GIS Analysis of Erie County Socioeconomic Status and Education by School District

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Abstract

In the Western New York area, there are over a dozen different higher education institutions excluding colleges with multiple locations, trade and professional schools, or satellite locations for online institutions—all within 100 miles of the city of Buffalo (*Best colleges*, 2022; *Colleges near*, 2022). Within Erie county, there are 28 public school districts, each of which has a different socioeconomic breakdown, high school graduation rates, and college acceptance, attendance, and matriculation rates. Using GIS software to map the public record and census data, this research will explore the potential connection between public school districts, socioeconomic status, high school graduation rates, and college Pell Grant awards within Erie county.

By comparing the various data points, researchers will be able to determine how socioeconomic status within Erie county public school districts impacts education as well as showing areas of concern or areas of success within Western New York, both for public school districts and in relation to the multiple local colleges and universities. Because of the multitude of choices surrounding higher education pursuits, it is important to understand "both the perception and the reality of opportunity. While there is an array of higher education offerings, for many underserved populations these options aren't available to them" (Iloh, 2018, p. 238). In other words, not only does the college or university need to be accessible to the potential student, but their values need to align with the values of the higher education organization they are interested in attending.

Generally speaking, this research has shown that the public school districts within Erie county that have a higher percentage of economically disadvantaged students also have lower graduation rates. Conversely, the public school districts with the highest graduation rates also

have the lowest percentage of economically disadvantaged students. This relates back to the idea of the geography of opportunity, or the concept that "structural inequalities that are historically entrenched in particular urban and suburban areas" (Yoon & Lubienski, 2017, p. 54). Although the rates of Pell Grant recipients in colleges and universities in Erie county does not necessarily align with the socioeconomic status of the public school districts in which they are located, it is still important to understand their surrounding community and potential future students. Knowing the connection between the level of economic disadvantage, public school districts, and the overall academic success in both high school and college will allow higher education institutions to better predict who will be applying or attending their institutions, and encourage or assist the students who live within their community.

Keywords: education, socioeconomic status, graduation rates, public school districts, higher education institutions, geographic information systems

Introduction

In the Western New York area, there are over a dozen different higher education institutions excluding colleges with multiple locations, trade and professional schools, or satellite locations for online institutions—all within 100 miles of the city of Buffalo (*Best colleges*, 2022; *Colleges near*, 2022). Within Erie county, there are 28 public school districts, each of which has a different socioeconomic breakdown, high school graduation rates, and college acceptance, attendance, and matriculation rates. Using GIS software to map the public record and census data, this research will explore the potential connection between public school districts, socioeconomic status, high school graduation rates, and college Pell Grant awards within Erie county.

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Research Questions

1. Which public school districts have the highest percentage of economically disadvantaged students?

2. Does the public school district in which an individual lives impact the persistence and graduation rates of students?

3. Does the location of the higher education institution have an impact on the overall percent of Pell Grant recipients attending the institution?

Literature Review

There are many factors involved in the decision-making process surrounding attending college or university, and it often guided by where an individual lives or even where they attend high school in relation to higher education institutions. When researching choices after high school, "most students consider only a limited number of colleges, and this small set of institutions is largely determined by location" (Turley, 2009, p. 126). In addition to location,

socioeconomic status and the public school district students attend also has an impact on future

educational endeavors. In general, "location, convenience, and information on school programs,

quality, and social and racial composition as derived from (segregated) social networks are all

issues that have been shown to be important," both to students and guardians seeking higher

education opportunities (Lubienski et al., 2009, p. 612). Led by GIS and location-based research,

studies show there is a connection between college choice, public school districts, and overall

socioeconomic status.

Educational disparity within public school districts often directly leads into continued

educational disparity in higher education. Funding for public schools is vital for overall

educational equity and improved access to education and future opportunities (Kaplan, 2020).

Challenges, particularly in the public school districts, stem from unequal funding, lack of

resources, and disparate policy practices across schools. Kaplan (2020) explains:

> During the No Child Left Behind period, we acted as though schools were operating on a
>
> level playing field, and therefore we could hold every school and every student
>
> accountable for standardized test scores, even though we hadn't done the work of
>
> extending equal educational opportunities to all kids and in all schools. That's what the
>
> achievement gap that we talk about really is – it's a manifestation of that racial
>
> inequality. (para. 5)

The achievement gap starts in primary school and even with policies specifically targeted to

lessen these challenges such as the No Child Left Behind Act, there continues to be educational

inequity, particularly among lower socioeconomic areas and districts. Working to improve

outcomes and access, "students from disparate backgrounds would have equal chances of school

success, and thereby achievement gaps would close" (Kornhaber et al., 2014, p. 6). This

continues into higher education choices and opportunities since where someone attends college matters, as "each option comes with separate and unequal costs and outcomes" (Iloh, 2018, p. 228). Expanding policies for educational improvement and support will benefit economic and education results and can "promote more equitable access for disadvantaged students to a range of higher-quality school options" (Lubienski et al., 2009, p. 603).

