20-21	4912
21-22	4978
22-23	5198
23-24	5693
24-25	4536

Figure 7. Total Population per Year

## Analysis of Retention Rates

**Lunch Status Trends:** Free lunch students decreased from 26.29% (1301) in 2020-21 to 23.30% (1169) in 2021-22, then increased to 32.70% (1483) by 2024-25, despite an 8.46% count drop in 24-25. Reduced lunch students grew from 3.01% (149) to 7.23% (328), a 120.13% increase in count, with high stability in 2024-25 (-0.30%). Paid lunch students decreased from 70.70% (3499) to 60.07% (2724), with a 27.24% drop in count in 2024-25, exceeding the overall enrollment drop (20.34%).

**Socioeconomic Impact:** The 2024-25 enrollment drop (20.34%) disproportionately affected Paid lunch students (58.41% retention), possibly indicating higher-income families leaving the district. Free (65.19%) and Reduced (81.16%) lunch students were more likely to stay, likely due to reliance on school meal programs, though the loss of early education programs (PK/P2) may have impacted younger Free lunch students. The increase in Free (32.70%) and Reduced (7.23%) percentages in 2024-25 suggests the remaining student population has a higher proportion of lower-income families.

## Attendance Rates by Student, School & Meal Status

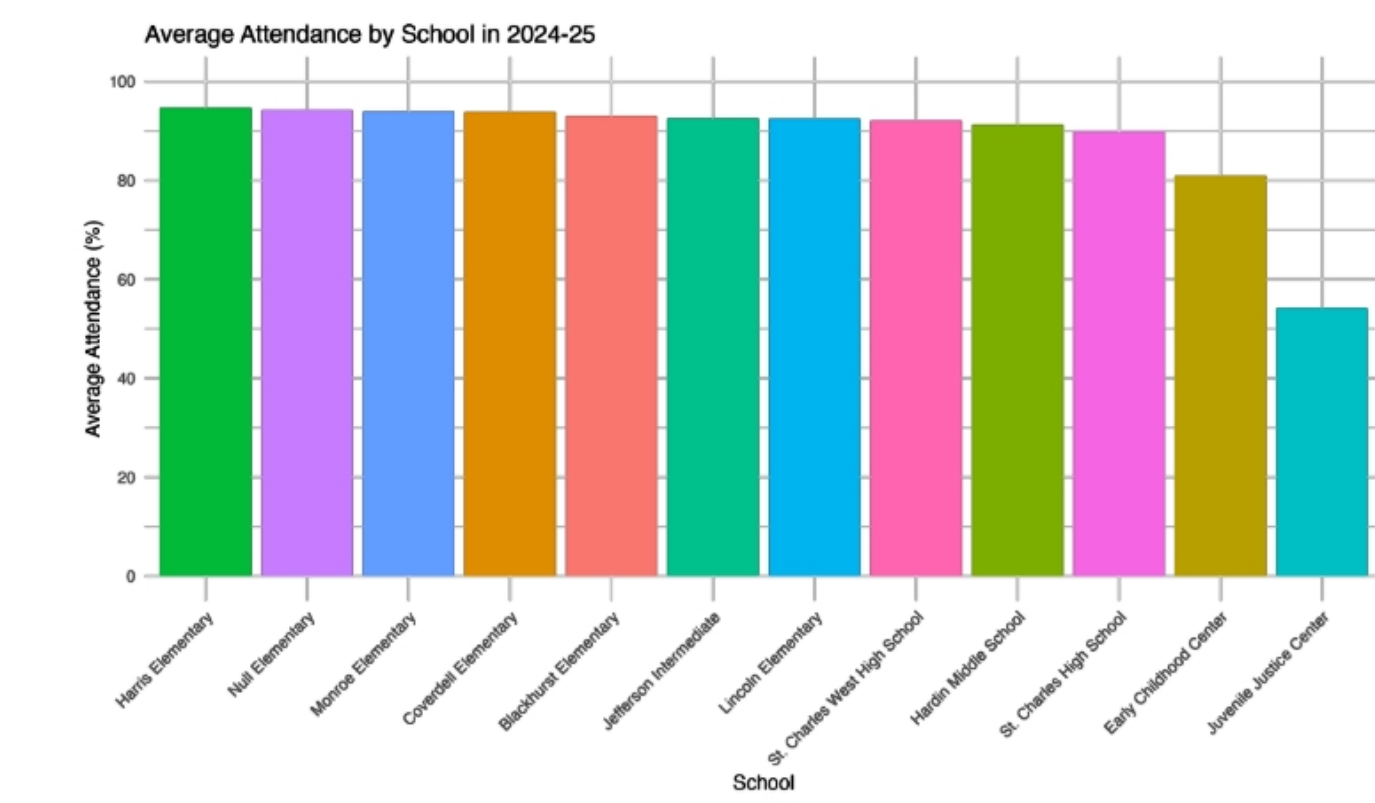


Figure 8. Average Attendance by School

## Analysis of Average Attendance

**Averages Across the District:** The analysis of attendance in the St. Charles School District from 2020-21 to 2024-25 shows strengths and challenges. Elementary schools like Harris, Blackhurst, and Coverdell maintain high attendance above 93%, reflecting strong engagement. Middle and high schools, including Hardin Middle, Jefferson Intermediate, St. Charles High, and St. Charles West High, improve over time, reaching 90-92% in 2024-25, but lag behind elementary schools. The Early Childhood Center struggles, dropping to 80.94% in 2024-25 due to 38 zero-attendance students, likely from program changes. The Juvenile Justice Center also faces issues, with 54.15% attendance in 2024-25, needing targeted interventions.



Figure 9. Average Attendance vs Meal Status by Year

Meal Status	Avg. Attendance	SD Attendance	Total Students
Empty	81.824831115660	23.223806662532	977
Free	89.644789191261	11.016671646760	5218
Paid	92.742006244496	8.8266057068685	12491
Reduced	92.099807474518	8.9627136335586	883

Figure 10. Average Attendance by Meal Status Table

