

State University of New York College at Buffalo - Buffalo State College

Digital Commons at Buffalo State

Career & Technical Education Theses

Educational Foundations

12-2019

CORRELATING CENSUS DATA WITH BOCES ENROLLMENT DEMOGRAPHICS: A STUDY ON THE NEED FOR DEMOGRAPHIC COHESION

Dana N. Roman

State University of New York College at Buffalo - Buffalo State College, Romadn92@mail.buffalostate.edu

Follow this and additional works at: https://digitalcommons.buffalostate.edu/careereducation_theses



Part of the [Vocational Education Commons](#)

Advisor

Dr. Steve Macho

First Reader

Dr. Steve Macho

Second Reader

Judith Davis

Third Reader

Kimberly Lemieux

Department Chair

N. John Popovich, Ed.D. Chair and Associate Professor of Career & Technical Education

Recommended Citation

Roman, Dana N., "CORRELATING CENSUS DATA WITH BOCES ENROLLMENT DEMOGRAPHICS: A STUDY ON THE NEED FOR DEMOGRAPHIC COHESION" (2019). *Career & Technical Education Theses*. 3.
https://digitalcommons.buffalostate.edu/careereducation_theses/3

Follow this and additional works at: https://digitalcommons.buffalostate.edu/careereducation_theses



Part of the [Vocational Education Commons](#)

STATE UNIVERSITY COLLEGE AT BUFFALO
CAREER AND TECHNICAL EDUCATION PROGRAM

CORRELATING CENSUS DATA WITH BOCES ENROLLMENT DEMOGRAPHICS:
A STUDY ON THE NEED FOR DEMOGRAPHIC COHESION

A MASTERS THESIS IN
CAREER AND TECHNICAL EDUCATION

BY

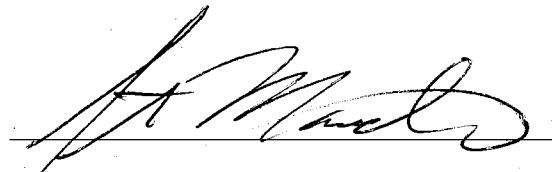
DANA NICHOLE ROMAN

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTERS OF SCIENCE IN EDUCATION
IN CAREER AND TECHNICAL EDUCATION
DECEMBER 2019

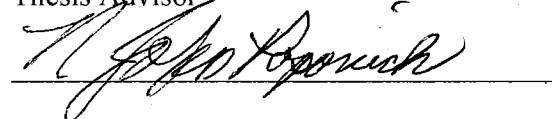
DATES OF APPROVAL:

11-19-19



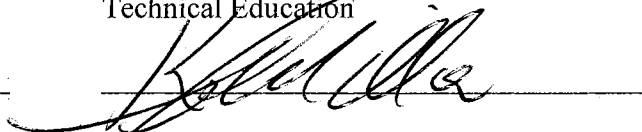
Steve Macho, Ed.D.
Associate Professor of Career and Technical
Education
Thesis Advisor

11/19/19



N. John Popovich, Ed.D.
Chair and Associate Professor of Career and
Technical Education

11/20/19



Kevin J. Miller, Ed.D.
Dean of the Graduate School

THESIS COMMITTEE SIGNATORY

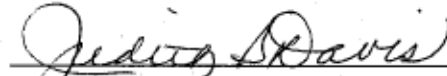
DATES OF APPROVAL:

11-19-2019



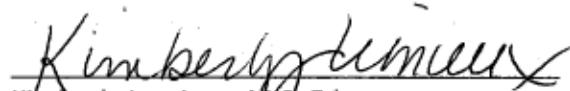
Steve Macho, Ed.D.
Associate Professor of Career and Technical
Education
Thesis Advisor

11/19/2019



Judith Davis, M.S. Home Economics
Education
Lecturer in Career and Technical Education

11/19/2019



Kimberly Lemieux, M.S. Ed.
Lecturer in Career and Technical Education

Contents

| | |
|---|----|
| List of Tables and Figures | 4 |
| Abstract | 5 |
| Chapter 1 | 7 |
| Problem Statement | 7 |
| Research Question | 7 |
| Method | 8 |
| Assumptions | 8 |
| Limitations | 8 |
| Definitions | 9 |
| Chapter 2 | 10 |
| The History of Career and Technical Education | 10 |
| The History of BOCES | 17 |
| The United States Census | 18 |
| The Pew Research Institute | 18 |
| Related Publications | 19 |
| Chapter 3 | 23 |
| Problem Statement | 23 |
| Research Question | 23 |
| Assumptions | 24 |
| Limitations | 24 |
| Method | 24 |
| Chapter 4 | 26 |
| Chapter 5 | 35 |
| Problem Statement | 35 |
| Research Question | 35 |
| Method | 36 |
| Limitations | 36 |
| Conclusions | 36 |
| Recommendations | 38 |
| References | 41 |

List of Tables and Figures

| | |
|---|----|
| Table 1: Enrollment Proportions Split by County and Gender. ON BOCES Enrollment Data (Middle Column) Provided by ON BOCES Program; Census Data (First and Last Column) from Census.gov..... | 28 |
| Table 2: Enrollment Proportions Split by County and Race/Ethnicity. ON BOCES Enrollment Data (Middle Column) Provided by ON BOCES Program; Census Data (First and Last Column) from Census.gov..... | 31 |
| Figure 1: Enrollment Proportions Split by Gender for Orleans County in 2010..... | 33 |
| Figure 2: Comparing Proportion of Hispanic Enrollment in Orleans County for 2000 and 2010 | 34 |

Abstract

BOCES was a public institution originally created in 1948 to enable smaller rural school districts to combine resources and funding. Pooling of resources allows for the creation of programs that would not otherwise be economically feasible due to low population density and funding gaps (boces.org). BOCES has evolved to include rural and larger school districts as well. Just as there is a need for the skills learned at BOCES to match industry demands, so too is there a need for the work-force diversity to be reflected in the student population at BOCES. To meet this need, BOCES administration must pay special attention to attracting a diverse swath of the population from the school districts it serves.

Predicting demographic changes in the population could serve as a useful method in changing marketing strategies for the ever-changing student population. The United States Census collects regional demographic data every decade about all individuals in the U.S. Using pre-existing census and enrollment information may be the key to understanding future population trends. Specifically, are demographics in census data predictors of changes in enrollment at Orleans-Niagara BOCES from 2000 to 2010?

To put it simply, yes and no. Gender demographics were not predictors of changes in enrollment in 2000. The 2010 gender demographics showed only slight differences. Race demographics also showed little change between 2000 and 2010.

The one race category that did not follow these trends was the Hispanic population in Orleans county. Not only did the Hispanic population greatly increase from 2000 to 2010, the number of Hispanic students enrolled in BOCES dropped between 2000 and 2010.

This decrease in Hispanic student enrollment shows a lack of student recruitment from a section of the population which is rapidly increasing. Further research is necessary. The U.S. population continues to shift towards a more ethnically diverse make-up and that shift needs to be reflected in the workforce.

