

# Ohio Work-Based Learning GIS Application: Data Sources and Methods

## Introduction

Geographic information systems (GIS) can help state leaders use data to examine factors such as housing, health care, food, education, transportation, and employment that influence equity and opportunity gaps among students. Although GIS is not a new tool, a number of states are now exploring how GIS can be used to inform the design and implementation of their work-based learning (WBL) systems, including how to differentiate supports for schools and districts on the basis of their unique contextual needs. As part of the State Work-Based Learning Initiative, the CCRS Center is leveraging its expertise in behavioral and social science research, GIS, and technical assistance to support state education agencies as they work to develop high-quality WBL systems.

In early 2018, the American Institutes for Research (AIR) began work on a GIS application for the state of Ohio to understand the geography of education systems, the labor force, and employment across the state. The app, located [here](#), displays numerous features of these constructs. AIR used Esri's ArcGIS Pro and ArcGIS Online software to create the Ohio Work-Based Learning Planning Map application.

The user can use the app to focus on particular regions of interest by overlaying geographic characteristics like counties and school districts.

The app is organized into two tabs: CTE Landscape and Hot Spot Analyses.

The **CTE Landscape** tab contains nine separate “widgets,” each of which contains a number of layers. For example, the Education widget includes a layer for Community Colleges. When the user selects that layer, all community colleges show as points on the map.

The **Hot Spot Analyses** tab allows the user to run hot spot analyses. These analyses identify statistically significant “hot” and “cold” spots. The red and blue points and areas indicate whether the observed spatial clustering of high or low values, respectively, is more pronounced than one would expect in a random distribution of those same values. See Esri's [primer](#) on hotspot analyses for more information.

In this document, we describe each of the data sources and any data quality issues by widget as well as by feature class.

# Data Sources

## Career & Technical Education Programs

Program data were categorized based on Ohio’s 20 career clusters and are in alignment with other forms of CTE reporting. These programs are at the middle school, high school, and postsecondary levels. All CTE programs are displayed as point features. Data on the locations of each CTE program were provided by the Office of Career-Technical Education within ODE in July 2018 and is current as of FY 2017.

**Table 3. CTE Clusters**

Cluster title
Agribusiness & Production Systems
Agriculture, Food and Natural Resources Bioscience
Air Transportation
Allied health and Nursing
Animal Science and Management
Business and Administrative Services
Engineering and Design
Exercise Science and Sports Medicine
Finance
Ground Transportation
Health Information Management
Horticulture
Information Support and Services
Interactive Media
Manufacturing Operations
Marketing
Medical Bioscience
Natural Resource Management
Network Systems
Programming & Software Development

## Education

All providers were displayed as points, with different shapes and colors for each of the layers.

**Table 2. Education and Workforce Development Providers**

Layer	Feature class	Data source	Description and limitations
Community Colleges	Point	<a href="#">Ohio Higher Ed</a>	Locations of community colleges
Ohio Technical Centers	Point	<a href="#">Ohio Higher Ed</a>	Locations of OTCs, which provide post-secondary CTE training in the skill trades that prepare learners for certificates, industry-recognized certifications, and state licensures.
Regional Campuses	Point	<a href="#">Ohio Higher Ed</a>	Locations of regional campuses of public universities.
Universities	Point	<a href="#">Ohio Higher Ed</a>	Locations of public universities.
High Schools	Point	<a href="#">National Center for Education Centers</a>	Locations of all high schools (highest grade is 10 <sup>th</sup> , 11 <sup>th</sup> , or 12 <sup>th</sup> grade)
High Schools: % Hispanic Students	Point	Ohio Department of Education (ODE)	Locations of all high schools symbolized on the % of Hispanic students
High Schools: % Black, non-Hispanic Students	Point	Ohio Department of Education (ODE)	Locations of all high schools symbolized on the % of Black, non-Hispanic students
High Schools: % of Students with Disabilities	Point	Ohio Department of Education (ODE)	Locations of all high schools symbolized on the % of Students with Disabilities

## Borders

This widget includes features that emphasize geographic borders.