Challenges of educational achievement are often caused by issues far beyond the student or school's control. Kornhaber et al. (2014) suggest that "disparate student achievement is strongly associated with influences outside schools' purview" (p. 8). One such issue is the location of public schools, the boundaries between the districts, and the location of higher education institutions in comparison. A recent study discovered that the "greater distance to the nearest college is associated with a decreased likelihood of attending college even after students' ability and family background are controlled" (Turley, 2009, p. 128). In relation to college and university locations, it is "especially significant for socioeconomically disadvantaged families, since there are many financial benefits associated with living at home during college, such as saving money on rent, utilities, food, and travel and taking advantage of cheaper tuition at an in-state or community college" (Turley, 2009, p. 127). Those seeking higher education tend to "believe that attending a college that is close to home is important. As a result, living near colleges may be associated with a greater likelihood of going to college" (Turley, 2009, p. 128). Although there are a multitude of challenges connected with pursuing higher education including educational inequity, public school district support, and location concerns, the economic and social benefits of individuals pursuing higher education outweighs these challenges, particularly for students from economically disadvantaged backgrounds.

Analyzing existing geographic information focused research detailing the relationship between socioeconomic status, public school districts, and higher education institution locations shows a connection between economic status, education, and achievement levels. Yoon and Lubienski (2017) highlight that GIS software and analysis is "useful in highlighting the historical inequalities underpinning current racial biases and segregation and associated low levels of academic achievements" (p. 54). For example, using GIS to examine income and college attendance shows that "parental income was positively related to median distance traveled with students whose parental income was less than $6,000 traveling 43 miles compared to students whose parental income was $200,000 or more traveling 258 miles" (Mattern & Wyatt, 2009, p. 20). Overall, the students with higher GPAs and academic achievement tend to travel farther away for college (Mattern & Wyatt, 2009, p. 23). Using these same avenues of research and data collection, scholars have started to examine the "historical legacy of the racial and social segregation 'regime' and its impact on geographically concentrated outcomes related to poverty, poor health, academic performance, racial desegregation, and the distribution of teachers and other school resources such as property taxes" (Yoon & Lubienski, 2017, p. 59). That being said, GIS analysis and the maps created using the software are not neutral. GIS scholars in particular take a "constructivist approach, noting that all types of maps are socially constructed" (Yoon & Lubienski, 2017, p. 57). Although the GIS data in this case suggests a relationship between socioeconomic status, school districts, and college locations, the data still needs to be deciphered by a researcher which opens studies to bias or misinterpretation.

Methodology

When designing a GIS model to evaluate the potential connection between public school districts, socioeconomic status, high school graduation rates, and college attendance and

graduation rates, there are a variety of inputs to consider. Data input includes information on public school districts within Erie county, the number of economically disadvantaged students compared to non-economically disadvantaged students, high school graduation rates, the number of Pell Grant recipients compared to non-Pell Grant recipients, and college graduation rates. All of this information is coded based on public school district of the high schools and the school district in which the higher education institutions are located.

The inputs have been collected from a variety of sources in various formats in order to compare the information. First, a shapefile of New York State divided by county was utilized as the base for the GIS file of Erie county. This research focuses primarily on Erie county within Western New York, so the shapefile has been isolated and sized accordingly to highlight this area. Shapefiles with information about the borders of the public school districts have also been utilized. Data files with information about socioeconomic levels, high school graduation rates, Pell Grant awards, and college graduation rates have been collected through provided websites, including the New York Census Bureau, the New York State Education Department, the United States Department of Education, and other sources.

Data Collection

Data was collected from a variety of public sources, including Data USA, the Integrated Postsecondary Education Data System (IPEDS) of the National Center for Education Statistics (NCES), and the New York State Education Department (NYSED). Data USA provides an overview of Western New York with information about race and ethnicity, income, education, housing, and more. There are also a variety of infographics with links to additional information on other websites. Through IPEDS, numerical data was gathered, including information related to the specific racial breakdown of each college in Western New York, as well as financial aid

information. Using the financial aid statistics will also provide insight into household income due to Pell Grant awards. IPEDS is also referenced in a variety of Data USA discussions, so there is the opportunity to cross reference both raw data and data that has been organized within charts, graphs, and other presentation methods. NYSED includes specific information about school districts within Erie county, including graduation rates and enrollment information.

Data files were organized into Excel documents to extract relevant information surrounding socioeconomic status and graduation rates. Data surrounding the public school districts was primarily gathered from the New York State Education Department while information about colleges and universities was collected through each of the previously mentioned sources and reorganized within a single spreadsheet. From IPEDS, the document includes reported enrollment information for 12 local colleges surrounding the total number of enrolled students, racial backgrounds, gender identity, percent of financial aid awarded, in-state or out-of-state tuition, and number of Pell Grant recipients. Individual data points for public school districts were pulled from each individual school district page from NYSED. This includes 28 public school districts, and the data surrounding the total number of students enrolled, the demographic breakdown of the students, the number and percentage of economically disadvantaged students, and the overall four-year graduation rates. With a more expansive research question in mind, demographic information was originally collected and organized alongside the socioeconomic and graduation data, but has not been utilized for the creation of any GIS maps at this time.

Findings and Information Products

The following tables and maps have been developed using GIS shapefiles, data from NYSED, and information about local colleges and universities. The findings presented include

details about high school and college economic status, graduation rates, and geospatial information. Within the tables, economic status is divided by public school districts and select local colleges and universities. GIS products showcase this information in alternative formats, comparing public school district breakdown, socioeconomic status, and graduation rates by location as well as coding the data with various colors and bar graphs.

