Differentiating rural locale factors related to students choosing and persisting in STEM

Marjorie Darrah
West Virginia University

Roxann Humbert
WVU Center for Excellence in STEM Education

Caitlin Howley
ICF International, Inc

ABSTRACT

For the growing worldwide economy to be successful, science, technology, engineering, or math (STEM) workers are needed. Once recruited to pursue a STEM major, the challenge is keeping these students on track. A large diverse workforce is needed in these fields, but past research has shown students from rural settings are disadvantaged when attending college. It is difficult to look at differences of rural vs. urban to determine whether these settings have any impact on a students' decisions to declare and persist in a STEM major. Many states have large portions considered rural, Maine (61.3 percent), Vermont (61.1 percent), West Virginia (51.3 percent) (World Population Review, 2022). In states like these, it is hard to differentiate rural and urban settings since much of the state is rural. This study attempts to look at locales in a way that classifies them, not by population or proximity to urban settings, but by other factors that may affect students related to STEM persistence. This case study is the state of West Virginia and cluster analysis is used to develop Locale Codes (LC) to differentiate counties based on a variety of factors, including declaring and persisting in a STEM major. The findings show some counties have a higher percentage of students declaring STEM, but these students are less successful in college than other counties that have proportionally fewer students declaring STEM. The factors related to the locale that contribute to these differences are examined.

Keyword: STEM, rural, locale codes, cluster analysis,

INTRODUCTION

Developing a science, technology, engineering, and mathematics (STEM) workforce is critical for the United States and many other countries, but for years it has been known that these countries do not produce enough STEM majors to meet the current government and industry employment demand (Peri, Shih, and Sparber, 2015; van den Hurk, Meelissen and van Langen, 2019). One problem is that college students who enter the STEM pathway often leave by either changing majors or dropping out altogether (Chen, 2013), which is referred to as the "leaky pipeline" (van den Hurk, Meelissen and van Langen, 2019). Despite the rapid growth of enrollment in STEM disciplines in recent years, the number of students graduating with a STEM degree has remained relatively stagnant due to diminishing student retention rates (Eagan, Hurtado and Chang, 2010; Thompson and Bolin, 2011). In the United States, more than half of all college students who declare a STEM major drop out or change their major in the first two years of postsecondary education, and this problem is particularly acute for first-generation college students (Chen, 2013).

When pursuing post-secondary education, rural students have additional barriers to overcome. West Virginia lies completely in Appalachia and has over 51 percent of the population living in rural areas. Additionally, thirty-four of its fifty-five counties are considered rural, and it is ranked the third most rural state in the U.S. (World Population Review, 2022). According to VISION 2025 – The West Virginia Science and Technology Plan (WVHEPC, 2021), "The Vision 2025 goals aim to develop West Virginia's science, technology, engineering, and mathematics (STEM) talent pipeline, expand the research enterprise, catalyze more innovation and entrepreneurship activity, and support the growth of high-tech companies." In order to achieve this vision, the state of West Virginia needs a highly educated, technically skilled, and entrepreneurial workforce.

Barriers to starting and completing a college degree for these rural students include familial commitments and lack of resources or support needed to identify educational paths to higher wage jobs (Keily and McCann, 2021). These barriers for rural students have created opportunity and participation gaps in education programs. They also experience access issues, such as limited broadband, which further contribute to the challenges residents of nonmetro areas face in accessing education and work. The COVID-19 pandemic has exposed and exacerbated these challenges. Addressing these barriers to promote higher educational attainment and better access to education can provide economic opportunity and help to address skill shortages within labor markets, especially in rural communities (Keily and McCann, 2021). West Virginia has almost half their counties (26 or 55) with poverty rates between 20.9% and 41.0% (ARC, 2021).

Research suggests that students coming from a rural location experience worse postsecondary academic outcomes – lower achievement scores, lower college attendance rates, and lower college completion rates – than non-rural young people (Byun et al., 2012; Gibbs et al. 2004). Other research indicates that these differences disappear when socioeconomic status (SES) is taken into account, such that rural young people from low-income households perform similarly to non-rural young people from low-income households, and that rural young people from high-income households perform similarly to non-rural young people from high-income households (Author et al,. 2014a; Marré, 2017). In other words, it is because there tend to be higher rates of poverty in rural areas than in non-rural places that it can appear as though rurality is the primary determinant of education outcomes. In fact, SES is the factor most durably predictive of education experiences and outcomes, regardless of locale. As useful as these insights are about the relationship of rurality and poverty, they tell us little about how locale and SES together contribute to circumstances that might depress postsecondary outcomes such as college persistence.

