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ECE-476 Data Science for Social Good

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Background

Cooper Union's Retraining Program for Immigrant Engineers (RPIE) is a free professional development program for immigrant, refugee, and asylee engineers looking to build a competitive portfolio for the professional workforce and career they want. This program was developed as an extension of a program Bnai Zion had initiated in 1987 to help immigrant scientists and engineers from the Soviet Union find jobs in the U.S. [7]. The program had to be upscaled due to the growing number of participants. Thus, Bnai Zion formed a partnership with Cooper Union [7]. In 2015, the program became solely under Cooper Union, and the following year, a partnership was formed with the Workforce Development Department at the Church Avenue Merchant Block Association (CAMBA) [7]. The program is currently administered by Cooper Union and consists of above two hundred twenty five participants.

RPIE gives engineers the opportunity to expand their technical knowledge and stay up to date with the rapidly evolving engineering market. In the twelve week program, participants obtain a deeper understanding of what it means to be an engineer in the U.S. They learn hard and soft skills that are required in the U.S. job market for engineers. Course offerings in the program are reflective of the top hard and soft skills identified through market analysis of job postings. RPIE participants are prepared to succeed "through preparation for certification exams, introductions to emerging key topics, problem-based seminars, and the technical and professional communication skills required in today's market" [7].

The following is the eligibility criteria for RPIE:

- an immigrant, refugee, or asylum seeker who has a degree in an engineering field from a university outside the U.S. OR an immigrant, refugee, or asylum seeker with an international degree who has worked in a field related to engineering.

- authorized to work in the U.S.

- comfortable writing, speaking, reading, and listening in English in a classroom setting.

- unemployed, underemployed, or employed in a job not related to your field.

- interested in building community, strengthening technical expertise, and developing communication skills.

- must live in New York City or within a reasonable commuting distance of New York City

Currently, RPIE is limited to New York City and the New York metropolitan area. However, there are immigrants located throughout New York State who have obtained engineering degrees or worked in related professions in their native countries but have not been able to land a corresponding occupation in the U.S. Expansion of RPIE across the state would enable these immigrants to obtain jobs relevant to their education and experience. Yet, before expanding the program, it's important to understand which parts of New York State would benefit most from the program. In other words, the locations of the target audience in New York State must be extracted. This is critical to ensure that resources are being used efficiently and to determine whether the program is worth expanding across the state.

Methodology

To answer the question of where in New York State RPIE should expand, we began by analyzing the applications RPIE received from immigrants. This data was provided by RPIE and

consisted of responses to the program's application. While much of the data was not very useful in our analysis due to several incorrect responses (which may have resulted from a lack of understanding English), we did use the data to discover how immigrants were hearing about this program.

Once we understood how the program was spreading among the immigrant community, we decided to explore in which New York State counties immigrants with higher education were predominantly located. This was done using open source data from the U.S. Census. The values from the census were normalized for each county . The number of immigrants with higher education was divided by the total number of immigrants, total number of people with higher education, and the total number of people. These values were plotted on bar graphs in descending order. The top ten values were displayed on the respective counties in three distinct New York State maps.

Our next step was to attempt to explain why the top ten counties might have a large number of immigrants with higher education. We looked at what engineering industries are located in these counties. Given the job posting dataset provided by RPIE, we studied which counties had the most unique job postings. We looked for any overlaps (which counties appeared at the top in all three examinations) between the immigrant population, unique job postings, and industry location findings. We also observed the education level required for the posted jobs.
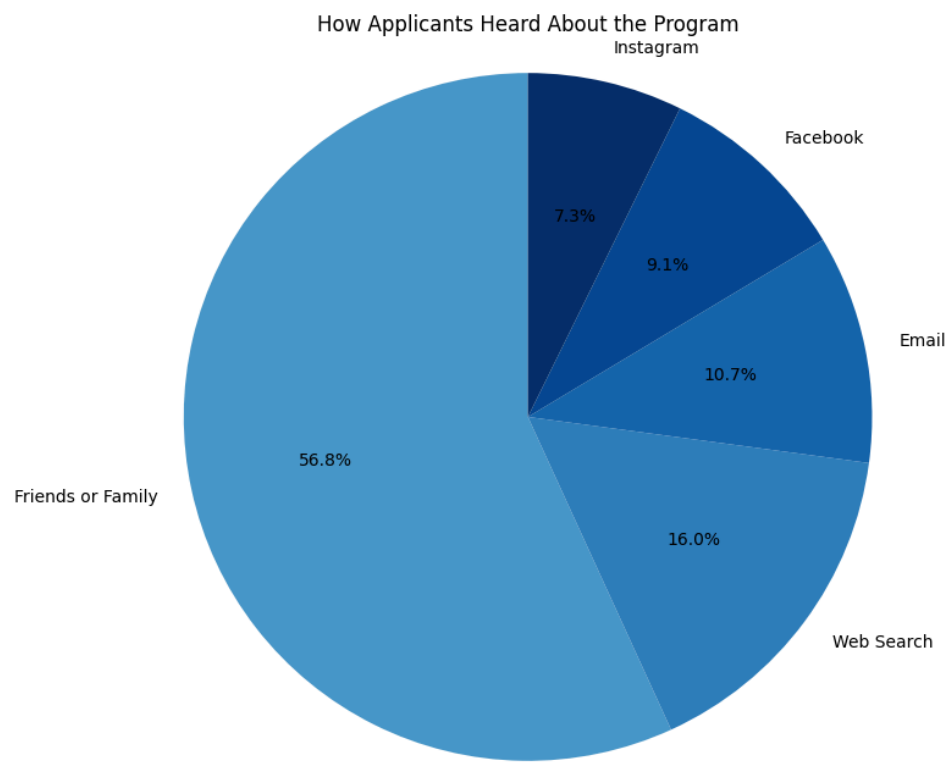
Results