Chapter 1

Problem Statement

The United States Census is used to count every individual in the U.S. and is collected once a decade. The data collected is broken down into demographic categories. These categories can be further broken down by region (census.gov). Demographics are statistical markers of human populations such as gender, age, race, income, and geographic location (Merriam Webster.com). BOCES was a public institution originally created in 1948 to enable smaller rural school districts to combine resources and funding. The pooling of resources allowed for the creation of programs that would have not otherwise been economically feasible due to low population density and funding (boces.org). BOCES has evolved to include rural and larger school districts as well.

Just as there is a need for the skills learned at BOCES to match industry demands, so too is there a need for the work-force diversity to be reflected in the student population at BOCES. To meet this need, BOCES administration must pay special attention to attracting a diverse swath of the population from the many school districts it serves. Predicting demographic changes in the population could serve as a useful method in changing marketing strategies for the ever-changing student population. Using pre-existing census and enrollment information may be the key to understanding future population trends.

Research Question

Were demographics in census data predictors of changes in enrollment at Orleans-Niagara BOCES from 2000 to 2010?

Method

This paper will be an examination of the changes in demographics for the greater Niagara Frontier and if those changes are reflected in enrollment at Orleans-Niagara Boards of Cooperative Educational Services (BOCES). This analysis will be achieved through the comparison of BOCES enrollment statistics to Niagara and Orleans County census data. The demographics data will be collected from state enrollment records for the Orleans-Niagara BOCES programs and compared to demographic data in the 2000 and 2010 U.S. census. Special attention will be paid to changes in the population regarding gender, race, and the available socio-economic data.

Assumptions

The research will mainly be based upon the assumption there is a relationship between both sets of data. Further, this data must be fine-grained enough to show a change in demographics. An assumption will be made that all data reported by Orleans-Niagara BOCES is accurate. Also, we must assume all census data from 2000 and 2010 was truthfully reported and accurately recorded. The largest assumption for this study will be the availability of data on student demographics from Orleans-Niagara BOCES.

Limitations

Research will be limited to United States census data from 2000 and 2010 with a focus on the Orleans-Niagara BOCES district. Data will also be gathered from Orleans-Niagara BOCES concerning student population demographics for 2000 and 2010.

Definitions

The United States Census- is used to count every individual in the U.S. and is collected once a decade. The data collected is broken down into demographic categories. These categories can be further broken down by region

Demographics- are statistical markers of human populations such as gender, age, race, income, and geographic location

BOCES- The Board of Cooperational Education Services is a public institution created in 1948 to enable smaller rural school districts to combine resources and funding. The pooling of resources allowed for the creation of programs that would have not otherwise been economically feasible due to low population density and funding (boces.org).

Chapter 2

The History of Career and Technical Education

Throughout modern history, state and federal governments have had a major impact on Career and Technical Education. Mainly using legislation and grants, the government has aided in the spread and accessibility of vocational training in the United States. Federal legislation has been revised concerning CTE as recently as 2016 and was passed by unanimous vote on May 17, 2017. Through each legislative action there are a few common themes: allocation of funds, specific vocations, reaching new demographics, and improving infrastructure/oversight. This legislation was passed to address the changing industry demands and keep U.S. workers at the forefront of globalization trends.

The Morrill Act of 1862 was funded by the sale of public land to the government. This act created the first vocational colleges called “land grant institutions,” named after the means by which they were funded (Gordon, 2014, p.74). Later funding would come from federal and state government. For instance, The Smith-Hughes Act of 1917 legislated federal funds pay half of teachers’ salaries and the states pay the other half. The act earmarked those federal and state funds to only be spent on the salaries of vocational education teachers, not on the salaries of academic teachers (Friedel, 2011, p.39).

The George Acts increased funding for vocational education from 1929 to 1946. The George Reed Act in 1929 increased the budget by \$1 million annually from 1930 to 1934. The money was specifically meant to expand vocational education in agriculture and home economics. Under the George-Ellzey Act of 1934, \$3 million was to be divided annually between agriculture, home economics and trades and industry. The George-Deen Act of 1936 set aside a much larger budget at \$14 million a year for vocational education. This act required Congress to re-allocate an appropriate budget each year. This portion of the George-Deen Act

continues to be in effect today with each reauthorization of the Carl D. Perkins Act (Friedel, 2011, p.40).

The George-Barden Act of 1946, the last of the George Acts, not only increased funding for vocational education but also mandated a different distribution of the money. Home economics was separated from the rest of vocational education and apportioned a larger share of the funding than previously allotted (Friedel, 2011, p.40). Increasing the funding share to home economics appears to foreshadow the greater inclusivity of later legislation.

Early legislation targeted a subsection of the population. The Morrill act of 1862 “was to promote the liberal and practical education of the industrial classes” (Gordon, 2014, p. 57). The Commission on National Aid to Vocational Education in 1914 added vocational education to high school curricula. Nonetheless, a large portion of the population was not covered by this legislation because of individual circumstances.

The Vocational Education Act of 1963 was the first piece of legislation to ensure vocational education became more inclusive. This act tried to be more inclusive by recognizing academic, socioeconomic, or other disadvantages (Scott and Sarkees-Wircenski, 2004, p.73). Amendments to the act in 1968 and 1976 expanded the legislation to include people who were considered mentally retarded, deaf, or otherwise disabled. More funds were also allocated for high school and postsecondary students. The need to retrain individuals already in the work force was also recognized. Teacher training and evaluation programs were also improved (Gordon, 2014, p.449) These teacher training programs were originally part of the George-Barden Act.

The Perkins acts ranging from 1984 to 2006 largely tried to expand the scope of inclusivity. The Vocational Education Act of 1963 and its amendments of 1968 and 1976 were

replaced by the Carl D. Perkins Act of 1984 (Perkins I). Perkins I simplified the previous acts and added protections for individuals with limited English proficiency. The act also tried to improve gender equity in vocational programs. One method for improving gender equity was to target services for single parents, homemakers, and displaced homemakers. A second method was to focus on eliminating sex bias and stereotyping from vocational programs (Friedel, 2011, pp.41-43).

Perkins IV did not try to expand services but instead sought to monitor services provided to underserved groups to insure equity. This type of performance evaluation is indicative of the infrastructure and oversight requirements mandated over much of the history of vocational education.

Early on, the Federal board for The Vocational Education was created by the Smith-Hughes Act in 1917. The board's role was to oversee the states and administer the law, ensuring each state had created its own vocational education board. Some states created a separate vocational education board, while others simply renamed their existing boards to cover the mandate. Maintaining separate boards greatly perpetuated the separation of vocational and academic instruction. Smith-Hughes also stipulated half of instruction time was to be spent doing hands on, practical learning. This was to be over a minimum of nine months per year and not less than thirty hours per week (Scott and Sarkees-Wircenski, 2004, p.73). The major implication of these restrictions being vocational students would spend much of their time outside of the classroom.