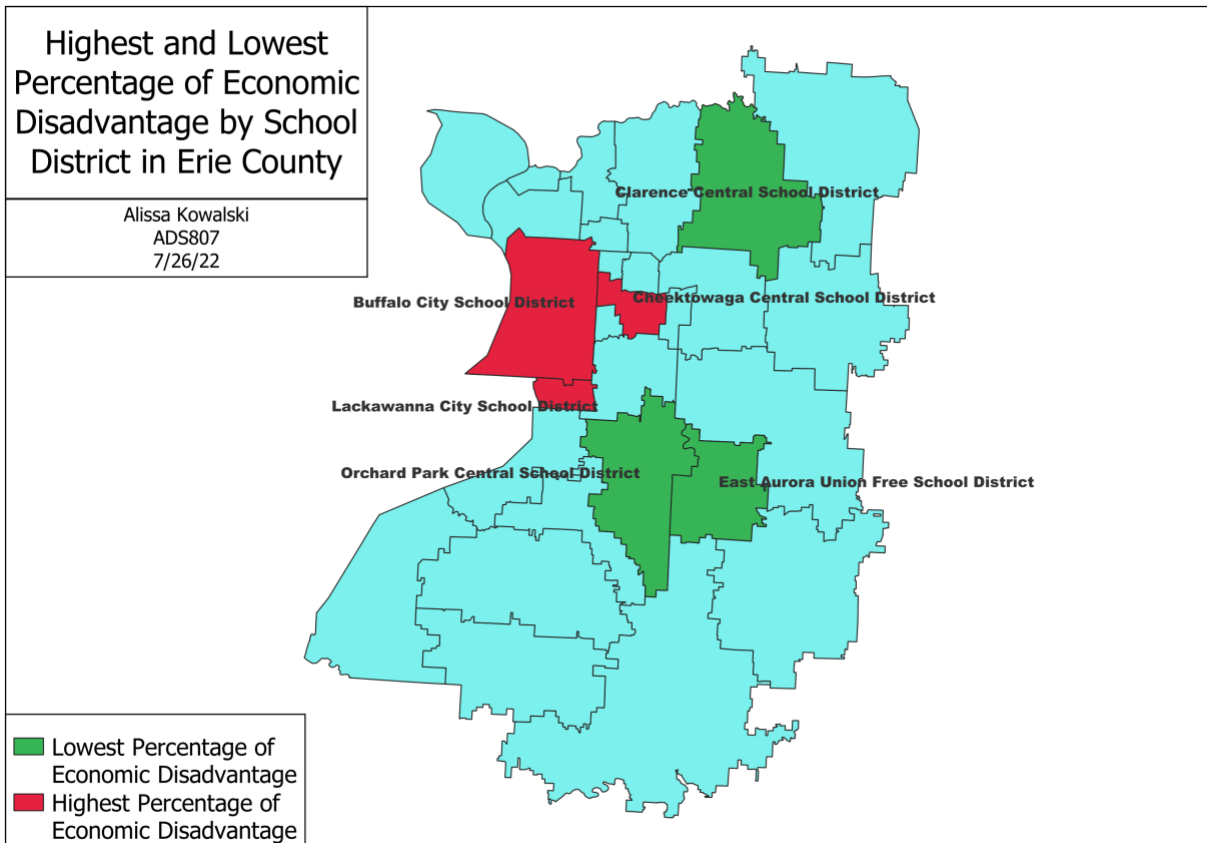| Districts in Erie County	Total K-12 Students	Economically Disadvantaged	Economically Disadvantaged %	4 Year Graduation %
Akron CSD	1334	584	44%	95%
Alden CSD	1581	495	31%	96%
Amherst CSD	2925	1012	35%	93%
Buffalo CSD	30674	25117	82%	76%
Cheektowaga CSD	2138	1480	69%	87%
Cheektowaga-Maryvale UFSD	2087	977	47%	87%
Cheektowaga-Sloan UFSD	1232	684	56%	86%
Clarence CSD	4228	602	14%	95%
Cleveland Hill UFSD	1254	785	63%	85%
Depew UFSD	1784	902	51%	85%
East Aurora UFSD	1758	220	13%	97%
Eden CSD	1307	338	26%	88%
Evans-Brant CSD (Lakeshore)	2179	1196	55%	90%
Frontier CSD	4612	1470	32%	91%
Grand Island CSD	2869	744	26%	95%
Hamburg CSD	3321	831	25%	92%
Holland CSD	829	318	38%	95%
Iroquois CSD	2127	448	21%	98%
Kenmore-Tonawanda UFSD	6648	3366	51%	88%
Lackawanna CSD	1790	1482	83%	82%
Lancaster CSD	5631	1095	19%	95%
North Collins CSD	547	224	41%	92%
Orchard Park CSD	4649	746	16%	97%
Springville-Griffith Inst CSD	1647	614	37%	96%
Sweet Home CSD	3261	1701	52%	94%
Tonawanda CSD	1729	929	54%	93%
West Seneca CSD	6214	2548	41%	91%
Williamsville CSD	9913	1711	17%	95%

The above table (Table 1) outlines the 28 public school districts within Erie county, the number and percentage of students who are economically disadvantaged within each district, as well as the overall four-year graduation rates. Generally speaking, the public school districts with a higher percent of economically disadvantaged students will have a lower four-year graduation rate. This can be seen with districts like Buffalo CSD and Lackawanna CSD, both of which have a population of economically disadvantaged students over 80% – the highest rate in Erie county

– and a graduation rate under 85% – the lowest rate in Erie county (NYSED). On the opposite

end of the spectrum, there are districts like East Aurora that have the lowest population of

economically disadvantaged students at 13% and one of the highest graduation rates at 97%

(NYSED). This table, along with the GIS maps, highlight the various disparities among school

districts in Erie county, connecting back to the idea that educational inequality starts in primary

school and is often related to economic inequality as well (Mattern & Wyatt, 2009; Yoon &