An insufficient amount of research has investigated how locale factors for rural areas might influence students' decisions to study STEM and then to persist in their studies, this project sought to examine such relationships. A notable exception to the lack of research about rural STEM participation is a recent study by Saw and Agger (2021), who find that rural students have consistently fewer local STEM education opportunities and resources than suburban students – and as a result, tend to be underrepresented in college STEM programs. On-site access to advanced placement (AP), International Baccalaureate (IB), and other advanced STEM courses is less; access to STEM teachers with ongoing professional development opportunities and high levels of teaching self-efficacy is lower; and access to a wide range of extracurricular STEM activities (fairs, contests, after school programs, enrichment programs) is lower. Rural students' STEM career aspirations are, according to this research, partially explained by geographic disparities in STEM learning opportunities.

Another study examined the relation of growing up in a rural county and college achievement using a large sample of physical science and engineering students at the state flagship university of West Virginia (Author, 2020). Their work examined the mediation of the effect of county-level measures of rurality and access to civic facilities on college-level achievement. They found that a variable capturing rurality and its relation to lower socioeconomic status and lack of enriched high school course offerings had a negative effect on college achievement not mediated by high school achievement. Also, a variable measuring rurality and its relation to the lack of access to civic facilities that may provide academic enrichment opportunities also had a negative effect on college achievement; however, the effect of this variable became positive after controlling for high school achievement.

In this article, the focus is on how a variety of place- and resource-related factors can help us understand more fully the ways in which rural students come to select science, technology, engineering, and math (STEM) majors and then persist in those majors. This research effort supports a National Science Foundation (NSF)-funded statewide alliance in West Virginia seeking to improve the persistence of rural, first-generation college students in STEM programs, particularly in states with low STEM research capacity. The project is supported by a grant from the program called Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES), which funds projects that improve access to STEM education and career pathways, particularly for groups that are underrepresented in STEM. Low STEM research capacity states are in which NSF has determined the need for special investment because they have received less than or equal to 0.75% of NSF research funding. Currently, such states are eligible to compete for funding from the Established Program to Stimulate Competitive Research (EPSCoR) program. In fact, there appears to be growing political consensus that rural places tend to have lower STEM capacity across the nation that requires additional investment and support. For example, in April 2021, the Rural STEM Education Act to improve science, technology, engineering, and mathematics (STEM) education and training access in rural communities was introduced into the US Senate (US Senate Committee on Commerce Science and Transportation, 2021).

LITERATURE REVIEW

Rural students are as able as their non-rural peers (Lee, 2001; Williams, 2005). Nonetheless, rural Americans are less likely to hold a college degree than their peers from suburban or urban areas and rural young people tend to have somewhat lower rates of postsecondary enrollment and completion (Shapiro et al., 2019; Provasnik et al., 2007). Evidence suggests that, all college students, rural or not, possess the same mean aptitude to study and be successful in engineering majors; however, rural students are underrepresented in these majors in Tennessee (Boynton & Hossain, 2010). Similarly, Saw and Aggar (2021) report fewer rural students in STEM majors and find that this may be in part a consequence of their relatively lower levels of access to STEM extracurricular activities compared to non-rural youth. Another study suggests that rural high schools are less likely to have what the researchers term “abundant” support for STEM education, to include student access to an ample selection of higher-level STEM courses, STEM-focused professional development for teachers, and informal STEM learning opportunities for students (Vaval et al., 2019).

These findings are not particularly surprising given research about the systematic disparities in resources that rural students tend to experience. For instance, students from rural areas are less likely than their suburban or urban counterparts to have attended a school that offers Advanced Placement (AP) courses (Gagno & Mattingly, 2016; Gibbs, 2003; Provasnik et al., 2007), to have had access to guidance counselors (Griffin et al., 2011; Provasnik et al., 2007, Wimberly & Brickman, 2014), and to have a parent (or known an adult) who attended college (Demi et al., 2010; Provasnik et al., 2007).