Perkins I was the first act to allocate a specific split of funds for secondary and post-secondary schools. This split was included in each state's Perkins plan and was decided on a

state-by-state basis. Further division of funds was then determined by a formula set forth in federal law. When the Carl D. Perkins Vocational and Applied Technology Act of 1990 (Perkins II) was enacted, it sought to give greater flexibility to the state's usage of funding. Funds were no longer specifically allocated to programs for those with special needs. Instead the act sought to strengthen programs and services already in place, with the inclusion of those with limited English proficiency (Friedel, 2011, pp.44-45).

The Smith-Hughes Act was officially repealed in 1998. It was replaced by the Carl D. Perkins Vocational and Technical Education Act (Perkins III). States were then held to higher accountability standards. Each state was required to adhere to a standardized set of core indicators including academic achievement, placement and retention in advanced training, or employment and placement in non-traditional training programs. States were required to report this information to the federal government. Continual progress towards improvement was expected of each state's program (Friedel, 2011, pp.45-46).

The Perkins IV was enacted in 2006. It officially changed the title Vocational Education to the now commonly used Career and Technical Education. Originally the act sought to eliminate all federal funding for CTE. A compromise was reached to continue funding but place a much larger emphasis on academic achievement. These achievement standards were outlined in the No Child Left Behind Act of 2001. Students were also expected to meet standards mandated by each specific industry, when possible (Friedel, 2011, pp.49-51).

Standards and oversight were more clearly defined in the act, as was CTE itself. Perkins IV defines CTE as:

Organized educational activities that offer a sequence of courses that provides individuals with coherent and rigorous content aligned with challenging academic standards and relevant

technical knowledge and skills needed to prepare for further education and careers in current or emerging professions; provides technical skills proficiency, an industry-recognized credential, a certificate, or an associate degree; and may include prerequisite courses that meet the requirements of this subparagraph and include competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employ-ability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of an industry, including entrepreneurship of an individual (Carl D. Perkins Act 2006, Section 3(5)).

Throughout history, vocational education legislation has continually attempted to meet the demands of shifting job markets by targeting specific vocations. When the Morrill Act was written in 1862 it was intended to change agriculture from a way of life to a way to make a living. For the first time, science and mathematics and mechanics were integrated into agrarian education (Gordon, 2014, p.58).

In 1917, the Smith-Hughes act brought vocational legislation into the industrial age with provisions for agriculture, home economics, and trade and industrial subjects. Furthering this trend, the George-Deen act of 1936 included distributive occupations (marketing occupations) to meet changes in industrial manufacturing. The George-Bardin Act of 1946 sought to elevate home making by separating home economics from the rest of vocational education and apportioning it more funding (Friedel, 2011, p.40).

The Perkins Act of 1990 was written as a direct response to changes in the global economy and the loss of American jobs to overseas markets. It brought to the forefront the need for growth in computer-based information and technology training. Each subsequent Perkins Act placed greater focus on the emerging technology industry (Friedel, 2011, p.40).

Senator Edward Kennedy (D-MA) spoke about changes in the Perkins Act and the shift in vocational education to Congress in Senate Report No.100 (2006):

“As the needs of American business and industry have evolved, the revisions made to the Act over the years have reflected those changes. It is clear that vocational education is no longer the 1950s version. It has evolved from shop classes into courses that use cutting-edge technology and focus on emerging and growing fields that will become the jobs of the future. That is why we now call it career and technical education...”

State governments had to continually adjust policy to align with federal mandates. In 2006 New York State enacted a five-year plan to meet the standards laid down by Perkins IV. The focus of New York States plan was to align the New York State Board of Regents Standards with those of the Perkins IV (New York State Five Year Plan, p. 18). The plan sought to upgrade the course content and increase academic rigor to meet the ever-changing demands of CTE. Allowing for flexibility in scheduling, students could now meet all academic requirements while attending vocational training. There were also provisions for: increases in teacher training and assessment, increases in technical assessments of students, and an increase in accountability measures to be reported to the federal government. Students with special needs would continue to receive increased accessibility and support as well as a new provision for assistive technology (New York State Five Year Plan, p. 23).

Funding for CTE programs was done in a grant-based system and was based on program size and adherence to standards set forth by New York State. CTE programs must first meet all requirements set forth by the NYS Board of Regents and then the stipulations set forth in the Perkins IV act itself. (New York State Five Year Plan, p.27).

Changes in the global economy are still being addressed by legislation today. The Strengthening Career and Technical Education for the 21st Century Act was passed into

legislation on May 17, 2017. This is the first time Perkins legislation has been revised in a decade. Most notably the new bill puts the spotlight on local leaders and making changes to meet the shifting workforce needs. Work-based learning is heavily emphasized and CTE programs are evaluated on their ability to prepare students for the work force (Bill Summary, 2017).

The bill also encourages better integration of career and technical education services with other state-led programs. This will help to improve accessibility to a more streamlined workforce development system (Bill Summary, 2017).

Law makers have also acknowledged the projected worker shortages for the coming years. In the Strengthening CTE for the 21st Century Act there are provisions to encourage engagement with employers and local business leaders. These industry professionals will help set the standards in local CTE programs, ensuring students are better prepared to fill local workforce needs. The bill also allows greater flexibility for state lawmakers. They can shift more funds to CTE programs focused on economic changes and innovation (Bill Summary, 2017).

Title IX is a clause of the Federal Education Amendments passed in 1972. It explicitly states no person can be excluded, based on their sex, from participation in a federally funded education program (Britannica). While the focus of this clause was athletics, there were major implications for CTE as well. To comply with Title IX CTE schools must be sure to encourage gender equality in all their programs. This is often challenging as gender rolls and stereotypes can play a major role in a student's decision to attend a CTE program (Eardly, Manvell, 2006, p.396).

The History of BOCES

Boards of Cooperative Educational Services (BOCES) was formed in 1948 by the New York State Legislature. The goal of BOCES is to provide shared educational programs to smaller districts in the state. This allows for more cost-effective planning in those districts by combining multiple districts into one centralized CTE location (About BOCES). The Orleans-Niagara BOCES is comprised of 13 school districts. Many of them are rural districts with small populations. Combining them into one major hub allows students greater access to programs and services. ON BOCES services Albion, Barker, Lewiston-Porter, Lockport, Lyndonville, Medina, Newfane, Niagara Falls, Niagara-Wheatfield, North Tonawanda, Royalton-Hartland, Starpoint, and Wilson school districts (ON BOCES.org).

The programs offered by each BOCES district can vary based on size, funding, and program demand. ON BOCES lists the following programs on the ONBOCES.org website:

Advanced Manufacturing and Engineering, Auto Body Repair, Allied Health, Animation and Video Production, Automotive Technology, Heavy Equipment/Ag Mechanics, Building Trades, Certified Personal Trainer, Computer Technology, Conservation, Cosmetology, Culinary Arts, Digital Design & Production, Early Childhood Education, Electricity/Electronics, Emergency, Medical Services, Fashion Design/Interior Decorating, Graphic Communications, Heating, Ventilation Air Conditioning (HVAC), Heavy Equipment/Diesel Mechanics, Health Occupations, Technician (H.O.T.), Project Based Engineering, Security and Law Enforcement, Technical Math/Science/Technical Communications Career and Financial Management, Web Development and Game Programming, Welding , VIP Automotive Services, VIP Buildings and Grounds, VIP Food Service, VIP Landscaping and Grounds. (ON BOCES.org)

Funding for BOCES programs comes from the State and Federal governments. Money is allocated to each state and then broken down by district. Districts must prove they are following regulations mandated by federal legislation. It is up to the states government to determine if programs are following the most recent legislation. The Strengthening CTE for the 21st Century

Act was passed in 2017. ON BOCES and other CTE programs must make the necessary changes to their policies ensuring the continuation of funding (Bill Summary, 2017).