**Table 1. Border Layers**

Layer	Feature class	Data source	Description and limitations
Workforce Investment Areas	Polygon	<a href="#">JobsOhio</a>	Borders of workforce investment areas, which were designated for the purpose of implementing the Workforce Innovation and Opportunity Act (WIOA).
Ohio Senate Districts	Polygon	<a href="#">Census Bureau</a>	Borders of Ohio senate districts.
Ohio School Districts	Polygon	<a href="#">Census Bureau</a>	Borders of Ohio school districts.
Ohio Counties	Polygon	<a href="#">Census Bureau</a>	Borders of all counties across Ohio.

Layer	Feature class	Data source	Description and limitations
Ohio Interstate	Polygon	Esri	All major interstates in Ohio.
Ohio Economic Development Regions	Polygon	<a href="#">Ohio Labor Market Information</a>	Borders of Ohio's twelve former Economic Development Regions, defined by Ohio Development Services Agency

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## Economic Data

**Note about industries.** In each of the widgets below, we present data by industry, using the two-digit codes from the North American Industry Classification System (NAICS).<sup>1</sup>

**Table 5. Industry Classifications by Two-Digit NAICS Code**

Two-digit NAICS code	Industry
72	Accommodation and Food Services
56	Administrative and Support and Waste Management and Remediation Services
11	Agriculture, Forestry, Fishing, and Hunting
71	Arts, Entertainment, and Recreation
23	Construction
61	Educational Services
52	Finance and Insurance
62	Health Care and Social Assistance
51	Information
55	Management of Companies and Enterprises
31-33	Manufacturing
21	Mining, Quarrying, and Oil and Gas Extraction
81	Other Services (except Public Administration)
54	Professional, Scientific, and Technical Services
92	Public Administration
53	Real Estate and Rental and Leasing
44-45	Retail Trade
48-49	Transportation and Warehousing
22	Utilities
42	Wholesale Trade

## Employment Growth

Data from the Quarterly Workforce Indicators (QWI) from the U.S. Census Bureau were used for employment growth from the second quarter of 2007 to the second quarter of 2017. We break down growth by industry and by county.

## Hires

Data from the QWI were also used for new hires from the third quarter of 2016 to the second quarter of 2017. We break down the number of hires by industry and by county.

<sup>1</sup> <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2017>

## Businesses

Business locations were obtained from Esri, which sources its data from a comprehensive list of businesses licensed from Infogroup.<sup>2</sup> The data are current as of January 2018. Business locations are displayed as points, with larger circles indicating firms with more employees. The grouping was done using natural breaks in the data.

**Table 5. Businesses.**

NAICS Code(s)	Industry Group
332, 333, 332, 335, 336, 339	Advanced Manufacturing
3364, 334511	Aerospace and Aviation
3361, 3362, 3363	Automotive
324, 325	Energy and Chemicals
52, 521, 522, 5221, 52211, 52212, 52213, 52222, 5223, 523, 524, 5241, 5242, 52421, 52429, 525	Financial Services
11	Food and Agribusiness
62, 621, 6211, 621111, 621112, 6212, 6213, 6214, 6215, 6216, 6219, 622, 623	Healthcare
5415	Information Technology
42, 423, 4231, 4232, 4233, 4234, 4235, 4236, 4237, 4238, 4239, 424, 425	Logistics and Distribution

## Number of Businesses

The number of Businesses by industry was aggregated to the county level from the firm data. In addition, we provide the total number of businesses across all industries. All layers in this widget are presented as county-level polygons. All groupings were done using natural breaks in the data.

