College and Career Readiness in Charlotte, NC: An Analysis on Academic Performance, Career Readiness, and Upward Mobility.

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Overview

America has long been hailed as the land of opportunity, but is the age-old saying relevant equally across all parts of the US today? A study in 2014 by Raj Chetty and his colleagues, leveraging the possibilities of big-data, showed that opportunities for upward mobility (moving from lower fifth quartile of income to upper fifth income group) is unevenly distributed across different commuting zones in the US (Chetty et al., 2014, p. 1). Some major cities provide higher chances of upward mobility while some cities have a very low rate of upward mobility. The study showed that Charlotte, a booming economic hub of the southeast, has the least opportunity for upward mobility among fifty major cities in the US (Chetty et al., 2014, p. 1). The revelation took the city leaders by surprise. They scrambled to address the situation and formed a task force consisting of experts from different walks of life. After more than a year of intense study and consultations, the task force identified Early Care and Education, College and Career Readiness, and Child and Family Stability as the key determinants that influenced the children's ability to move up the economic ladder later in their lives. The task force also pointed out that the impacts of Segregation, and Social Capital cut across all three determinants mentioned above. With a goal to minimize the impacts of these determinants, the task force made several recommendations and implementation tactics. This paper is focusing on whether the recommendations made by the Task Force to address the issue of College and Career Readiness are being implemented so far. If they have been implemented, what have their impacts been? The task force report has placed a huge emphasis on the role of guidance counselors as most of the students from low socioeconomic backgrounds lack not just resources but also right information on the cost of attending college, admission procedure, and the quality of education institution. This situation can often lead the students to avoid college or apply for college with poor records in educational quality and degree completion

(Castleman & Goodman, 2014). Increasing the number of counselors and providing families and students from low socioeconomic backgrounds with necessary information and resources can significantly help them in making right decisions about their academic journey (Castleman & Goodman, 2014).

Hypotheses

Hypothesis 1 *As the number and quality of mentors increase, there will be an increase in academic performance and college acceptance rates for low-socioeconomic students.*

Active intervention by counselors have shown to have a significant positive impact on mathematics test scores and attitudes towards school (Lee, 1993). Guidance counselors assist in the college application and enrollment process (Deslonde & Becerra, 2018; Tang & Ng, 2019). For low-socioeconomic schools, the counselor's duties expand to help students navigate any roadblock that may arise to hinder postsecondary education enrollment (Deslonde & Becerra, 2018; Farmer-Hinton & Adams, 2006). The experience and pool of knowledge well-trained counselors have can give students access to social capital than they would otherwise not be able to utilize (Tang & Ng, 2019).

The variables that will operationalize this hypothesis are the number of guidance counselors in Charlotte-Mecklenburg Schools, as well as high school graduate intention. To operationalize academic performance, the percentage of the student population enrolled in Advanced Placement classes, and the percentage of exams that score at least a 3 out of 4 will be used. College enrollment rates are fairly straightforward, and economically disadvantaged students enrolling in college will be used. Dual enrollment is a sought after variable to help measure academic performance.

Hypothesis 2 *As the quality of mentors and counselors increase, there will be an increase in obtained CTE Credentials by students within Charlotte Mecklenburg County Schools.*

The literature suggests that deliberate intervention with academic progression

amongst students, has a direct correlation with academic performance, career pathway selection, and career progression. For example, students who have involvement within their educational career starting in early childhood, do indeed have a higher likelihood of climbing the ladder of economic mobility (Magnuson & Starr, 2000). Thus, educational involvement and academic guidance at an early age, including transitions into high school enable students to perform well academically and be conscientious of their career selection, including careers in technical education. Consequently, the consideration and pursuit of numerous career options engenders career awareness for students who may prefer vocational training over that of postsecondary education. It is suggested that, causally, early childhood habits help identify vocational preferences, competence, and parameters of success (Magnuson & Starr, 2000). The catalyst for economic prosperity and upward mobility is not strictly causal to postsecondary education efforts. Vocational training and Trades are very positive markers and are commonly overlooked as a viable option. The literature suggests that parents, educators, and counselors should emphasize the pursuit of vocations within the United States, primarily because of its dichotomy of historical attrition and increased necessity; this ideal was additionally supported by the Perkins Career and Technical Education (CTE) Act of 2006 (Castellano et al., 2017). The variables that will be operationalized to measure this hypothesis will come from the *NC Department of Public Instruction Data* that provides insight into obtained CTE credentials of students within Charlotte Mecklenburg County Schools, by year (CTE_Credentials, CTE_Enrollment); and also the aggregate and ratio of counselors and mentors within Charlotte Mecklenburg County Schools (Staff).