The United States Census

The United States Census was first taken in 1790, after George Washington took office. The Census is a questionnaire used to count the number of people living in the United States and then break the number down into different categories or demographics (Census.gov). The largest implication of the numbers gathered effects the amount of taxes and the number of seats in the House of Representatives each state is apportioned. The census is taken every ten years (Fact Finder).

Webster's Dictionary defines demography as "the statistical study of human populations especially with reference to size and density, distribution, and vital statistics" (Merriam-Webster.com). The US Census uses demographics to determine population shifts. Some of the demographic categories used are age, sex, race, Hispanic origin, migration, ancestry, language use, health, education, employment, income and poverty (Census.gov). The census data is freely available to the public online. This data is not only used by the government but many other public and private sectors as well. Businesses can use it to tailor to their shifting community, and schools can use the data to keep abreast of their changing district populations.

The Pew Research Institute

The Pew Research Institute is a non-biased research group. They gather information from the public through opinion polling, demographic research, content analysis and other data-driven social science research. The Pew Institute states firmly states they do not take sides on policies. They seek to simply collect data and then make it accessible and understandable to the public (Pewreserch.org).

In 2008 the Pew Institute published a study projecting changes in population growth in the United States from 2005 to 2050. One of the biggest shifts in population will be the increase in reliance on immigrants to keep the U.S. population growing. The number of foreign-born citizens will rise from 12 percent to around 19 percent of the total U.S. population (U.S. Pop projections, 2008, p.1)

If CTE programs are to continue to successfully service their communities, there will need to be a shift in marketing to these new demographic groups. Most importantly CTE programs will need to attract and recruit their children to replace the aging baby boomer generation as they retire over the next decade.

Related Publications

In the doctoral dissertation “Predictors of Student Enrollment Patterns in High School Career Academies”, Cox sought to determine whether demographic variables and prior education had an influence on enrollment of students in career and technical education programs. He believed it was important to address the absence of literature prior to his study “on career academy program participation, supporting the notion the demographic (gender, race/ethnicity, and socio-economic status) make up of career academies mirror the demographics of the schools, districts, and the communities in which they operate” (Cox, 2013, p. 19).

A quantitative study was done using data from a six-year period. Cox determined enrollment trends by creating two types of models to see if he could predict the influence of demographics and prior learning experiences influenced enrollment. He used a binary logistic regression and multinomial logistic regression (Cox, 2013, p. 19).

Cox found while there was a continued increase in non-Caucasian enrolling in career academies, most students were identified as Caucasian. He also found female students and students from economically privileged backgrounds enrolled in greater than average numbers. Furthermore, students who had participated in CTE programs had a higher rate of enrollment in high school programs (Cox, 2013, p. 19).

Because this study was limited by the usage of aggregate data, Cox suggests further research be done on this topic. He believes a more in-depth study be done, attempting to integrate students who cross multiple demographics (e.g., Native American female from an economically under-privileged household). This continued research would give a much clearer picture of where the gaps are in enrollment and how programs might shift their focus (Cox, 2013, p. 19).

In Hargis' dissertation "Career and Technical Education Program Alignment with Local Workforce Needs", she studied career and technical education in a section of Kentucky's Appalachian region. Hargis wanted to determine whether the program was meeting the regions employment needs and providing the students with the soft skills to obtain jobs in the industry (Hargis, 2011, p. 5).

In the problem statement Hargis' explains many of the area's technical centers (or ATC's) have been operating the same technical programs for over 30 years. The technical industry is constantly changing as well as the local demands of the workforce. Hargis points out, if the ATC's programs do not change with the needs of the industry then it will create gaps between the skills the students have and the needs of their potential employers (Hargis, 2011, p.9).

A quantitative study was done comparing the number of jobs available in the local market to the enrollment levels in the local CTE program. Soft skills were evaluated using the Kentucky Occupational Skills Standards Assessment (KOSSA) (Hargis, 2011, p.56).

Hargis' findings showed major inconsistency between CTE program enrollment and industry needs. Some programs were over-enrolled based on job placement opportunities, while others were under-enrolled leaving many local jobs unfilled. She also discovered passing the KOSSA was not a good indicator of the student's soft skills and employability (Hargis, 2011, p.109).

Hargis concludes program misalignment with local industry indicates most students will be forced to leave the area to find employment. She then goes on to explain this theory can be applied nationally, as it may have greater implication for the U.S. technology industry (Hargis, 2011, p.109).

Thomas V. Toglia wrote an article in the Journal *techdirections* entitled "Gender Equity Issues in CTE and STEM Education." In the article he explains the legislation behind addressing issues pertaining to the gender gap in CTE, and equity issues surrounding female students enrolling in non-traditional programs. He explains there has been legislation to encourage female students to enroll in CTE and STEM programs can lead to higher earning potential. Despite this legislation Toglia states there has been no growth in women in STEM jobs since 2000. This indicates female students are still not being encouraged to pursue courses in science and technology. Because more females are becoming heads of the household and family wage earners, this can have major economic impacts in the future (Toglia 2013, p.15).

Toglia then goes on to make suggestions on how to remedy the gender gap in CTE. He suggests better training for guidance counseling and more of a focus on exposing female students to all the opportunities available to them (Toglia 2013, p.16).

Chapter 3

Problem Statement

The United States Census is used to count every individual in the U.S. and is collected once a decade. The data collected is broken down into demographic categories. These categories can be further broken down by region (census.gov). Demographics are statistical markers of human populations such as gender, age, race, income, and geographic location (Merriam Webster.com). BOCES is a public institution created in 1948 to enable smaller rural school districts to combine resources and funding. The pooling of resources allowed for the creation of programs that would not otherwise be economically feasible due to low population density and funding gaps (boces.org).

Just as there is a need for the skills learned at BOCES to match industry demands, so too is there a need for the work-force diversity to be reflected in the student population at BOCES. To meet this need, BOCES administration must pay special attention to attracting a diverse swath of the population from the many school districts it serves. Predicting demographic changes in the population could serve as a useful method in changing marketing strategies for the ever-changing student population. Using pre-existing census and enrollment information may be the key to understanding future population trends.

Research Question

Were demographics in census data predictors of changes in enrollment at Orleans-Niagara BOCES from 2000 to 2010?

Assumptions

The research will mainly be based upon the assumption there is a relationship between both sets of data. Further, this data must be fine-grained enough to show a significant change in demographics. An assumption will be made that all data reported to the Orleans-Niagara BOCES report card is accurate. Also, we must assume all census data from 1990, 2000, and 2010 was truthfully reported and accurately recorded. The largest assumption for this study will be the availability of data on student demographics from the Orleans-Niagara BOCES.