Figure 1: Breakdown of applicants' responses to how they learned about the program

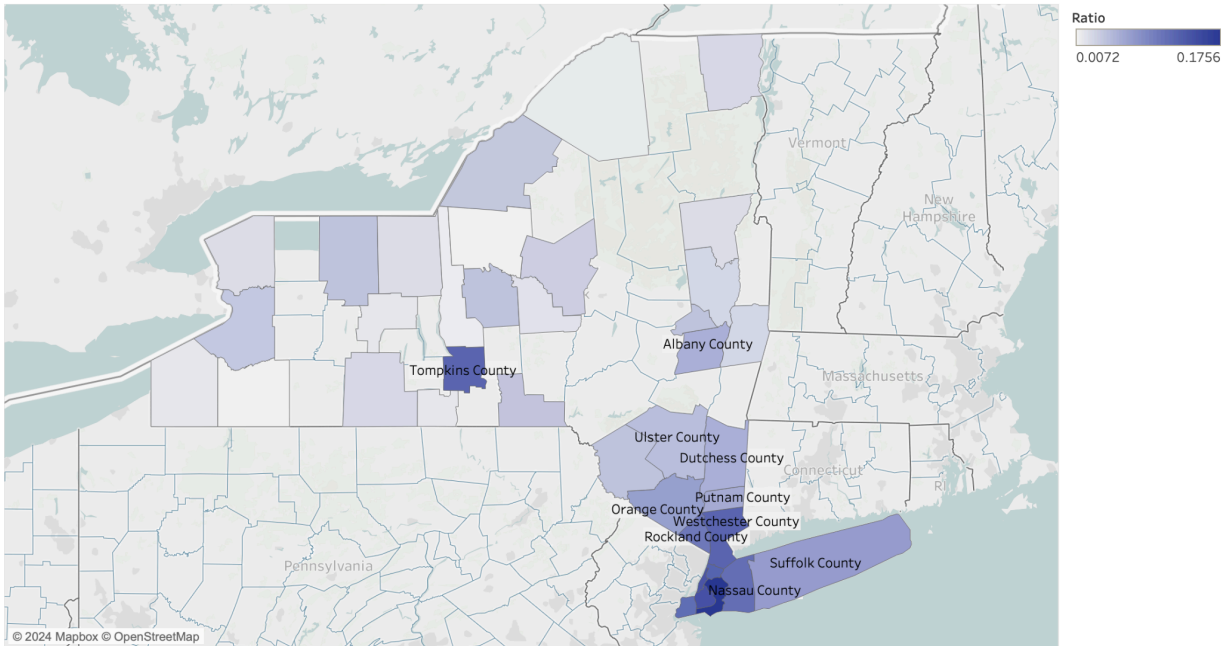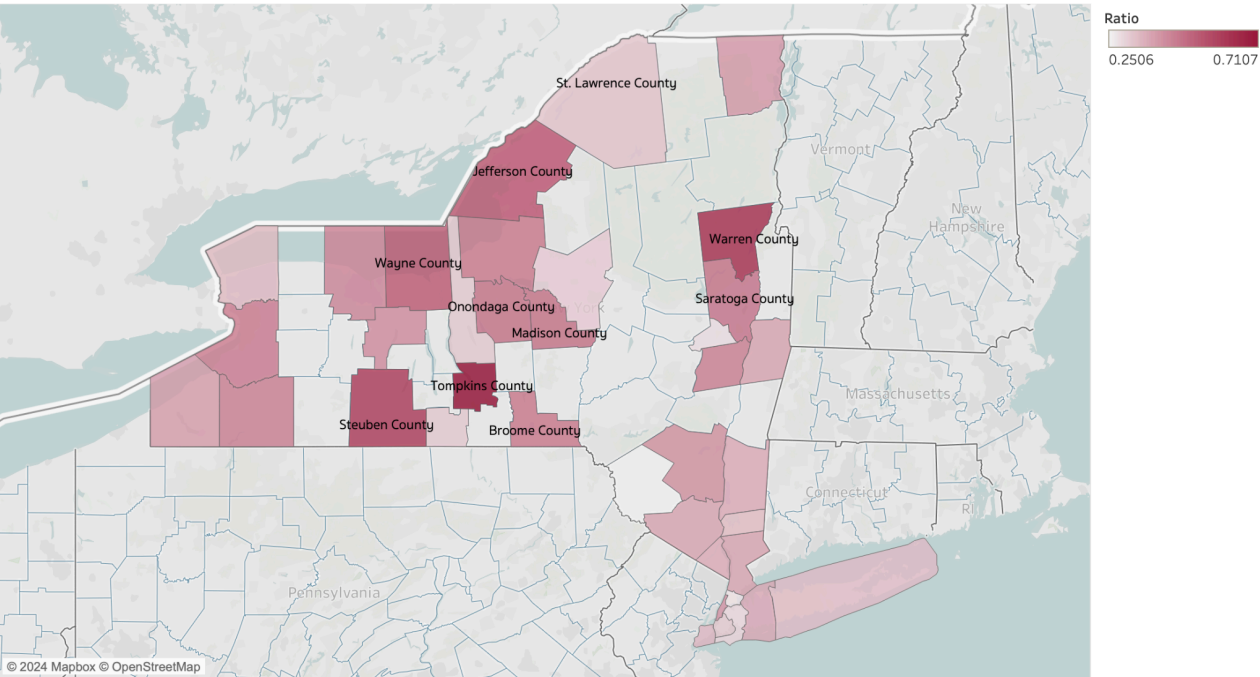**Immigrants With Higher Education to Total Population Ratio**