## Wages

All wage data are presented as polygons at the county level. Living wage data were drawn from the Living Wage Calculator from Massachusetts Institute of Technology.<sup>3</sup>

<sup>2</sup> [http://downloads.esri.com/esri\\_content\\_doc/dbl/us/I9940\\_Methodology Stmt Business Locations Summary 2018.pdf](http://downloads.esri.com/esri_content_doc/dbl/us/I9940_Methodology Stmt Business Locations Summary 2018.pdf)

<sup>3</sup> <http://livingwage.mit.edu/>

Weekly wage data were acquired from the Bureau of Labor Statistics (BLS).<sup>4</sup> Weekly wages are broken down by industry. In addition, average weekly wages across industries, also sourced from BLS, are presented.

## **Social Factors**

The last widget contains a variety of social factors that can provide context to the education and economic data. See Table 6 for a description of all data sources and Table 7 for a summary of the layers.

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<sup>4</sup> <https://www.bls.gov/cew/datatoc.htm>

**Table 1. Data Sources Used in Social Factors Layers.**

Data source	Methodological summary
2012–2016 American Community Survey (ACS) <a href="https://www.census.gov/programs-surveys/acs/">https://www.census.gov/programs-surveys/acs/</a>	The ACS is an ongoing survey that provides annual information on jobs and occupations, educational attainment, veterans, housing, and other topics. This mandatory U.S. Census Bureau survey regularly achieves response rates above 90%. It is used by a wide variety of stakeholders, including government, businesses, and researchers.  Although the ACS collects annual data for geographic areas with populations of 65,000 or more, it does not provide reliable single-year estimates for areas with smaller populations. For these areas, 5 years of data are pooled together to create more precise multiyear estimates.

**Table 2. Social Factors Layers.**

Layer	Feature class	Data source <sup>5</sup>	Description
Living Wage	Polygon	<a href="#">Living Wage Calculator</a>	Living wage in Ohio calculated for two adults with one working, and one child
Labor Force Participation Rate (%)	Polygon	2016 ACS 5-year estimates, table S2301	Labor force participation rate for population 16 years and over
Median Income	Polygon	2016 ACS 5-year estimates, table S1903	Household median income by Census Tract
Over 25 without HS Diploma (%)	Polygon	2016 ACS 5-year estimates, table S1501	Percent of population 25 years and over with less than 9 <sup>th</sup> grade and 9 <sup>th</sup> to 12 <sup>th</sup> grade with no diploma
Poverty Rate (%)	Polygon	2016 ACS 5-year estimates, table DP03	Civilian labor force- unemployment rate

<sup>5</sup> Many of the files used to populate the app were downloaded from the Federal Communications Commission’s Connect2Health website (<https://www.fcc.gov/reports-research/maps/connect2health/data.html>). However, we indicate the original data source for each layer.



Layer	Feature class	Data source <sup>5</sup>	Description
Vacant Housing Units (%)	Polygon	2016 ACS 5-year estimates, table DP04	Percent of vacant housing units per Census Tract
Unemployment Rate (%)	Polygon	2016 ACS 5-year estimates, table S2301	Unemployment rate for population 16 years and over

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## Glossary

**Feature Class:** Homogeneous collections of common features in GIS, each having the same spatial representation, such as points, lines, or polygons.

**Geographic Information System (GIS).** A framework for gathering, managing, and analyzing spatial data.

**Layers:** Logical collection of geographic data that are used to create maps and scenes. For example, a user could select the Community Colleges layer, which would highlight locations of all community colleges across the state.

**Line (feature class):** A feature class that represents the shape and location of geographic objects, such as street centerlines and streams, too narrow to depict as areas. Lines are also used to represent features that have length but no area. The Public Transportation Routes layer is the only layer in the Colorado Talent Development app that is a line feature.

**Point (feature class).** Features that are too small to represent as lines or polygons as well as point locations. Locations of community colleges and high schools are two layers that display as points.

**Polygon (feature class).** A set of many-sided area features that represent the shape and location of homogeneous feature types such as counties and county-level employment growth.

**Widget:** A button on the GIS app which shows layers of related data sources.