Limitations

Research will be limited to United States census data from 1990, 2000, and 2010 with a focus on the Orleans-Niagara BOCES district. Data will also be gathered from Orleans-Niagara BOCES concerning student population demographics for 1990, 2000, and 2010.

Method

This paper will be an examination of the changes in demographics for the greater Niagara frontier and if those changes are reflected in enrollment at Orleans-Niagara Boards of Cooperative Educational Services (BOCES). This analysis will be achieved through the comparison of BOCES enrollment statistics to Niagara County census data. The demographics data will be collected from state enrollment records for the Orleans-Niagara BOCES programs and contrasted against demographic data in the 2000 and 2010 U.S. census. Special attention will be paid to changes in the population regarding gender, race, and the available socio-economic data.

The Orleans-Niagara BOCES center serves the following school districts: Albion Central School District, Barker Central School District, Lewiston-Porter Central School District, Lockport City School District, Lyndonville Central School District, Medina Central School District, Newfane Central School District, Niagara Falls City School District, Niagara

Wheatfield Central School District, North Tonawanda City School District, Royalton-Hartland Central School District, Starpoint Central School District, and Wilson Central School District.

The United States census is broken down by zip code making it possible to examine each population in each school district. The United States Census data will be obtained from the US Census Bureau website.

The student demographic data will be collected from the Orleans-Niagara BOCES report card and the NYSED report card. Both are available for public information on the internet. The enrollment data will also be requested from ON BOCES directly. This will give more specific information than what is publicly available. The information will be collected in the form of numerical statistics. Should the data not be easily accessible for each demographic category, the available data will be used, and recommendations will be made to remedy this issue.

Once the data is collected each demographic category will be contrasted, using the BOCES and the census data. This will be done to determine if the information is aligned or if there is a difference in the numbers for each group.

If the data is aligned, then it will indicate the Orleans Niagara BOCES center is reaching all facets of the community it serves. If the data is not aligned, then it will indicate the BOCES center is not properly reaching all the demographic groups in the community. Recommendations for how to remedy this issue will be made upon that discovery.

Once the demographic data had been collected and contrasted it will be explained using written explanations as well as infographics. Tables and bar graphs will be used to show population percentages and growth and decline of demographics.

Chapter 4

Data from both the 2000 and the 2010 census was gathered. The data was taken directly from the census website and is grouped by the age range 15 to 19 years of age (census.gov). The BOCES data was collected directly from ON-BOCES and contained the age range 14 through 20 years of age (Tables. 1 and 2). Because of this discrepancy in how the data was presented only population percentages could be compared instead of raw counts. The percentages are presented in Tables 1-2 in this chapter. The census data was grouped into ages 14 and under, 15 to 17, 18 to 19, and 20 to 24 years of age. The ON-BOCES data was not grouped by age but separated into individual ages. There was also no way to align the data to draw reasonable and reliable conclusions about students in the economic disadvantaged and below poverty line status groups. The ON-BOCES data was presented labeled “economically disadvantaged” and no specific ages were given. The census data was grouped into 15, to 17, and 18 to 24 years of age and labeled “below poverty status”. Because of the disparity in the data this portion of the comparison was not done.

Below is data from 2000 and 2010. Within each year, the data is further divided into census data and ON-BOCES data. In the composite table for 2000 and 2010 data there are three columns. Enrolled in School (15-19) is taken from the census data. Enrolled in ON-BOCES (14-20) is taken from the BOCES data. Not Enrolled in School (15-19) is taken from the census data. Those columns are added vertically to equal 100% of the population. The tables are also divided into rows first by county: Niagara, Orleans, and Both counties. They are then further divided by gender into male and female.

In the 2000 census data set, there was about a 1 percent difference in gender groups of students enrolled in school in both Niagara and Orleans county. Niagara County showed 49.77% female vs. 50.23% male gender gap. Orleans county showed 47.13% female and 52.87% male gender gap. The students not enrolled in school in Niagara county broke down to 47.43% female and 52.57% male. In Orleans county the percentage of students not enrolled was 51.98% female and 48.02% male. The gender gap widened greatly when BOCES enrollment was taken into consideration. In Niagara county there was about a 15 percent difference in male and female students enrolled. At 57.94% for males and 42.06% for females there were more males than females enrolled in BOCES. In Orleans county there was a 29 percent difference in BOCES enrollment between males and females. The enrollment for males was 64.62% versus 35.38% for females (Table 1).

In the 2010 census dataset, there was about a 1 percent difference in gender between students enrolled in school in Niagara and Orleans County. Niagara County showed a 49.60% female to 50.40% male gender gap. Orleans County showed a 47.05% female to 52.95% male gender gap. Compared to the data from 2000 for both counties there is still only a marginal (1%) difference in male versus female enrollment. The gender gap held steady in 2010 at 15 percent in Niagara county BOCES enrollment. There was a slight shift in the gender breakdown as the number of females increased to 43.97% and the number of males decreased to 56.03% versus 2000 enrollment. In Orleans county the gender gap also held steady at 29 percent for 2010. The number of females enrolled in BOCES decreased to 34.56% and the number of males increased to 65.44% when compared to the 2000 data (Table 1).

Table 1: Enrollment Proportions Split by County and Gender. ON BOCES Enrollment Data (Middle Column) Provided by ON BOCES Program; Census Data (First and Last Column) from Census.gov.

| | | Enrolled in School (15-19) | Enrolled in ON BOCES (14-20) | Not Enrolled in School (15-19) |
|-------------|---------------|----------------------------|------------------------------|--------------------------------|
| 2000 | | | | |
| | Niagara | | | |
| | Female | 49.77% | 42.06% | 47.43% |
| | Male | 50.23% | 57.94% | 52.57% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Orleans | | | |
| | Female | 47.13% | 35.38% | 51.98% |
| | Male | 52.87% | 64.62% | 48.02% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Both Counties | | | |
| | Female | 49.35% | 41.17% | 48.61% |
| | Male | 50.65% | 58.83% | 51.39% |
| | Total | 100.00% | 100.00% | 100.00% |
| 2010 | | | | |
| | Niagara | | | |
| | Female | 49.60% | 43.97% | 45.00% |
| | Male | 50.40% | 56.03% | 55.00% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Orleans | | | |
| | Female | 47.05% | 34.56% | 35.25% |
| | Male | 52.95% | 65.44% | 64.75% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Both Counties | | | |
| | Female | 49.16% | 42.66% | 41.10% |
| | Male | 50.84% | 57.34% | 58.90% |
| | Total | 100.00% | 100.00% | 100.00% |

The Race and Ethnicity data from the census for 2000 and 2010 was broken down into thirty-six different groups. The ON-BOCES for student ethnicity in 2000 and 2010 was broken down into five different groups. Both data set categories were simplified into White, Black or African American, American Indian or Alaskan Native, Asian or Pacific Islander, and Hispanic. This was done to allow for easier comparison between the census data and the ON-BOCES data.