Figure 2: A New York State density map with counties shown. The counties labeled are the top 10 with the highest immigrants with higher education to total population ratios.

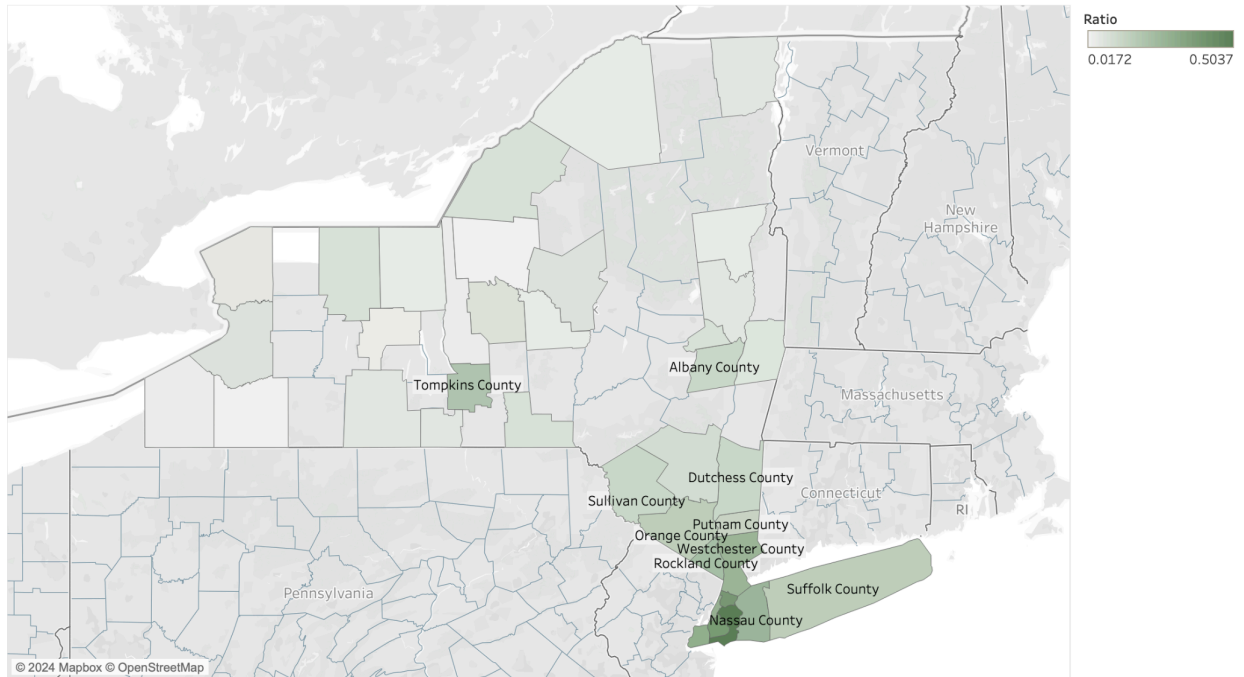## Immigrants With Higher Education to Immigrant Population Ratio