Data Description

Data Sources and Sets

The North Carolina Department of Public Instruction (NCDPI) is tasked with carrying out education legislation (NC DPI). It oversees public schools, charter schools, and schools for students with hearing and vision impairments. It not only develops the

curriculum taught in North Carolina, but also provides leadership and support in accountability, finance, and administrative work (NCDPI, 2021). The NCDPI also provides licenses to teachers in the state (NCDPI, 2021). It coordinates and collaborates with school administration and accountability offices to collect and organize data on schools state-wide (NCDPI, 2021).

NCDPI utilizes school reporting data to compile the annual School Report Card. The Report Cards go over topics related to primary and high school performance (ReportCards, 2022). Readily available for download is information ranging from 2013-2020, all in Microsoft Excel format. Various information is covered by county, including charter and regional schools (ReportCards, 2022). The NC Report Cards contain information on academic performance, such as Advanced Placement (AP) classes and exams, college enrollment, and CTE programs(ReportCards, 2022).

The North Carolina Public Schools Statistical Profile is intended to supply statistical information on the public school system, but also contains information on charter and regional schools(NCStats, 2021). It has a variety of information at the state, district, and school level(NCStats, 2021). It provides "general statistical data to the public, professional educators, and the General Assembly" (NCStats, 2021). For school personnel, the number of individuals in each position are given across the school district. High school graduates are broken down by demographic and post-high school intentions, whether that is college, employment, or something else(NCStats, 2021).

> The Institute of Social Capital (ISC) was founded in 2004 by stakeholders in the Charlotte-Mecklenburg region. It became part of the UNC Charlotte Urban Institute in 2012. The ISC provides unidentified administrative data and assistance in the research and data analysis efforts. To access the data, one must provide a request. The intention is to use this information to gain the percentage of first-generation college students dually-enrolled at CPCC during their junior and senior high school years. Also, to gain the information on the

> percentage of CMS students in paid internships, if possible. This information may be elsewhere, or not available. (Khadka et al., 2022)

The Quality of Life Explorer takes a closer look at societal, structural, and economic conditions within Mecklenburg County (QoL, 2022). It provides information in the form of maps, tables, and reports, broken down by neighborhood. Reports can be created by filtering the data geographically, allowing for custom geospatial analysis (QoL, 2022). Specifically, the Quality of Life Explorer has median household income by zip code. This allows the team to find the median household income where each school is located, giving some glimpse at the economic level of each institution (QoL, 2022).

Missing

This research focuses on high school alone out of primary and secondary education. Beginning early in life planning can have a great impact on the success of a student (Magnuson & Starr, 2000). However, the decisions finalized in high school can have lasting more immediate effects on a student. The Chetty report was published in 2014 and the Leading on Opportunity Report was published in early 2017 (Chetty et al., 2014; Task-Force, 2017). Those entering high school or graduating since 2017 are the closest to making those lifelong decisions. If effective change is to be made in the last few years to positively alter one of these students' choices, focusing on the success of high school is most important. The data necessary to perform accurate analysis on the academic performance and job readiness of students needs to cover all high schools in Mecklenburg County. Academic measures, such as test scores and college enrollment per school can help measure the college readiness of the graduating students. The quality and number of mentors to provide guidance and access to social capital for students is integral to increasing the education attainment of Charlotte-Mecklenburg students. Currently, cohesive and comprehensive data on measures related to career readiness, such as if students are given access to paid internships or how many of a graduating class seeking employment find it, is lacking. Information on high school students taking college courses is outdated (2017 and

before), and no longer kept by the sources we have investigated. This is a loss to understanding the effectiveness of the 'Career and College Promise Program' which allows students to earn college credits at CPCC during high school. Without more solid information on career-related data, measuring how well-equipped students are to thrive in a professional environment is mostly about how many skills they are taught while still within reach of the Charlotte-Mecklenburg School system.

Codebook

Much of the data collected in the various data sets are reported by the school, due to accountability laws (NCDPI, 2021). If the data request from the ISC is successful, that information comes through collaborative collection efforts and administrative data. Refer to Table A2 for the full codebook. As one can see, the years for some of our variables are lacking, such as information regarding CTE enrollment and credentials.