Lubienski, 2017). This table, in conjunction with the following GIS maps, provides key details

about academic success, socioeconomic status, and the connection to the location of the public
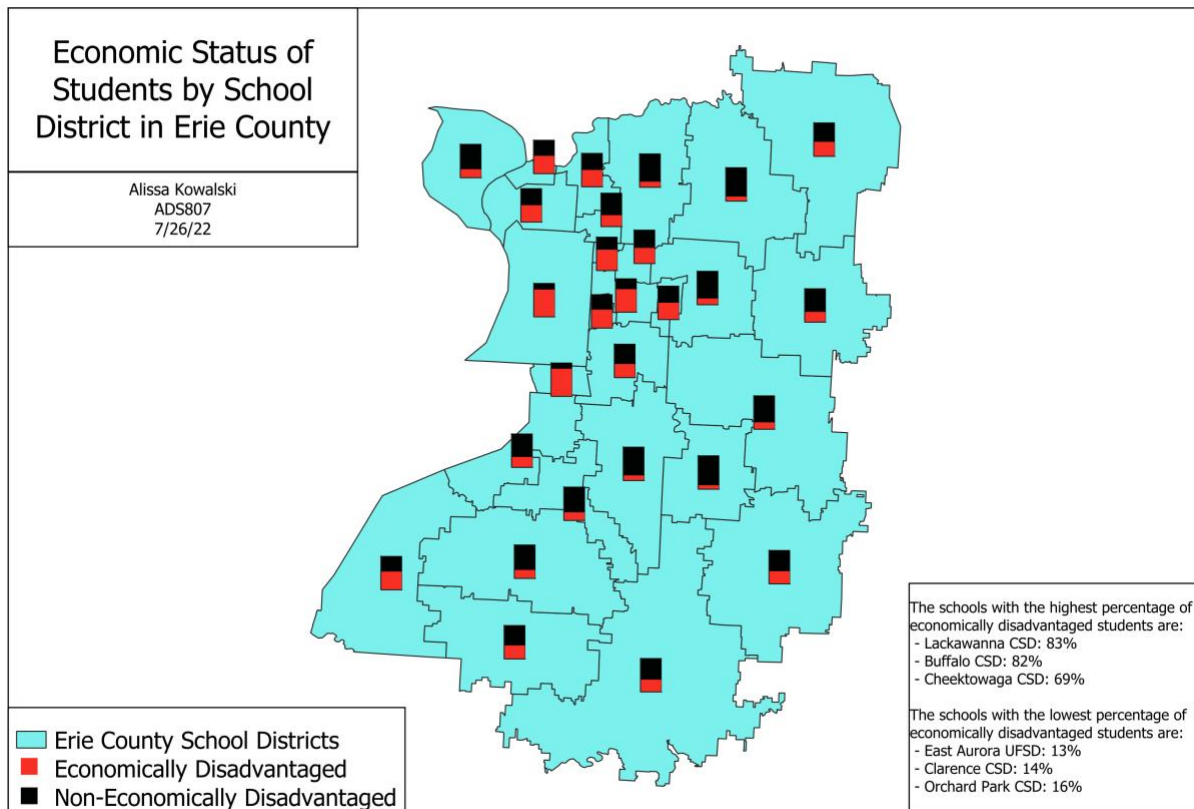
school districts.
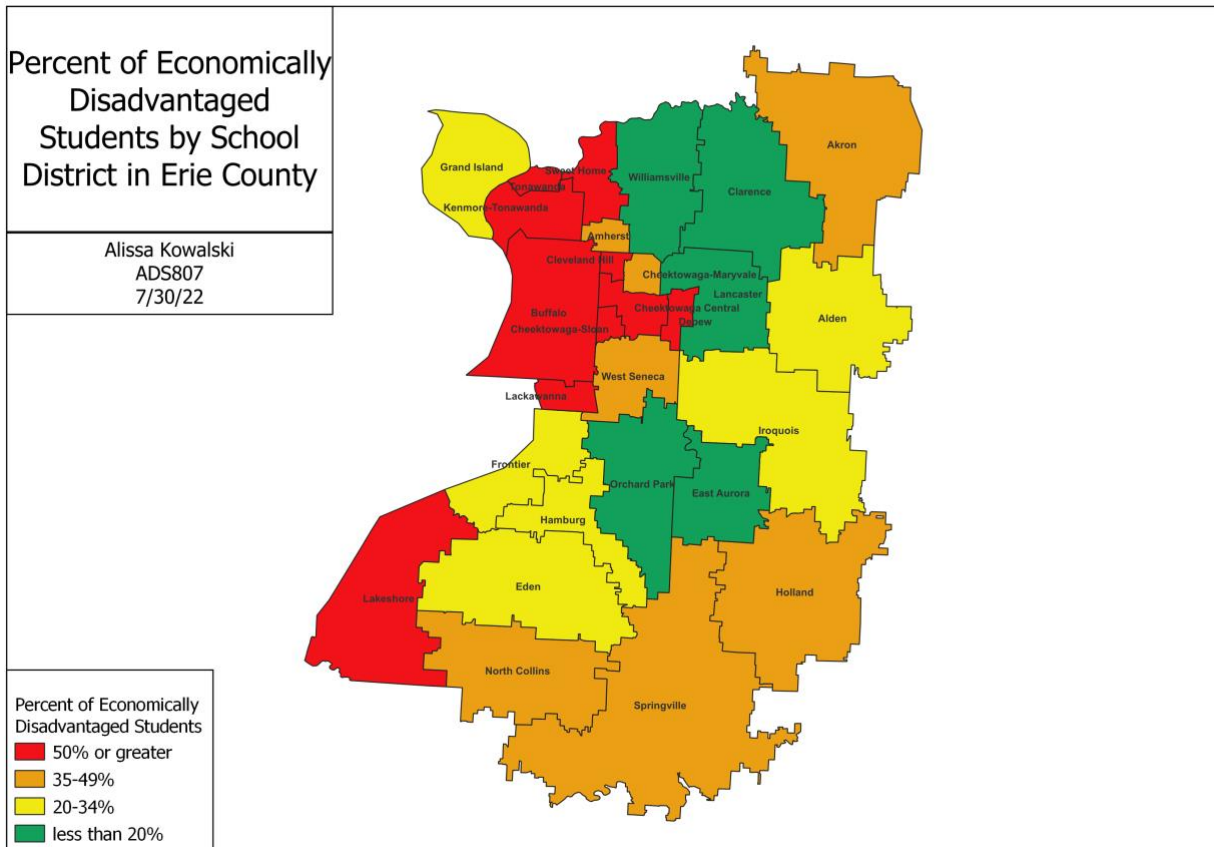
This map, entitled "Percent of Economically Disadvantaged Students by School District in Erie County," color codes the 28 public school districts in Erie county based on their percentage of economically disadvantaged students. This is a supplement to the table, which includes the name of the school district, the percent of economically disadvantaged and non-disadvantaged students, as well as the exact number for each category. This map divides the percentage of economically disadvantaged students into four categories: less than 20% is green, 20%-34% is yellow, 35%-49% is orange, and 50% or greater is red. This resulted in a fairly even division of school districts among the colors, with most school districts falling into the middle categories of yellow and orange.