The data from the census for enrolled and not enrolled students was grouped into ages 15 to 17 and 18 to 19. The ON-BOCES data did not provide ages for the enrolled students. Because of this discrepancy population percentages were used for comparison instead of raw counts.

The racial breakdown for students enrolled in school in Niagara county in 2000 was 89.45 percent White, 7.28 percent African American, 1.91 percent Hispanic, 0.86 percent for American Indian, and 0.50 percent for Pacific Islanders. The racial breakdown of the students enrolled in BOCES in Niagara county closely reflects the census information with a few subtle differences. The White population was 89.1 percent, 8.41 percent were African American, 1.24 percent American Indian, .95 percent Hispanic, and .29 Pacific Islander (Table 2).

In Orleans County in 2000 the racial breakdown is slightly less diverse. 91.82 percent of students enrolled in school were White, 6.24 percent African American, and 1.95 percent Hispanic. Of the students enrolled in BOCES 92.92 percent were white, 5.19 percent African American, and 1.89 percent Hispanic (Table 2).

Niagara County students enrolled in school in 2010 were reported as 85.61 percent white, 9.31 percent African American, 3.45 percent Hispanic, 1.03 percent American Indian, and 0.59 percent Pacific Islander. The Niagara county BOCES student breakdown for 2010 was 84.97 percent White, 10.42 percent African American, 2.23 percent American Indian, 1.49 percent

Hispanic, and 0.89 percent Pacific Islander (Table 2). Compared to the 2000 data there was a shift in Niagara county towards a more ethnically diverse student body. The change was also reflected in BOCES enrollment.

Students enrolled in Orleans county in 2010 were reported as 88.81 percent White, 6.57 percent African American, and 4.62 percent Hispanic. The BOCES enrollment differed slightly, reporting 89.86 percent White, 7.83 percent African American, 0.92 percent Hispanic, 0.92 percent American Indian, and 0.46 percent Pacific Islander. The differentiation between American Indian and Pacific Islander students living in Orleans county versus being enrolled in BOCES can be explained by the practice of program sharing among counties. If a student desires to enroll in a program not offered by the county the student may apply for special permission to attend the program in another county (Table 2).

Comparing 2010 to the 2000 data for Orleans county there was a 6 percent drop in the percentage of white students enrolled in school. Of those students there was also an 8 percent drop in BOCES enrollment. There was less than 1 percent increase in African American students enrolled in school. There was, however, a 2 percent increase in BOCES enrollment among African American students. The Hispanic student population saw the most dramatic changes with a 3 percent increase in student enrollment. BOCES enrollment saw a change in the opposite direction, dropping below 1 percent.

Table 2: Enrollment Proportions Split by County and Race/Ethnicity. ON BOCES Enrollment Data (Middle Column) Provided by ON BOCES Program; Census Data (First and Last Column) from Census.gov.

| | | Enrolled in School (15-19) | Enrolled in ON BOCES (14-20) | Not Enrolled in School (15-19) |
|-------------|-----------------------------------|----------------------------|------------------------------|--------------------------------|
| 2000 | | | | |
| | Niagara | | | |
| | White | 89.45% | 89.10% | 87.33% |
| | Black or African American | 7.28% | 8.41% | 7.64% |
| | American Indian or Alaskan Native | 0.86% | 1.24% | 2.24% |
| | Asian or Pacific Islander | 0.50% | 0.29% | 0.93% |
| | Hispanic | 1.91% | 0.95% | 1.86% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Orleans | | | |
| | White | 91.82% | 92.92% | 73.98% |
| | Black or African American | 6.24% | 5.19% | 21.95% |
| | American Indian or Alaskan Native | -- | -- | -- |
| | Asian or Pacific Islander | -- | -- | -- |
| | Hispanic | 1.95% | 1.89% | 4.07% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Both Counties | | | |
| | White | 89.83% | 89.61% | 83.91% |
| | Black or African American | 7.11% | 7.98% | 11.30% |
| | American Indian or Alaskan Native | 0.72% | 1.08% | 1.66% |
| | Asian or Pacific Islander | 0.42% | 0.25% | 0.69% |
| | Hispanic | 1.91% | 1.08% | 2.43% |
| | Total | 100.00% | 100.00% | 100.00% |
| 2010 | | | | |
| | Niagara | | | |
| | White | 85.61% | 84.97% | 81.95% |
| | Black or African American | 9.31% | 10.42% | 11.32% |
| | American Indian or Alaskan Native | 1.03% | 2.23% | 1.21% |
| | Asian or Pacific Islander | 0.59% | 0.89% | 2.07% |
| | Hispanic | 3.45% | 1.49% | 3.44% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Orleans | | | |
| | White | 88.81% | 89.86% | 76.79% |
| | Black or African American | 6.57% | 7.83% | 23.21% |
| | American Indian or Alaskan Native | -- | 0.92% | -- |
| | Asian or Pacific Islander | -- | 0.46% | -- |
| | Hispanic | 4.62% | 0.92% | 0.00% |
| | Total | 100.00% | 100.00% | 100.00% |
| | Both Counties | | | |
| | White | 86.33% | 85.65% | 81.67% |
| | Black or African American | 8.70% | 10.06% | 11.96% |
| | American Indian or Alaskan Native | 0.80% | 2.05% | 1.15% |
| | Asian or Pacific Islander | 0.46% | 0.83% | 1.96% |
| | Hispanic | 3.71% | 1.41% | 3.25% |
| | Total | 100.00% | 100.00% | 100.00% |

In general, race and gender are fairly balanced between students enrolled in school and students enrolled in ON BOCES in 2000 and 2010. This chapter highlighted several key exceptions. School enrollment split by gender was balanced in both counties for 2000 and 2010. On BOCES enrollment split by gender was skewed towards high male enrollment in both counties, but especially Orleans county. In Orleans county the Hispanic student population enrolled in school grew from 2000 to 2010. The Hispanic student population enrolled in ON BOCES dropped between 2000 and 2010.