Variable Information

All the variables are numeric, allowing for the mean, standard deviation, minimum, maximum, non-missing, and percent of missing values to be calculated. Table A4 & A5 provide information on the statistics of the variables. Identifier variables are covered in Table A3. These can be found in the appendix.

Several or more years of data are missing for some key variables, such as CTE credentials earned and students enrolled in a CTE program. College enrollment is not complete for every subgroup and every year. Most importantly, the 2020 school year enrollment data is missing. It also appears that the 2016 year is missing for this variable, as well. Without more comprehensive CTE data, potential analysis on the measures that increase the probability of success for students entering the workforce is potentially crippled. Going forward, substitutes may need to be located, or innovative and accurate methods of completing missing data should be used.

Analysis

There are a few potential analysis methods that could be implemented to help validate our hypotheses. The Chi-Squared Test can be used to help test the relationship between predictor and target variables. The evaluation metric, p-value based on degrees of freedom, can provide a statistically significant (or not significant) answer whether a predictor variable is related to the targets. Regression analysis is perfect for continuous variables, of which the majority of the variables being studied are. The few discrete variables that exist (such as number of counselors) can be divided into the student population, or another population statistic, to create a continuous variable. Regression allows for evaluation metrics such as the root mean squared error, correlation coefficients, and mean absolute error. It can be implemented with machine learning models or multivariate equations. Random Forest models are generally strong and simple to put into practice and can perform regression. Correlation can be helpful in determining the direction of a relationship between variables. The team is still looking into final analysis techniques. Regression and the Chi-Squared are some of the methods that seem to fit with the type of data and problem we are approaching. More machine learning models are being reviewed for fit with the research question and variables that operationalize it. Regression analysis is a definite tool to utilize, but as to how it will be implemented remains a question. The hypotheses suggest a relationship between variables. Correlation coefficients can be an important tool in determining the validity of a hypothesis.

Conclusion

The strategies and implementation tactics proposed by Opportunity Task Force appear in line with the scholarly literature. From increasing the number of guidance counselors to provide insight into academic and career options, to increasing the accessibility of AP courses to students from low socioeconomic backgrounds, the literature suggests that those mitigation measures in fact have shown positive effects on students (Castleman & Goodman, 2014). It is expected to see a positive correlation between the

number of guidance counselors and college acceptance rates. Similarly, a positive relationship between counselors and the number of students obtaining CTE credentials is an expectation. With the implementation of a linear regression model to establish the relationship between these variables, it is anticipated to see a positive value for coefficient of the dependent variable. Other machine learning models are still under consideration, but the team expects to find results consistent with the hypothesis that have been presented in this paper. However, the details of those explorations are still underway and the team is actively looking for data that could continue to help establish those relationships. The next step for our team will be deciding the appropriate analysis methods and machine learning models for future prediction. Further research into the domain via scholarly resources is necessary to support future methods, models, and evaluation metrics that will be implemented. The next sprint will divulge into the attributes of the results, the interpretation of analysis, and the determination of the chosen predictive model with effort to anticipate future markers for scholastic success. This effort will be done to assist students in the pursuit of academic and occupational success, and alleviate hardship hereafter with regard to systemic obstructions in Upward Mobility.

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Appendix A

Table A1

Intentions Dictionary

Intention Abbreviation	Intention Full
int_employ	Employment
int_military	Military
int_other	Other
int_commcoll	Community College
int_privjr	Private Junior Institution
int_privsr	Private Senior Institution
int_pubsr	Public Senior Institution
int_tradesch	Trade/Business School

Table A2

Codebook

Variable	Information		
	Years	Type	Description
		Report Card	
AP_part_pct	2014-2020	Continuous	Percent of students enrolled in AP classes
AP_pass_pct	2014-2020	Continuous	Percent of AP exams with a score of 3 or more
enroll_**subgroup**[a]	2011-2019	Continuous	Percent of students enrolling in college
CTE_enroll_pct	2018-2020	Continuous	Percentage of students enrolled in a CTE program
CTE_cred_pct	2018-2020	Continuous	Ratio of CTE credentials earned over students enrolled in programs
		NC Stats	
total_counselors	2015-2020	Discrete	Guidance counselors employed district wide
int_**intention**[b]	2015-2020	Continuous	Percent of students by post-secondary intention
		ISC	
Dual Enroll	—	Continuous	Percent of students dual-enrolled[b]
		Quality Explorer	
2019_med_hh_inc	2019	Discrete	2019 Median Household Income by Zip Code

[a]See Table A4 & A5 for all subgroups.