Examining the locations of the school districts with a higher percentage of economically disadvantaged students shows that they are mainly in urban and rural areas, with the highest concentration of economically disadvantaged students being in the city of Buffalo and the surrounding area. Conversely, the school districts with the lowest percentage of economically disadvantaged students are in suburban areas. Both the areas with the highest and lowest percentage of economically disadvantaged students are surrounded by school districts with similar level of midrange economic disadvantage.

Highest and Lowest Percentage of Economic Disadvantage by School District in Erie County

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Clarence Central School District

Buffalo City School District

Cheektowaga Central School District

Lackawanna City School District

Orchard Park Central School District

East Aurora Union Free School District

Lowest Percentage of Economic Disadvantage
Highest Percentage of Economic Disadvantage

The above map, "Highest and Lowest Percentage of Economic Disadvantage by School District in Erie County," is similar to the previous map in that it shows the school districts in Erie county. However, this map calls attention to the three districts with the lowest percentage of economically disadvantaged students and the three districts with the highest percentage of economically disadvantaged students. The three areas with the lowest percentage, colored green, are East Aurora UFSD, Clarence CSD, and Orchard Park CSD. These school districts are all suburban areas, roughly equidistant from the city of Buffalo and the surrounding rural areas of Erie county. The three areas with the highest percentage are red and are all clustered in the same area of Erie county. Those school districts are Buffalo CSD, Lackawanna CSD, and Cheektowaga Central CSD.

Economic Status of
Students by School
District in Erie County

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The schools with the highest percentage of
economically disadvantaged students are:
- Lackawanna CSD: 83%
- Buffalo CSD: 82%
- Cheektowaga CSD: 69%

The schools with the lowest percentage of
economically disadvantaged students are:
- East Aurora UFSD: 13%
- Clarence CSD: 14%
- Orchard Park CSD: 16%

■ Erie County School Districts
■ Economically Disadvantaged
■ Non-Economically Disadvantaged

The map, "Economic Status of Students by School District in Erie County," uses bar

graphs to illustrate the number of students who are economically disadvantaged compared to the

number of students who are not economically disadvantaged. While this is the same data

presented in the table, it provides a visual accompaniment to represent the division of students

within the various school districts. By utilizing the number of students in each category rather

than the percentage, the bar graph visual reflects slightly different numbers. Economically

disadvantaged students are represented by the red of the bar graph while non-economically

disadvantaged students are represented by black. There is a large concentration of red in the

northwest area of Erie county, with Buffalo CSD having the highest number of economically

disadvantaged students even though Lackawanna CSD has a slightly higher percentage. The bar