Researchers often consider economic factors and the make-up of rural communities, but seldom look at how differences among these communities may relate to college outcomes for students. Specifically, few researchers consider that coming from areas with few social or cultural opportunities may affect students’ likelihood to attend or succeed in college.

To prepare student to compete for STEM Careers, their education must impart both interest in and the academic skills necessary for STEM while they are young. Although most school systems include STEM in their curriculum, there is still a gap in access for students who come from rural areas (Harris & Hodges, 2018). Additionally, parental support in these areas may be lacking, since pursuing such degrees and jobs may mean leaving, which can cause a problem for some parents in rural areas (Peterson et al., 2015). While K-12 curriculum and parental support are seen as predictors, this is only part of the picture. There may be a connection between non-academic factors, such as access to museums, libraries, etc. as well as a few other academic factors such as access to AP courses, that make a difference.

There is no one index, set of features, or way to examine what works to describe rurality in all locations and for all purposes (Doogan et al., 2018; Isserman, 2005; National Academies of Sciences, Engineering, and Medicine, 2016). Most commonly researchers examine population size and density; however other researchers have looked at various factors. The factors often considered include economic measures (employment rate, education levels, family income), agricultural measures (percent land cover, percent agricultural land), demographics (race, religion), remoteness (distance to a metro area) accessibility (highways, railroads, ports), etc. (Nelson, 2021). Turley (2009) did find a significant positive relationship between the likelihood of students applying to college and the number of colleges near where the students lived; however, this was not specific to STEM. It has also been shown that rural students who live or attend high school near colleges are more inclined to enroll in post-secondary education, and this is true even when controlling for income and parents' education (Williams & Luo, 2010; Author et al., 2014b; Turley, 2009). However, no studies were found that focused on indicators used to define rurality as it applies to a student's decision to declare a major and persist in STEM.

The US Census Bureau reports that West Virginia is 50th out of 50 states in bachelor's degrees held by citizens over the age of 25 (US Census Bureau, 2020). The state of West Virginia also has a substantial rural population using the US Census Bureau's definition of locale categories (Ratcliffe et al., 2016) with over 51% of its population living in rural areas; 13 of its 55 counties have 100% of their population in rural areas. The largest city in West Virginia is Charleston, with a population of a little over 50,000 (2010 Census), it barely meets the Census Bureau's requirement to be designated an Urbanized Area. Many of the cities and towns in West Virginia are considered Urban Clusters, at least 2,500 and less than 50,000 people; everything else is rural.

On the flip side, urban living benefits include transportation, like buses and trains, more opportunities for employment, good colleges and universities, libraries, theaters, museums, entertainment, recreation, diverse population, etc. West Virginia areas often lack these resources that are associated with urban living. Therefore, the state's students do not have access to these urban amenities. Instead of just designating a student as being from an urban or rural area, it was conjectured that investigating the factors that students have been exposed to may be enlightening.

Researchers found that rural students have different K-12 academic experiences than students who attend suburban and urban schools (Author 1990; Gjelten 1982). However, it was noted that school characteristics such as size, pupil-teacher ratio, rural classification, and percent of students eligible for free or reduced lunch do not have a statistically significant correlation with students' educational aspirations in either high or low poverty rural schools (Irvin et al., 2011). So then, what about these schools might shape a student's decision to attend college and persist in a STEM major. It was conjectured that the number and type of AP classes offered might be one factor. However, just 69% of rural students nationwide attend schools offering AP courses, while 93% of urban and 96% of suburban students do (Provasnik, 2007).

While this past research presents a picture based on some of the common factors associated with rurality, is there a better way to define the locales in West Virginia? Can indicators such as museums, mass transit, universities in the area, cultural events, percent of high schools offering AP courses, percent of population with advanced degrees, etc. be used to better describe the locale as it applies to a student's decision to major and persist in STEM.

Building on the analysis of factors associated with rural college students' STEM uptake, this research is grounded in the following questions:

1. What might a locale-coding continuum that combines locale and STEM learning opportunities look like?
2. What locale factors are associated with rural students declaring and persisting in STEM majors?

METHODS

Investigation of existing county classifications

When looking at education one could look at measuring rurality by school or county. In the United States, using county level data is most common. (Isserman, 2005; Waldorf, 2006). Since the school systems in West Virginia are county based, that is the approach that is taken in this study. The research began by determining if there were codes that existed that would identify those counties in West Virginia that encourage students to study and persist in a STEM major. Three common ways of classifying counties were considered, the Rural-Urban Continuum Codes (RUCC), the National Center for Education Statistics (NCES) codes, and the Economic Research Service (ERS) codes.