Figure 3: A New York State density map with counties shown. The counties labeled are the top 10 with the highest immigrants with higher education to immigrant population ratios.

Immigrants With Higher Education to Total Population With Higher Education Ratio

Ratio
0.0172   0.5037

Figure 4: A New York State density map with counties shown. The counties labeled are the top 10 with the highest immigrants with higher education to the total population with higher education ratios.
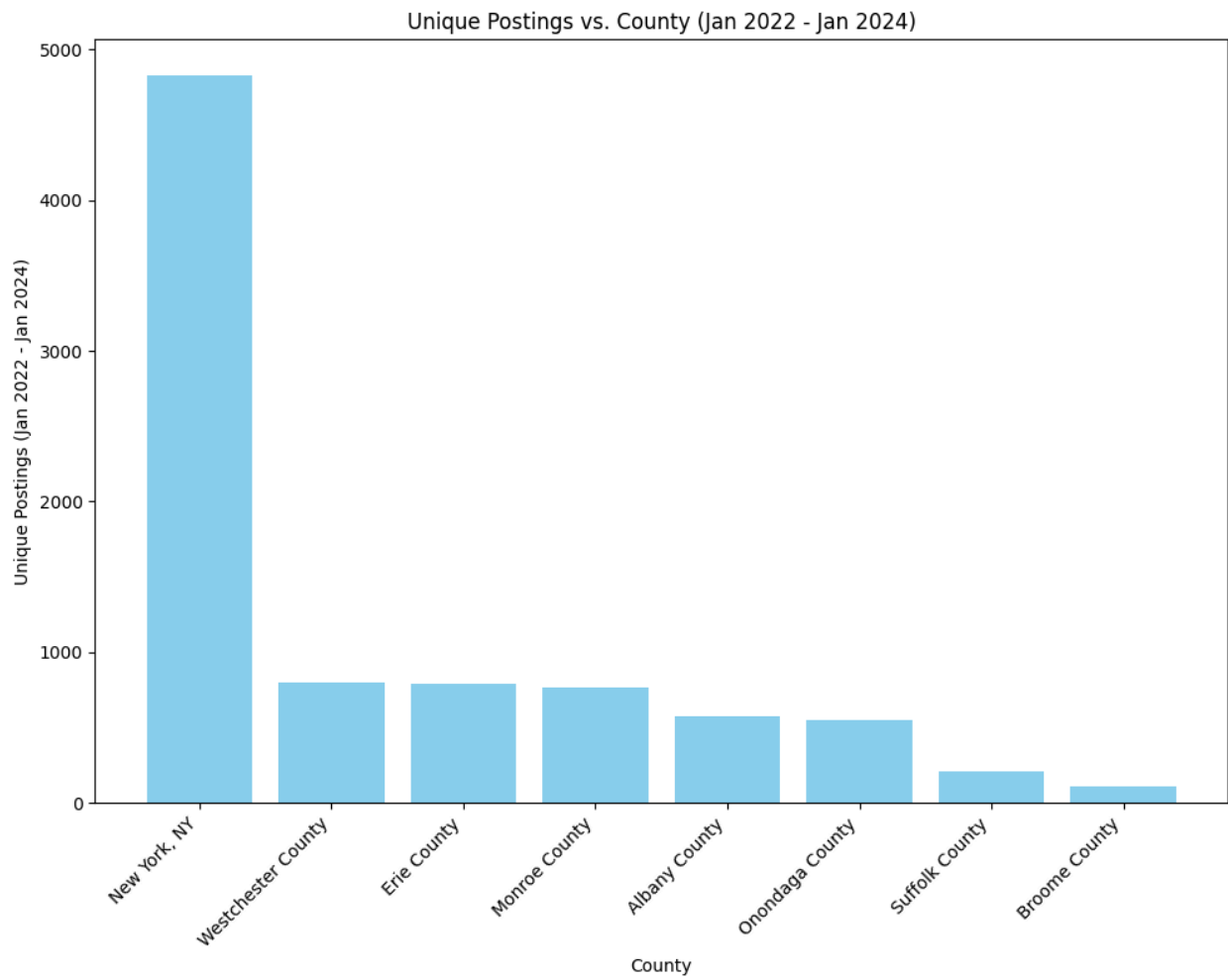
Figure 5: Unique job postings in New York City and 7 other counties with the most postings
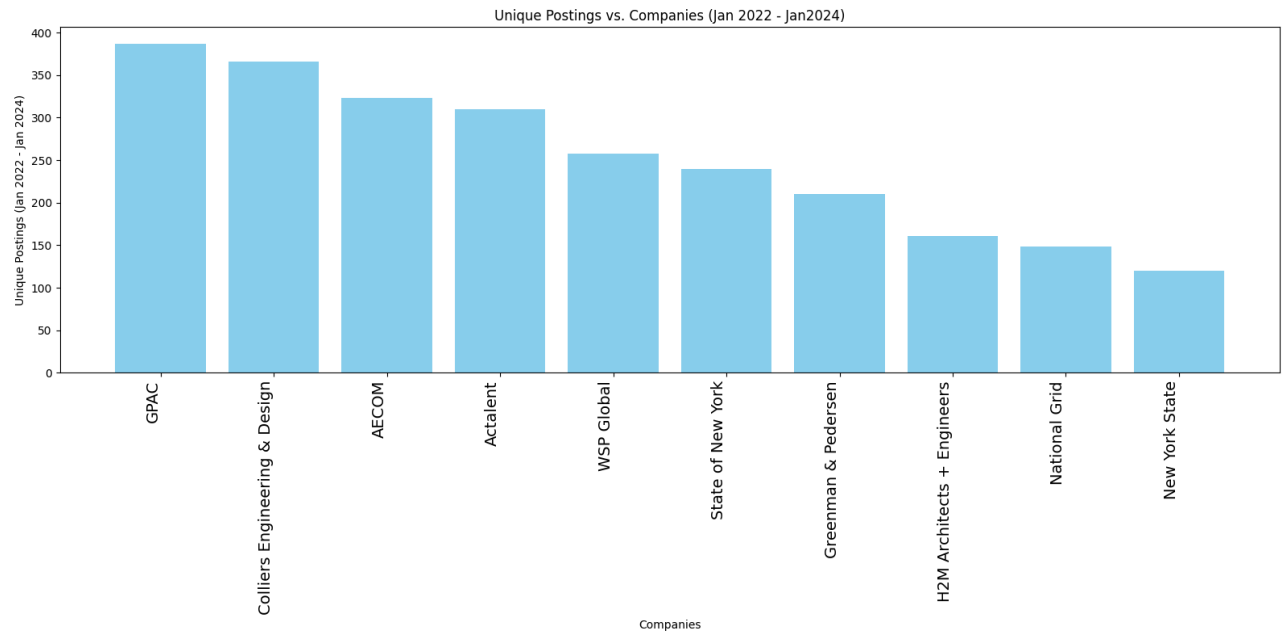
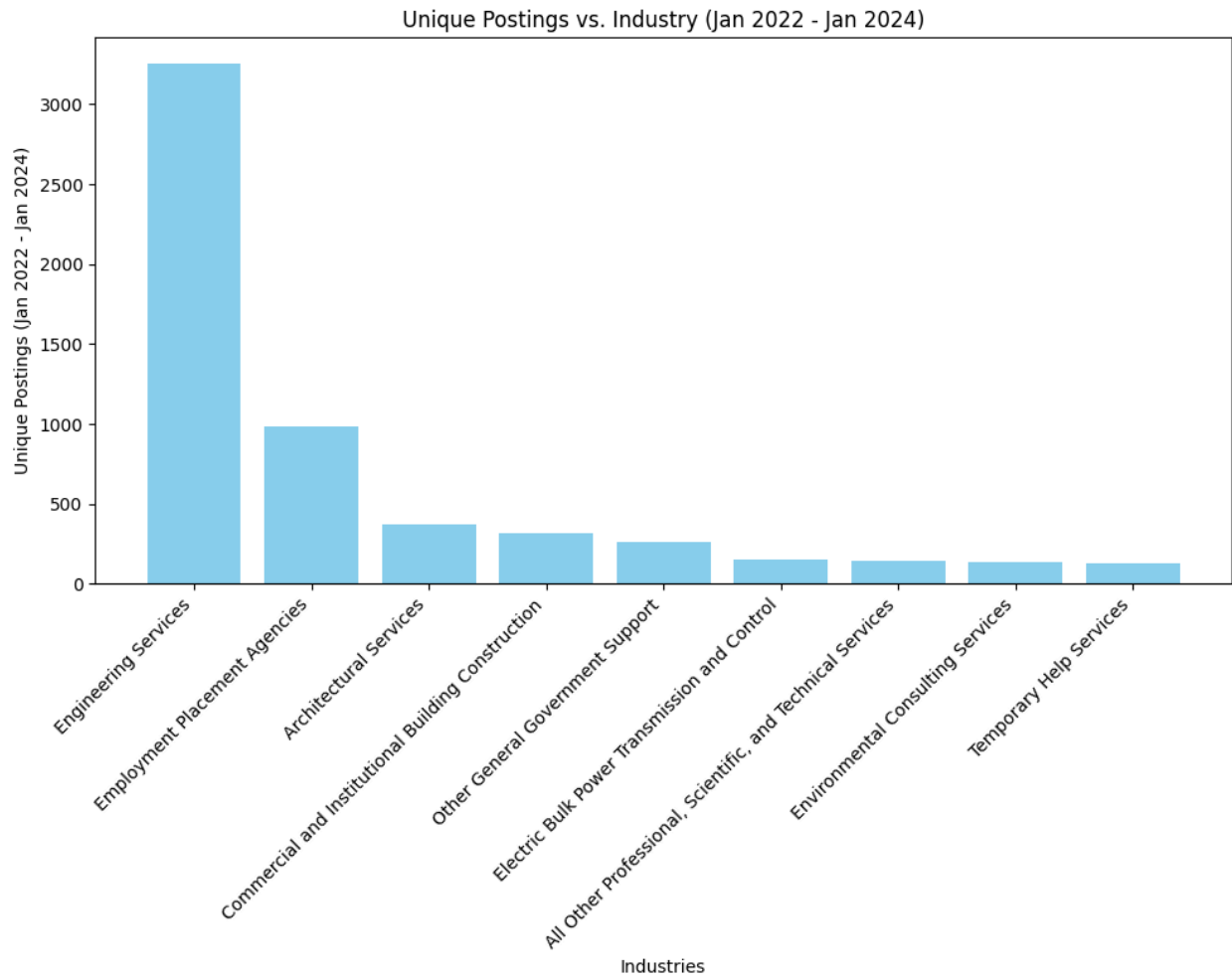Figure 6: Number of unique job postings at each company