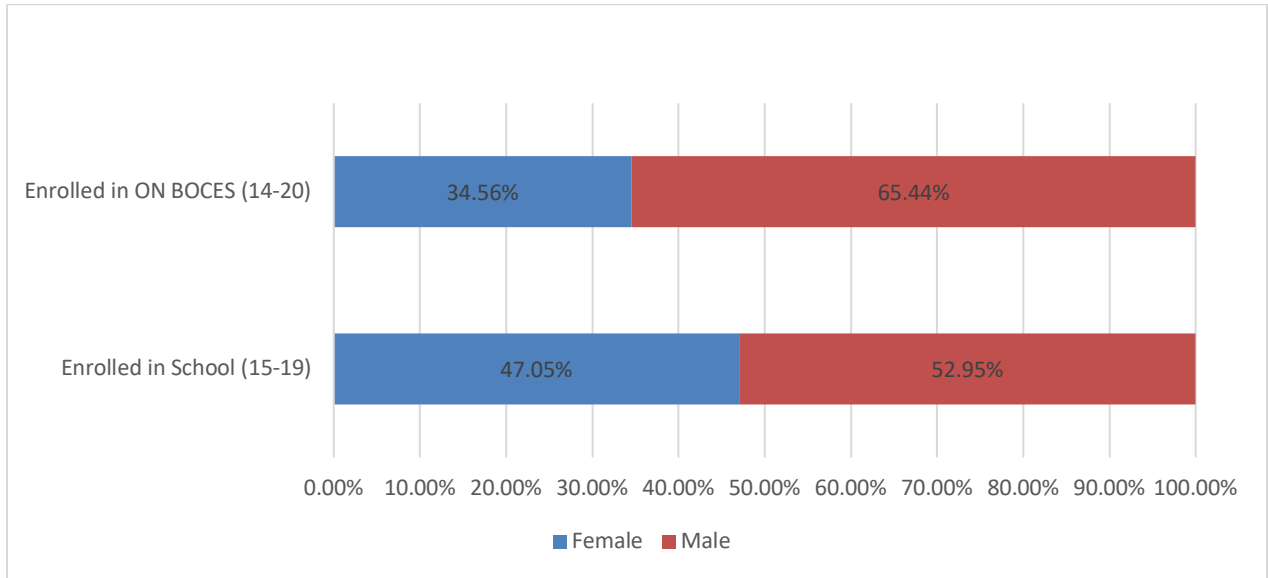


Figure 1: Enrollment Proportions Split by Gender for Orleans County in 2010

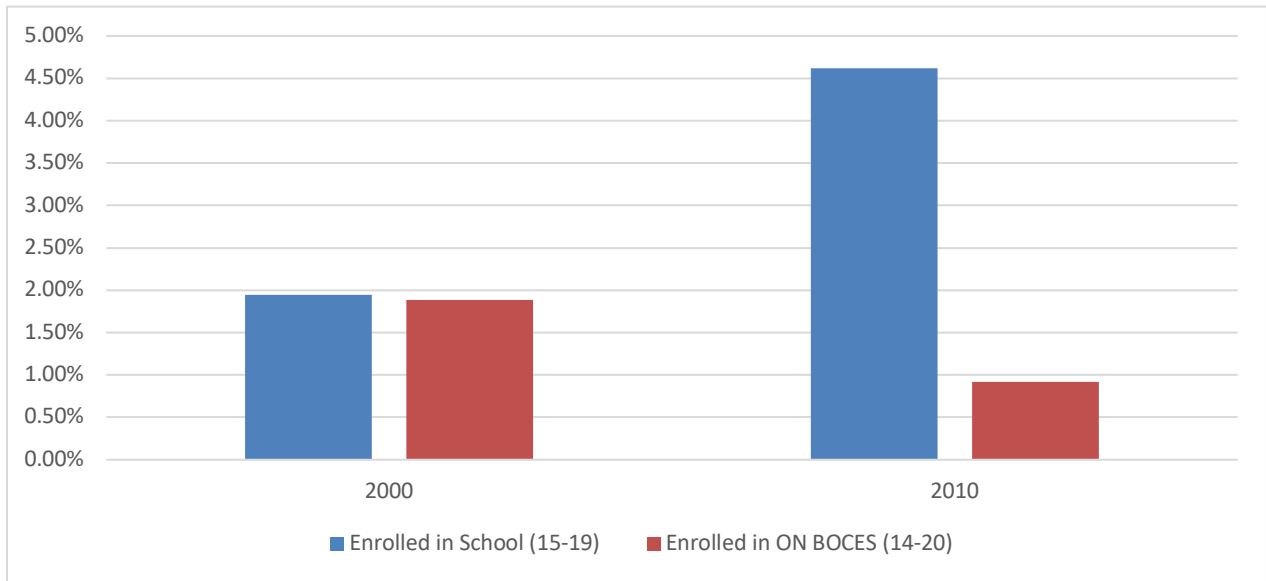


Figure 2: Comparing Proportion of Hispanic Enrollment in Orleans County for 2000 and 2010

Chapter 5

Problem Statement

The United States Census is used to count every individual in the U.S. and is collected once a decade. The data collected is broken down into demographic categories. These categories can be further broken down by region (census.gov). Demographics are statistical markers of human populations such as gender, age, race, income, and geographic location (Merriam Webster.com). BOCES is a public institution created in 1948 to enable smaller rural school districts to combine resources and funding. The pooling of resources allowed for the creation of programs that would have not otherwise been economically feasible due to low population density and funding (boces.org).

Just as there is a need for the skills learned at BOCES to match industry demands, so too is there a need for the work-force diversity to be reflected in the student population at BOCES. To meet this need, BOCES administration must pay special attention to attracting a diverse swath of the population from the many school districts it serves. Predicting demographic changes in the population could serve as a useful method in changing marketing strategies for the ever-changing student population. Using pre-existing census and enrollment information may be the key to understanding future population trends.

Research Question

Were demographics in census data predictors of changes in enrollment at Orleans-Niagara BOCES from 2000 to 2010?

Method

This paper was an examination of the changes in demographics for the greater Niagara frontier and if those changes were reflected in enrollment at Orleans-Niagara Boards of Cooperative Educational Services (BOCES). This analysis was achieved through the comparison of BOCES enrollment statistics to Niagara County census data. The demographics data was collected from state enrollment records for the Orleans-Niagara BOCES programs and compared to demographic data in the 2000 and 2010 U.S. census. Special attention was paid to changes in the population regarding gender, race, and the available socio-economic data.

Limitations

Research was limited to United States census data from 2000 and 2010 with a focus on the Orleans-Niagara BOCES district. Data was also gathered from Orleans-Niagara BOCES concerning student population demographics for 2000 and 2010.

Conclusions

In summary of chapter 4, race and gender are mostly balanced between students enrolled in school and students enrolled in ON BOCES in 2000 and 2010. This chapter highlighted several key exceptions. School enrollment split by gender was balanced in both counties for 2000 and 2010. On BOCES enrollment split by gender was skewed towards high male enrollment in both counties, but especially Orleans county. In Orleans county the Hispanic student population enrolled in school grew from 2000 to 2010. The Hispanic student population enrolled in ON BOCES dropped between 2000 and 2010.

Data for both gender and race were analyzed from 2000 and 2010 using census data and student enrollment data from ON-BOCES. Upon completion of the study there were some obvious disparities between the student population of Orleans and Niagara counties and the student body enrolled in ON-BOCES.

Did the study answer the research question “Are demographics in census data predictors of changes in enrollment at Orleans-Niagara BOCES from 2000 to 2010”? To put it simply, yes and no.

Gender demographics were not predictors of changes in enrollment. The census showed a 1% gender gap in 2000 of students enrolled in school in both Niagara and Orleans counties. The gap was much wider when BOCES enrollment was taken into consideration. There were 15% more males than females enrolled in BOCES in Niagara County. Orleans county showed 29% more males than females enrolled in BOCES.