The RUCC codes (USDA, 2020) separates metropolitan counties by population size or their metro area and nonmetropolitan counties by their level of urbanization and proximity to metro areas. The metro and nonmetro classifications have been divided into three metro and six nonmetro codes. Each county is assigned one of the nine codes. This allows researchers to examine county data in residential groups,

The NCES codes for each county (NCES, 2006) were considered. Referred to as the "urban-centric" classification system to distinguish it from the previous "metro-centric" classification system, this classification system has four major locale categories – city, suburban, town, and rural – each of which is subdivided into three subcategories. The full set of categories can be found at https://nces.ed.gov/surveys/ruraled/definitions.asp.

Lastly, the Economic Research Service (ERS) codes were considered. These are also referred to as the County Typology Codes (USDA, 2021). The 2015 County Typology Codes classify all U.S. counties according to six mutually exclusive categories of economic dependence. The economic dependence types include farming (1), mining (2), manufacturing (3), Federal/State government (4), recreation (5), and non-specialized (0) counties. These codes did not appear to have relevance for the purpose of this research study, so they will not be consider moving forward.

Student data

A set of student data, obtained from a <large state university>, was used to represent success and persistence of STEM majors for each county. Since this university has a land grant mission of serving the state, there were a sufficient number of students from every West Virginia County that attend this institution and the university also has many STEM majors from which to choose. A data set was constructed to look at students who entered the university during a 5-year span, between 2010 and 2014, so they could be tracked through graduation by 2020. The data set contained 13,408 student records, of which 3264 were STEM majors. The data for each county included:

- number of students who declared STEM
- number of students who graduated from STEM within 5 years

To determine if there was a relationship between the RUCC and NCES coding schemes and the data on students who declared a STEM major and persisted, a correlation was run between the county codes and students who declared a STEM degree between 2010 and 2014 and persisted in a STEM degree through 2020. The higher the RUCC and NCES classification codes the more rural an area.

From Table 1 (Appendix) it can be observed that the correlations were very low between these two types of codes and the number of students who declared and persisted in a STEM major. This implied that it might be possible to create a better coding related to these variables.

Developing new county classifications – Locale Codes

The analysis included non-academic factors (e.g., mass transit, museums, and libraries) and academic related factors (e.g., average number of AP courses per high school, percent of residents with advanced degrees) that might differentiate types of rural areas. To start the process, county level data was obtained from the West Virginia Department of Education, West Virginia Library Commission, West Virginia Department of Transportation, Institute of Education Sciences National Center of Education Statistics, the Statistics Atlas, the 2010 census report, National Center for Education Statistics, and Wikipedia. The final list of factors included:

- number of libraries
- number of museums
- number of STEM museums
- public transit
- number of advanced education institutions
- average number of STEM AP courses per high school
- percentage of population graduate from high school
- percentage of population graduate with Bachelors
- percentage of population graduated with advanced degrees
- percent high school graduation rate
- percent college going rate
- median size high school
- percent rural high schools (based on the NCES codes)

It should be noted that the AP courses included in this study were Biology, Calculus AB, Calculus BC. Chemistry, Environmental Science, Computer Science A, Computer Science B, Computer Science P, Physics 1, Physics 2, Physics C- E&M, Physics C-M, Statistics and Research.

After collecting the preliminary set of factors about counties, clustering analysis was performed. The purpose of the clustering was to group counties with similar characteristics. Other researchers have taken a similar approach. Hedlund (2016) argues that the a priori urban-rural continuum model in Sweden should be abandoned in favor of a more open approach. He sorted 3983 areas into five clusters, with 16 subclusters, and determined that these location-specific typologies based on high-resolution data gave a greater insight into rural heterogeneity. Romano et al. (2016) also used clustering analysis, along with other techniques, to analyze social, economic, and geographic factors to obtain areas with homogeneous characteristics within the Basilicata Region of Italy. Their analyses resulted in identification of eight homogeneous areas and this enabled locating resources based on specific needs.