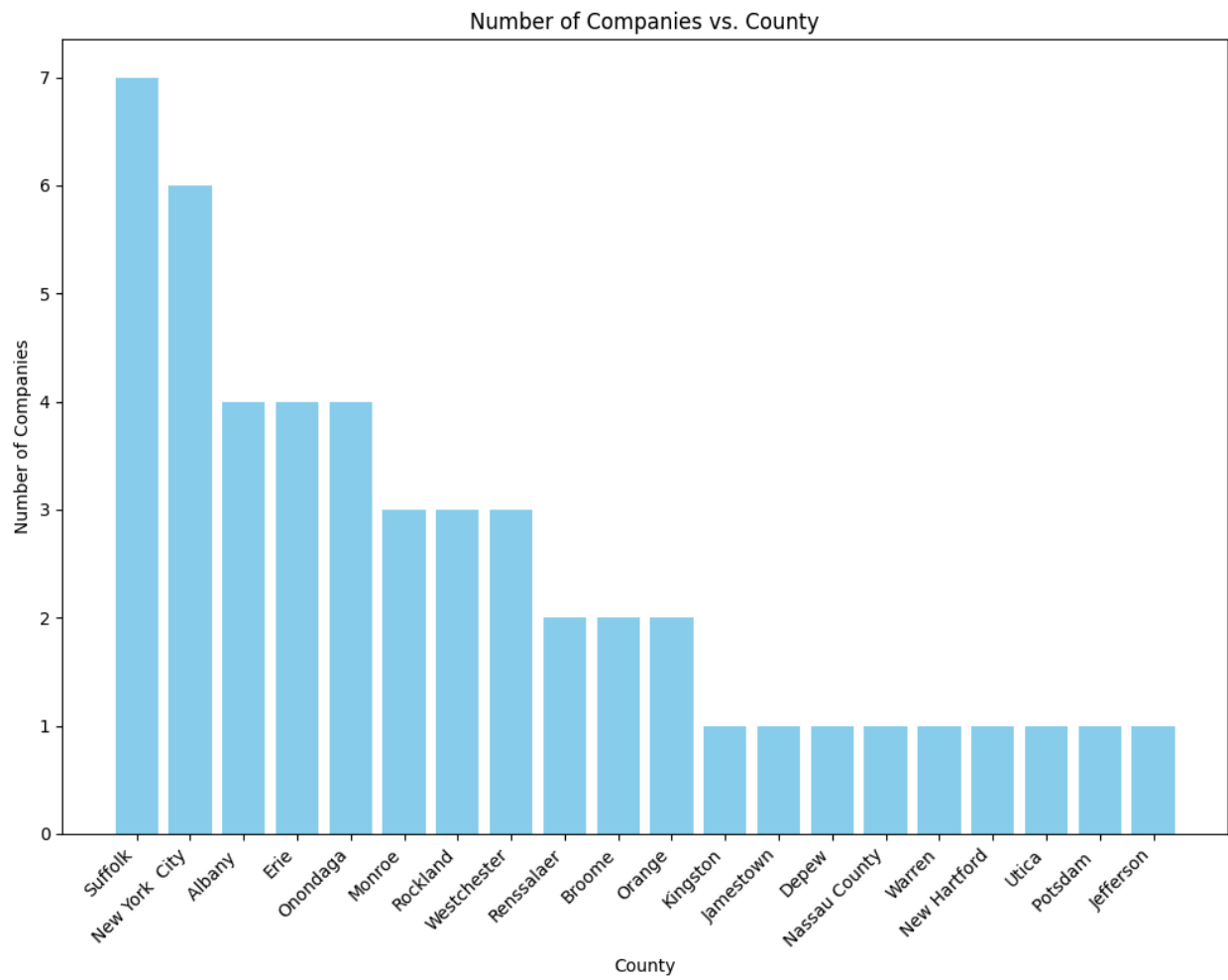Figure 7: Graph above shows which industries have the most unique job postings