## Comparing Attendance Rates to Meal Status

**Empty:** The 977 students with an unspecified meal status have the lowest average attendance at 81.82%, with a high standard deviation (SD) of 23.22, indicating significant variability. This group likely includes students who were not assigned a meal status due to data entry issues, transfers, or other administrative reasons. Their low attendance suggests they may face unique challenges, possibly related to incomplete enrollment or socioeconomic factors not captured by meal status.

**Free:** Students with "Free" meal status (likely from lower-income families) have an average attendance of 89.64%, with an SD of 11.02. This is higher than the unnamed category but lower than "Paid" and "Reduced", suggesting that socioeconomic barriers may impact their attendance.

**Paid:** The "Paid" group (combining S and P) has the highest average attendance at 92.74%, with an SD of 8.83, indicating more consistent attendance. This group, representing students not on free meals, likely benefits from greater access to resources.

**Reduced:** The "Reduced" category has an average attendance of 92.10%, very close to "Paid", with an SD of 8.96. This group is smaller (883 students) and may represent a specific subset of students (e.g., a special program or data entry variation).

## Data Entry Problems

Our team was tasked with cleaning and analyzing 10,000+ lines of data. In doing so, we discovered multiple discrepancies. The SCSD, between 2023 and 2024, changed their student records-keeping systems. With this change, some data was lost in translation or completely changed. This led to some issues in our analysis as certain grade levels needed to be changed, some students information was lost, and some programs (vocational) were completely ignored. We also ran into a few communications issues with the district, which led to some of our questions going unanswered, and therefore we decided to alter our methods as best as possible in order to provide proper analysis for the SCSD.

## Conclusion

The analysis of student attendance in the St. Charles School District highlights a clear correlation between socioeconomic factors, attendance rates, and population retention. We recommend the district should consider providing resources such as meal-support for "Free" students, targeted programs for low-attendance schools, and focus on utilizing better data systems to ensure equity and accuracy post-COVID-19