graphs with the highest amount of black and the lowest amount of red are again mostly present in the suburban areas.
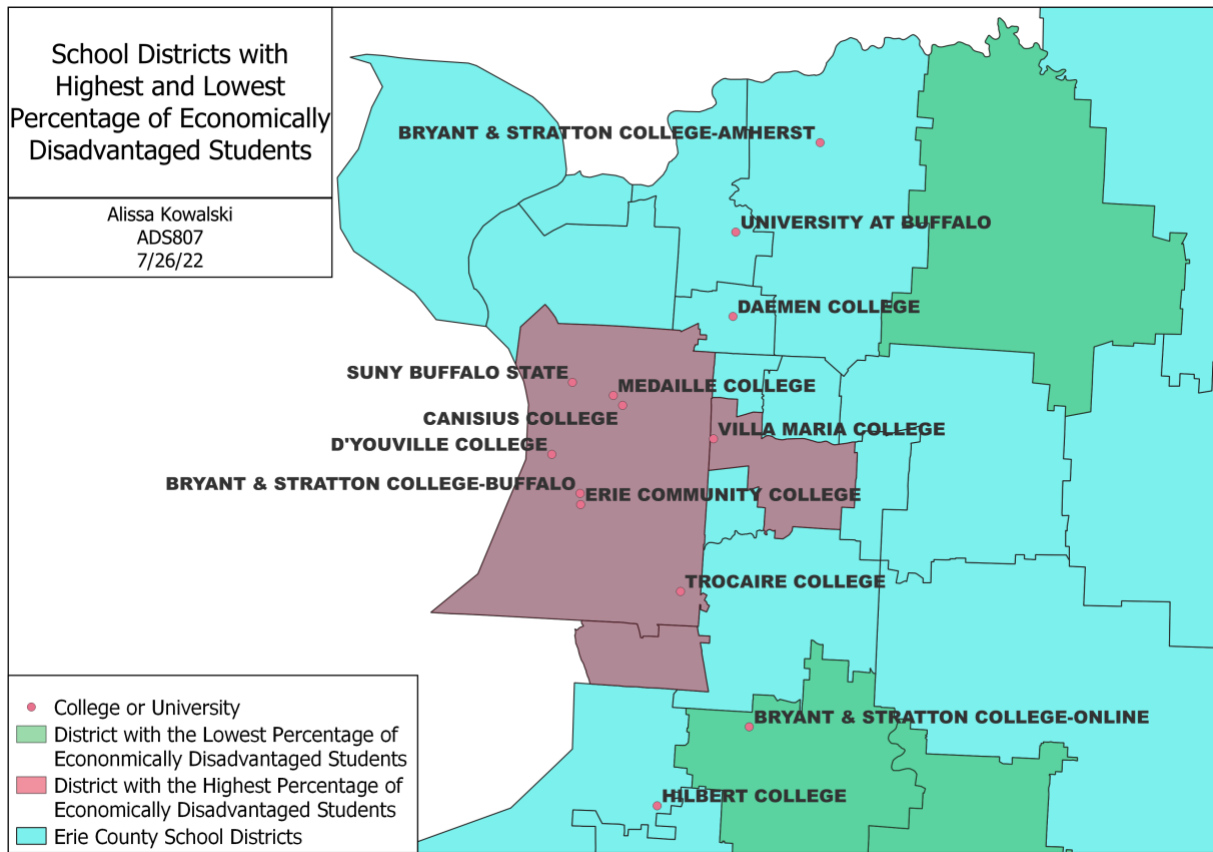
Institution Name	Full Time Students	Number of Pell Recipients	Number of Non-Pell Recipients	Percent Pell Recipients
Bryant & Stratton College-Buffalo	318	248	70	78%
Bryant & Stratton College-Orchard Park	1195	1064	131	89%
Canisius College	2298	827	1471	36%
D'Youville College	1873	786	1087	42%
Daemen College	2093	753	1340	36%
Erie Community College - All	5059	3136	1923	62%
Hilbert College	796	413	383	52%
Medaille College	1667	1183	484	71%
SUNY Buffalo State	7040	4787	2253	68%
Trocaire College	553	381	172	69%
University at Buffalo	26599	9043	17556	34%
Villa Maria College	430	339	91	79%