Figure 8: Graph above displays number of the 8 companies in Figure 7 (excluding State of New York and New York State) with offices in each county
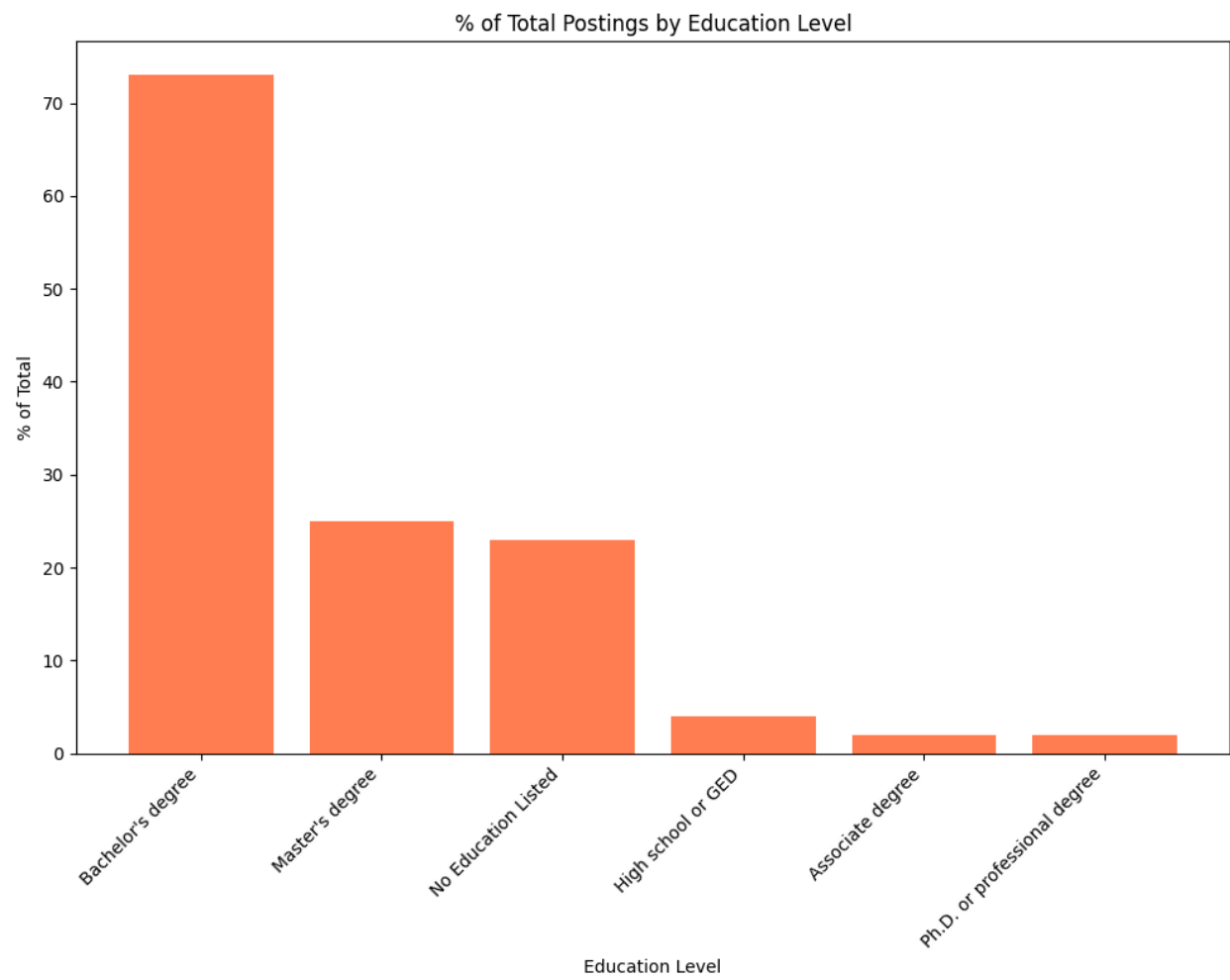
Figure 9: Education level required for available jobs represented in percentages