[b]See Table A1 for all graduate intention definitions.

Table A3

Identifier Variables

Identifier	Information		
	Type	Use	Description
		I.D. Variables	
School Name	String	Identify school by name	Full name of the high school
School Zip Code	String	Assign median household income	Five-digit postal code
School Agency Code	String	Join separate data	Six-digit DPI code
Year	String	Join separate data	Year of the data
Household Median Income	Integer	Identify low-income areas	Median income of the zip code for the year 2019

Table A4

Summary Statistics

Variable	Statistics					
	Count	Mean	Std	Min	Max	Missing
AP_pass_pct	136.0	0.43	0.23	0.05	0.84	0.04
AP_part_pct	138.0	0.22	0.13	0.0	0.57	0.03
total_counselors	142.0	440.77	46.77	361.0	508.0	0.0
int_employ	142.0	11.24	2.66	8.3	15.0	0.0
int_military	142.0	2.6	0.3	2.2	3.0	0.0
int_other	142.0	1.75	0.81	1.0	3.1	0.0
int_commcoll	142.0	33.81	1.92	31.3	36.9	0.0
int_privjr	142.0	0.33	0.11	0.2	0.5	0.0
int_privsr	142.0	8.75	0.63	7.8	9.5	0.0

Table A5

Summary Statistics

Variable	Statistics					
	Count	Mean	Std	Min	Max	Missing
int_pubsr	142.0	40.58	1.48	38.4	43.4	0.0
int_tradesch	142.0	0.9	0.15	0.7	1.1	0.0
enroll_All	42.0	0.63	0.17	0.34	0.95	0.7
enroll_AmericanIndian	0.0	nan	nan	nan	nan	1.0
enroll_Asian	31.0	0.52	0.31	0.06	0.95	0.78
enroll_Black	88.0	0.41	0.21	0.06	0.95	0.38
enroll_Disadvantaged	63.0	0.36	0.19	0.07	0.85	0.56
enroll_EnglishLearners	12.0	0.3	0.16	0.05	0.55	0.92
enroll_Female	91.0	0.48	0.19	0.15	0.92	0.36
enroll_Hispanic	65.0	0.25	0.19	0.05	0.7	0.54
enroll_Male	87.0	0.4	0.18	0.11	0.84	0.39
enroll_Twoormore	13.0	0.65	0.21	0.05	0.93	0.91
enroll_PacificIslander	0.0	nan	nan	nan	nan	1.0
enroll_Disabilities	16.0	0.39	0.12	0.24	0.66	0.89
enroll_White	63.0	0.52	0.25	0.05	0.91	0.56
CTE_cred_pct	19.0	16.26	14.95	0.0	54.0	0.87
CTE_enroll_pct	69.0	65.91	14.8	22.12	97.99	0.51