The above table (Table 2) lists select colleges and universities in Erie county, the number of full time students, the number of Pell Grant recipients compared to non-Pell Grant recipients, and the overall percentage. Pell Grant recipients are being used in this instance to show the divide between economically disadvantaged students and non-economically disadvantaged students. The percent of Pell Grant recipients covers a broad range, with the lowest percentage being University at Buffalo with 34% and the highest being Bryant and Stratton of Orchard Park with 89%. The average percentage of Pell Grant recipients within Erie county colleges and universities is roughly 60% of the full time students.
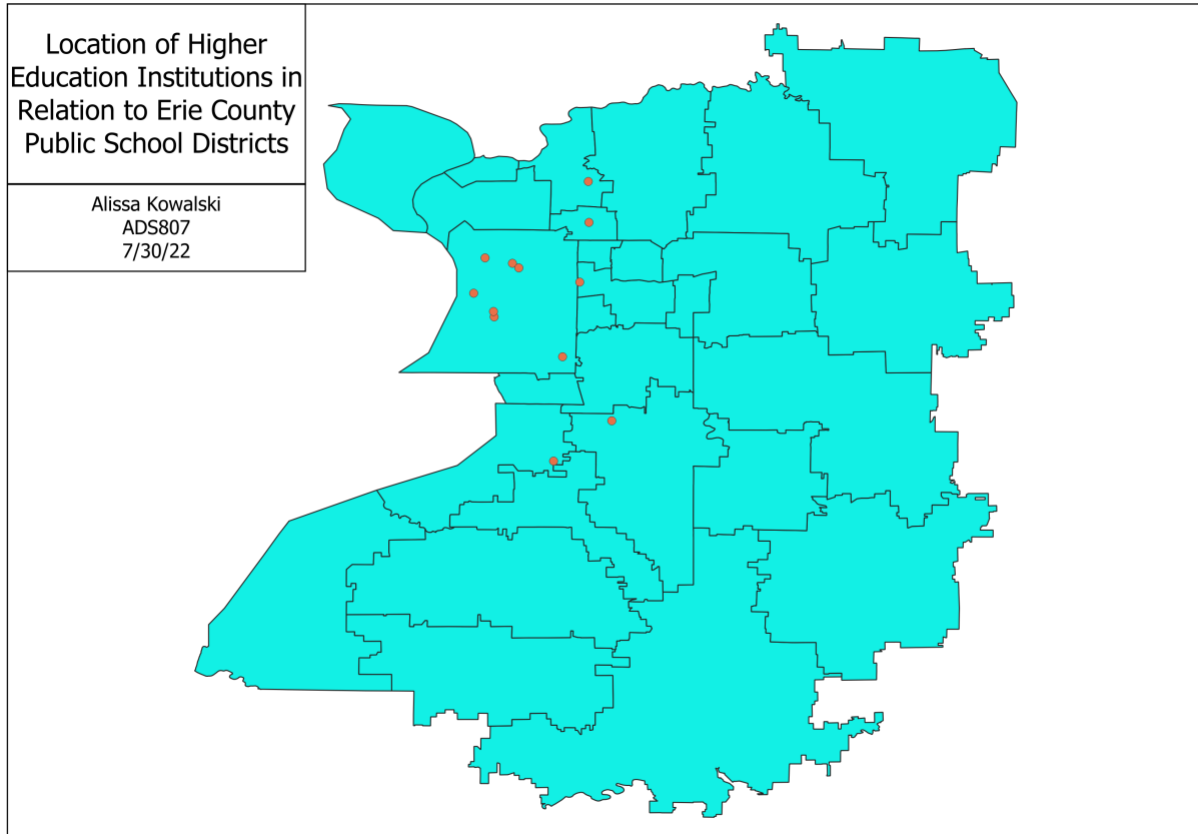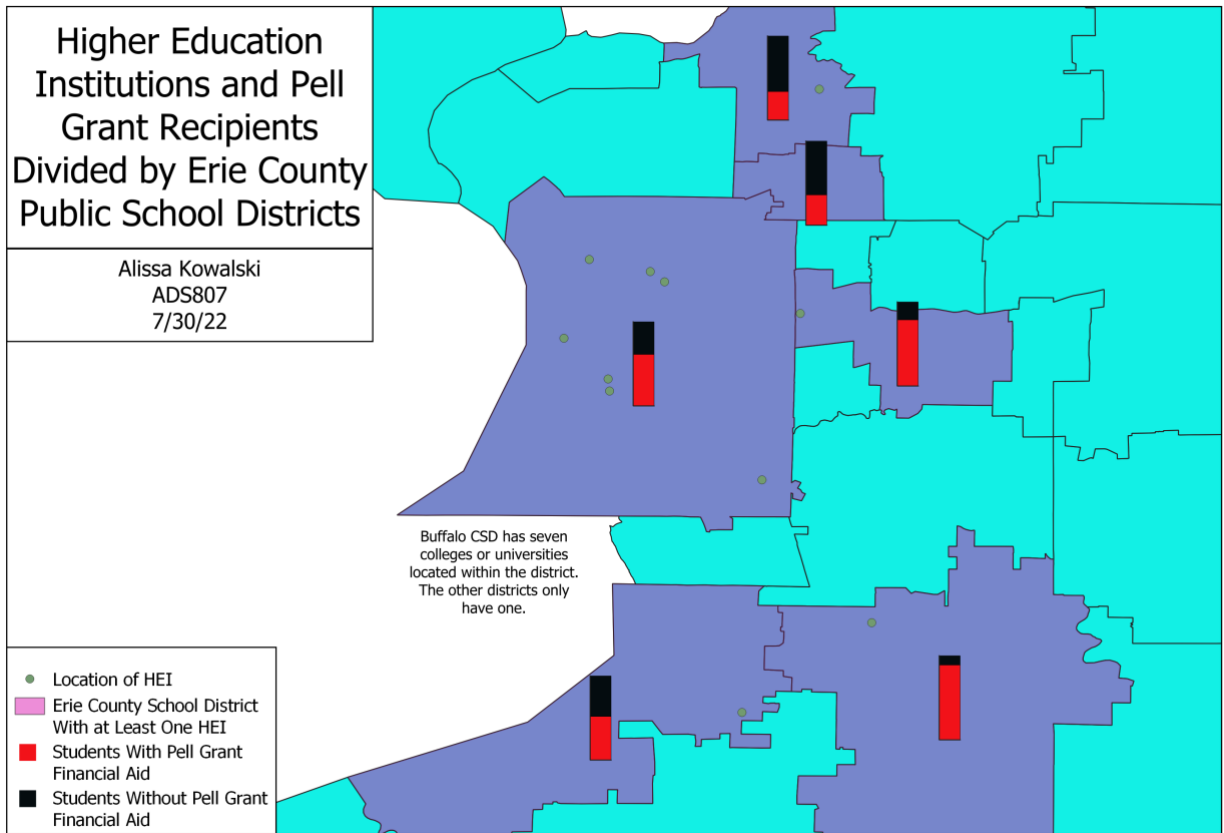
Location of Higher Education Institutions in Relation to Erie County Public School Districts

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"Location of Higher Education Institutions in Relation to Erie County Public School Districts" shows the locations of select colleges and universities in Western New York based on the school district breakdown of Erie county. Most local colleges and universities (54%) are located within the borders of the Buffalo CSD. The other six colleges and universities are all located within other school districts, with no other school districts in Erie county having more than one higher education institution. This map is a starting point for further discussions surrounding the locations of colleges and universities in Erie county in relation to the socioeconomic status of students attending those institutions.

School Districts with Highest and Lowest Percentage of Economically Disadvantaged Students

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Legend:
- • College or University
- District with the Lowest Percentage of Econonmically Disadvantaged Students
- District with the Highest Percentage of Economically Disadvantaged Students
- Erie County School Districts

The above map, "School Districts with Highest and Lowest Percentage of Economically Disadvantaged Students," details not only the locations of higher education institutions in Erie county, but also identifies the top three school districts with the highest percentage of economically disadvantaged students and the top three school districts with the lowest percentage of economically disadvantaged students. The highest percentages are indicated with pale red and the lowest percentages are indicated with pale green.