Discussion

According to Figure 9, a large percentage of jobs require a Bachelor's degree. Thus, expansion of RPIE would be beneficial for immigrants who do not have a Bachelor's degree in the U.S. and would allow them to obtain jobs. The other figures in the previous section allow us to narrow down which New York State counties expansion of RPIE would be particularly useful for people in that region.

Figures 2, 3, and 4 reveal counties with higher concentrations of immigrants with higher education. Figures 2 and 4 show higher concentrations near New York City, which is important since RPIE predominantly spreads through word of mouth, as shown by Figure 1. People geographically close to New York City are more likely to have heard about the program and therefore participate. Figure 3 shows high ratios further away from New York City most likely because those counties have less immigrants than counties near New York City. Thus, the number of immigrants with higher education divided by the number of total immigrants resulted in larger values.

As expected, Figure 5 displays that New York City has the largest number of unique job postings. Albany, Westchester, and Suffolk counties closely followed New York City and were previously observed to have high ratios in Figures 2 and 4. However, for the purpose of our analysis, we will not be including Westchester and Suffolk counties since they are within the New York City Metro region and are already eligible for RPIE. In Figures 3 and 5, the overlapping counties are Onondaga and Broome. These counties and Albany are home to a large number of immigrants with higher education and have a large number of jobs available compared to other counties.

Figure 6 shows that most of the companies that have the highest unique job postings offer jobs in the field of engineering. Colliers Engineering and Design is a provider of multidisciplinary engineering, architecture, design, and consulting services [4]. Architecture, Engineering, Construction, Operations, and Management (AECOM) is an infrastructure consulting firm [3]. Actalent is an engineering and sciences services and talent solutions organization [1]. WSP Global is a professional services firm providing strategic advisory, engineering and design services to clients in the transportation, infrastructure, environment, building, power, energy, water, and mining sectors [8]. Greenman & Pedersen is a consulting engineering, planning, survey, mapping, and construction management and inspection firm [5]. H2M Architects + Engineers is a multi-disciplined firm where architects, engineers, surveyors, landscape architects, and environmental scientists provide full service consultation and design [2]. National Grid is a large investor owned energy company [6].

Figure 7 shows that most job availability is in the field of engineering. The location of these jobs is broken down in Figure 8, which shows that Albany, Onondaga, and Broome are among the top counties with many companies supplying engineering jobs. This means that these three counties have a large number of immigrants with higher education, a large number of jobs, and are home to companies in the engineering sector. Thus, it would be most productive to expand RPIE in these locations.

References

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