The 2010 gender demographics showed only slight differences. The 1% gap remained the same for males versus females enrolled in Niagara and Orleans county schools. When BOCES enrollment was taken into consideration, Niagara county saw the same 15% gap, although the number of females increased, and number of males decreased compared to 2000 enrollment numbers. Orleans county saw the same 29% gap, but the population shifted in the opposite direction. More males enrolled in BOCES and female enrollment dropped compared to 2000 enrollment numbers.

In 2000, race demographics from the census were predictors of student enrollment in ON-BOCES. In both counties, the number of students in each racial category matched (with negligible differences) the same racial category in BOCES enrollment.

In 2010, the census and BOCES enrollment data again very closely matched. Population shifts in census data were reflected in almost all race categories. In Niagara county, there was a drop in the relative white student population. This drop was reflected in the number of white

students enrolled in BOCES. The downward shift in the white population also showed an increase in all other ethnicities in both school enrollment and BOCES enrollment.

One race category did not follow suit. The Hispanic population in Orleans county. In 2000, there was 1.91% Hispanic student enrollment in Orleans county. In contrast to 1.91% Hispanic enrollment in school, BOCES only had 0.95% Hispanic enrollment. In 2010 The Hispanic population of enrolled students jumped to 4.62%. Only 0.92% of the students enrolled in BOCES were Hispanic. Not only did the Hispanic population greatly increase from 2000 to 2010, the number of Hispanic students enrolled in BOCES dropped between 2000 and 2010.

This decrease in Hispanic student enrollment shows a lack of student recruitment from a rapidly increasing section of the population. The 2008 Pew Institute study made it clear. In order to fill the jobs left by Baby Boomers as they retire, an increase in recruitment of the foreign-born citizens and their school age children is absolutely necessary. The U.S. population continues to shift towards a more ethnically diverse make-up and the shift needs to be reflected in the workforce.

Recommendations

Across both counties, more needs to be done to attract female students to ON-BOCES. A study was done by Fluhr et al. (2017, pg.167) on the influence of non-traditional course taking and the effects on gender and the pay gap. This study found not only are there still much higher numbers of males versus females enrolled in STEM (science, technology, engineering, and math) fields, but males are more likely to enroll in non-traditional courses than females. This study indicates lower female enrollment is not only a problem in Niagara and Orleans counties, but nationwide. Perhaps one means to combat this issue is to expose more female students to the

variety of options available in BOCES. Exposing female students to agriculture, building trades, welding and other STEM programs could have a positive impact on enrollment.

Torgia (2013, p.15) claims more needs to be done to educate school counselors to the options available to all students. Higher paying, non-traditional careers for female students is an area counselors struggle with or are biased against introducing to female students (Torgia 2013, p.15). Gender free counselling training would also benefit the school district as it will help them meet the requirements set forth in The Strengthening Career and Technical Education for the 21st Century Act (Bill Summary, 2017). School districts are required to meet standards for equity and enrollment in all programs.

Some methods for increasing female enrollment discussed by Gordon (2014, p. 162) may include:

- providing career exploration activities
- treating students equally
- bringing non-traditional students and non-traditional workers to the attention of all students through panel presentations and career-day conferences
- recognizing the achievements of non-traditional students
- including assertiveness training as a part of an overall curriculum
- working with employers to help them obtain highly skilled workers, regardless of gender

To attract more Hispanic students, the same tactics can be used as those that can help close the gender gap. Two particular approaches include better exposure to STEM opportunities and more training for school counselors on how to reach new student demographics.

The present study examined the relationship between shifts in population taken from census data and if those shifts were reflected in BOCES enrollment for the years 2000 and 2010. Results from the present study revealed a general cohesion in both the census data and the BOCES data for 2000 and 2010. There were some discrepancies where female enrollment and Hispanic student enrollment were concerned. With both the Hispanic and female population the number of students enrolled in BOCES was far less than was recorded by the census.

If more research were to be done on this topic using both the census data and BOCES enrollment data, even clearer indicators for relationships between population trends and enrollment targets could be revealed. Further, making the BOCES data more easily accessible will encourage this type of research. As a point of comparison, the census data is universally available via a government website. Programs and websites for public data collection, storage, and distribution have opened in NY State (for example, <https://data.ny.gov/> and <https://ny.github.io/open-data-handbook/>). Following Governor Cuomo's executive Order No.95 these websites now contain instructions on how to publish data and allow for more access and transparency for research purposes. These sites can make studies like the present study much simpler in the future.

References

Bill Summary: Strengthening Career and Technical Education for the 21st Century Act.

Retrieved from

https://edworkforce.house.gov/uploadedfiles/strengthening_career_and_technical_education_for_the_21st_century_bill_summary.pdf

Friedel, Janice Nahra. (2011). Where has vocational education gone? The impact of federal legislation on the expectations, design, and function of vocational education as reflected in the reauthorization of the Carl D. Perkins Career and Technical Education Act of 2006. *American Educational History Journal*. Vol.38.1-2. 37.

Gordon, Howard R.D. (2014). *The History and Growth of Career and Technical Education in America: Fourth Edition*. Waveland Press.

Scott, John L. and Michelle Sarkees-Wircenski. (2004). *Overview of Career and Technical Education: Fourth Edition*. (pp73). Homewood, IL. American Technical Publishers.

Carl D. Perkins Career and Technical Education Act, 152 U.S.C § 3 (2006)

S. Rep. No. 100. Vol.152, at S8321 (2006)

U. S. Department of Education Office of Vocational and Adult Education. (2006) *The Carl D. Perkins Career and Technical Education Act of 2006 State plan*. Retrieved from <http://www.p12.nysed.gov/cte/perkins4/reference.html>

Britannica Academic. Title IX. Retrieved from

<http://proxy.buffalostate.edu:2793/levels/collegiate/article/Title-IX/125072>

About BOCES. Retrieved from

<http://www.boces.org/about-boces/>

Fact Finder for the Nation.

<https://www.census.gov/history/pdf/cff4.pdf>

Definition of “Demography”

<https://www.merriam-webster.com/dictionary/demography>

Cox, E. Daniel. (2013). Predictors of Student Enrollment Patterns in High School Career Academies (Doctoral Dissertation, University of South Florida). Retrieved from <http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=6074&context=etd>

Hargis, Karla Beth. (2011). Career and Technical Education Program Alignment with Local Workforce Needs (Doctoral Dissertation, Eastern Kentucky University). Retrieved from <http://encompass.eku.edu/cgi/viewcontent.cgi?article=1047&context=etd>

Fluhr, S. A. & Choi, N. & Herd, A. & Woo, H. & Alagaraja, M. (2017). Gender, Career and Technical Education (CTE) Nontraditional Course taking, and Wage Gap. *The High School Journal* 100(3), 166-182. The University of North Carolina Press. Retrieved June 21, 2018, from Project MUSE database.

Toglia, T. V. (2013). *Gender equity issues in CTE and STEM education*. Ann Arbor: Prakken Publications, Inc.

Eardley, E. and Manvell, J. (2006), "Legal remedies for girls' under-representation in nontraditional career and technical education", *International Journal of Manpower*, Vol. 27 No. 4, pp. 396-416. <https://doi.org/10.1108/01437720610679232>