As seen in both this map and the previous map, 54% of the colleges and universities in Erie county are located within the borders of the same public school district, Buffalo CSD. This is one of the areas with a high percentage of economically disadvantaged students in the public school system. In total 62% of the higher education institutions are located in public school districts that have the highest percentage of economically disadvantaged students. In comparison,

there is only one college (8%) located within the borders of a school district that has the lowest amount of economically disadvantaged students. This leaves four colleges (31%) in school districts that fall somewhere between the highest and lowest percentage of economically disadvantaged students.

Higher Education Institutions and Pell Grant Recipients Divided by Erie County Public School Districts

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7/30/22

Buffalo CSD has seven colleges or universities located within the district. The other districts only have one.

- Location of HEI
- Erie County School District With at Least One HEI
- Students With Pell Grant Financial Aid
- Students Without Pell Grant Financial Aid

This map, entitled "Higher Education Institutions and Pell Grant Recipients Divided by Erie County Public School Districts" uses bar graphs to show the difference between students who receive Pell Grant financial aid compared to those who do not. The public school districts that have at least one college or university within their borders are highlighted, as the numbers reflect all of the higher education institutions in that area. The Buffalo CSD has seven colleges or universities located within the district while the other locations only have one. This map visually shows what is presented in Table 2 and shows that there is not necessarily a connection between

economically disadvantaged public school districts and the Pell Grant recipients of higher education institutions in that area.

Discussion

Examining the tables, maps, and various other sources of information surrounding the socioeconomic status of students within the 28 public school districts in Erie county compared to the Pell Grant recipients of local colleges and universities highlights interesting disparities between rates of economic disadvantage and the nearness of higher education institutions. Research shows that students who come from a more economically disadvantaged school districts tend to attend higher education institutions that are closer to home than students who are less economically disadvantaged (Mattern & Wyatt, 2009; Turley, 2009; Yoon & Lubienski, 2017). Additionally, the closer the proximity of colleges and universities to individuals, the more likely that student is to continue their education past high school (Turley, 2009). However, the data from the current iteration of this project does not necessarily support either of these research claims. That being said, there are a number of higher education institutions in Erie county that are within a reasonable distance of various public school districts, so data about where graduates in Erie county are attending college or university would need to be compared to student graduation rates.

The expected results of this study included showing a connection between public school districts, socioeconomic status, education, and Pell Grant awards. Although there is noticeably a relationship between socioeconomic status and graduation rates of public school districts, there is not a clear connection between the Pell Grant recipients of higher education institutions and the public school district in which they are located. The results of the GIS models show that public school districts with a higher percentage of economically disadvantaged students have lower

four-year graduation rates, which is expected. The opposite of this is also true, as districts with a lower percentage of economically disadvantaged students generally have higher graduation rates. Comparing data surrounding public school districts and the socioeconomic status of their students does not necessarily have any connection to Pell Grant recipients at the higher education level within that same area. More information needs to be gathered to draw reasonable conclusions about socioeconomic status, location of colleges and universities, and the overall impact on the decision to attend a higher education institution after graduation.

Returning to the initial research questions, the first two questions can be answered conclusively, but the final question is less clear. Question one asked which public school districts have the highest percentage of economically disadvantaged students. As seen in previous tables and maps, the public school districts with the highest percentage of economically disadvantaged students were Buffalo CSD and Lackawanna CSD, both with rates above 80% (NYSED). Question two asked if the public school district in which an individual lives impact the persistence and graduation rates of students. The answer to this question is a definitive yes, as not only do the schools with the highest percentage of economically disadvantaged students also have the lowest graduation rates, but the inverse of this is also true. Buffalo and Lackawanna both have a graduation rate under 85%, while districts like East Aurora have the lowest population of economically disadvantaged students at 13% and one of the highest graduation rates at 97% (NYSED). The final research question asked if the location of the higher education institution has an impact on the overall percent of Pell Grant recipients attending the institution. The data gathered and the information products developed do not provide a clear answer to this question, and more research would need to be completed to offer a conclusive response in this case.

Conclusion

After collecting and analyzing information about Erie county public school districts and higher education institutions, there is a clear socioeconomic divide among high school districts that directly impacts graduation rates, but that does not necessarily reflect the Pell Grant awards of the colleges and universities located within those districts. There are a variety of reasons that this research did not yield a conclusive answer to all three of the initial research questions. Some of these limitations include a shortened summer semester course with less time to gather and analyze data inputs and craft information products. Combined with learning an entirely new data analysis software, this led to a stronger reliance on publicly available sources of information and less primary research being completed. All of these limitations also caused a shift in the research focus as it was necessary to narrow down the topic in order to complete the required coursework and develop the GIS maps.

Due to narrowing down the research focus, there are multiple areas to expand this project for future research. One extremely impactful area would be to address demographic data available for both public school districts and higher education institutions. This information is publicly available and has already been collected for future GIS analysis including comparing the public school districts by the demographic breakdown of students and examining if there is any connection to the demographics of the colleges within the borders of each district. This would also expand the discussion surrounding racial inequity within education, particularly in urban school districts and resource distribution. Another area for growth would be moving forward with the initial research proposal of exploring the zip code analysis within Erie county, but that would involve another expansive round of data collection and working to connect public school district information with demographic census information.

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