Appendix B

Figure B1

AP Participation Percent over Time

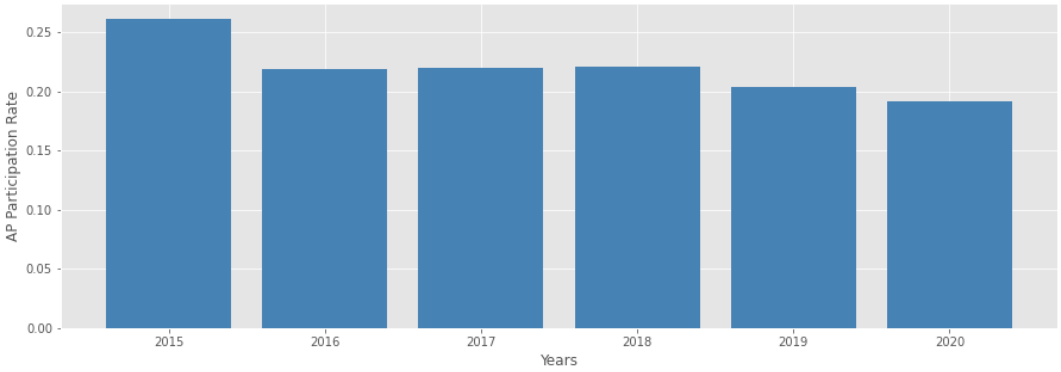

Figure B2

AP Pass Rate over Time

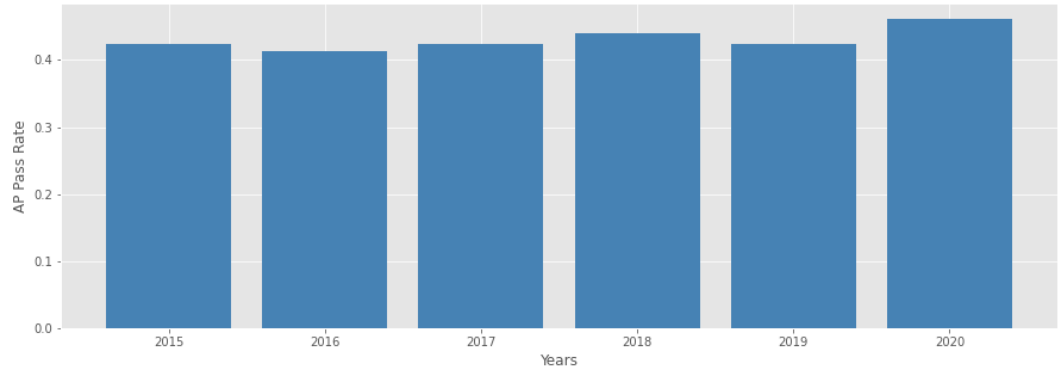

Figure B3

CTE Student Enrollment over Time

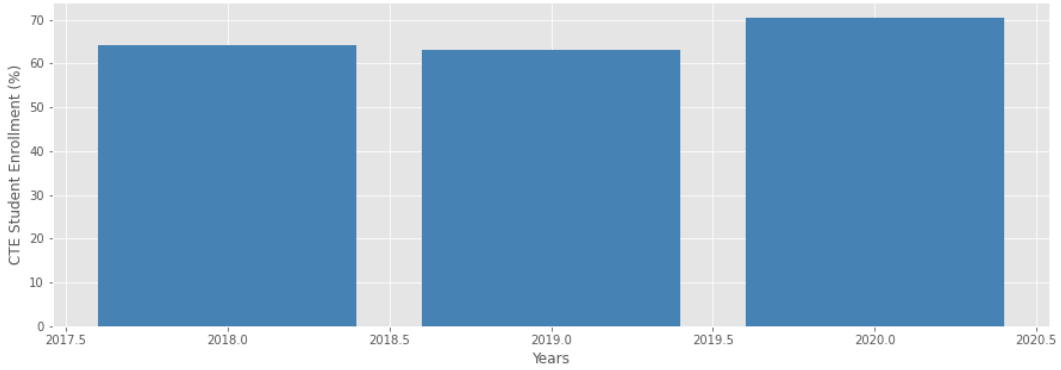

Figure B4

Economically Disadvantaged Students College Enrollment over Time

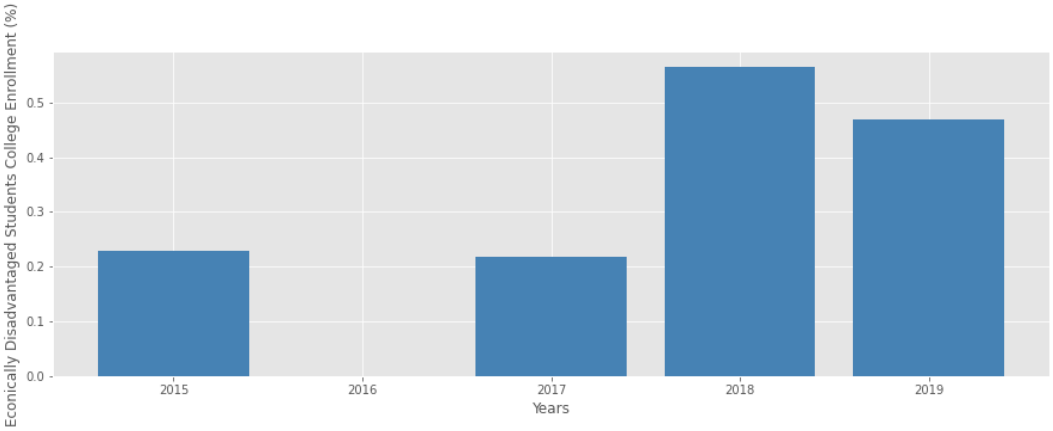

Figure B5

Number of Counselors at District Level