The method used for grouping counties was k-means clustering. The data was in two forms, raw number counts and percentages, so the data was first normalized before analysis. The clustering was completed using the k-means R packages. Several different sets of factors were considered and clusters of size 2, 3, 4, and 5 were explored. The Sum of Squares Method was used to choose the optimal number of clusters by minimizing the within-cluster sum of squares (a measure of how tight each cluster is) and maximizing the between-cluster sum of squares (a measure of how separated each cluster is from the others). The optimum results were obtained for size 3 clusters with the list of factors mentioned above. Table 2 (Appendix) shows the clustering of counties and the resulting Locale Codes (LCs).

DISCUSSION

The representative (centroid) for each cluster above is given in Table 3 (Appendix). These centroids are based on an average value for each factor for the counties. Locale Code 1 counties have more resources, larger high schools, and are the least rural (according to the NCES school codes.) Their graduation rate is slightly less than the other two clusters, but this may be due to the larger number of students in the county. Their college going rate is higher and their percentage of STEM majors is less than Locale Code 3, but their STEM graduation rate is higher.

Locale Code 2 counties have fewer resources, smaller high schools, and have more rural high schools than Locale Code 1 counties. Their high school graduation rates are slightly higher and their college going rates are slightly lower than Locale Code 1 counties. The percentage of STEM majors and the STEM graduation rate are also slightly lower.

Locale Code 3 counties have the fewest resources, smallest high schools, and are the highest percentage of rural high schools. It seems interesting that the high school graduation rate is the highest for Locale Code 3 (compared to Locale Codes 1 and 2), however, the college going rate is the lowest. Another interesting result is that the percentage of STEM majors is the highest for Locale Code 3 (compared to Locale Codes 1 and 2), but the STEM graduation is the lowest. There are several factors that might explain the problem with persistence of the Locale Code 3 students. Locale Code 3 counties have the lowest number and percentage of resources, specifically average number of AP courses offered per high school. There are far fewer advanced education institutions in the county and fewer people living in the county with bachelor's or advanced degrees.

Figure 1 (Appendix) shows a map of West Virginia and how the clustered counties are distributed around the state. The Locale Code 1 counties are the ones with the most resources and are located in areas with larger cities and more higher education opportunities.

Because the NCES codes are the most commonly used in education literature related to rurality, the new Local Code classification was compared to the NCES classification. Table 4 (Appendix) shows the cluster classifications and adds in parentheses the NCES classifications. It can be seen that for each cluster there are multiple NCES classifications. Table 5 (Appendix) shows each of the factors that were considered and their correlation with both classifications. The most important factors were Declared STEM WVU and Graduated in STEM WVU. The new classifications were more highly correlated than the NCES classification for these two factors.

Several counties had the same proposed Locale Code but different NCES codes. For example, Monongalia County and Hancock County both have an NCES code of 13, but Monongalia County is Locale Code 1 and Hancock County is Locale Code 2. The percentage of students from 2010 through 2014 who declared STEM at WVU and persisted through 2020 to graduate with a STEM degree was quite different. For Monongalia County, 17.2% of all students attending WVU declared STEM majors and 52.4% of those graduated with STEM degrees, but for Hancock County, 37.7% declared STEM majors and 29.7% of those graduated in STEM. From this it seems that more students from Hancock County were interested in STEM, but they may not have been able to meet the challenges of the degree requirements, while fewer students from Monongalia County declared STEM majors, but of those that did, a larger percentage of students was able to finish the degree. One explanation could be that Monongalia County offered an average of 6.25 AP courses per high school, while Hancock County only offered an average of 2.7 AP courses per high school. A summary is given in Table 6 (Appendix).

Another interesting example is the comparison of Preston County and Ritchie County, both with an NCES code of 42 but Local Codes of 2 and 3 respectively. For Preston County, 35% of all students attending WVU declared STEM majors and 25% of those graduated with STEM degrees, but for Ritchie County, 46.5% declared STEM majors and 20% of those graduated in STEM. Preston County's one high school offered seven AP courses, while Ritchie County's one high school did not offer any AP courses. It can be seen that having the AP courses in the high school may have been a contributing factor. A summary is given in Table 6 (Appendix).

CONCLUSIONS

This new coding scheme for the state of West Virginia will allow educators, school board members, and legislators to look at locales in a different way than by just using the government standard codes. The codes developed tell us about regions that are better at recruiting students to STEM majors and the regions who have better equipped students to persist in STEM majors at WVU. The locale description of these regions is based on the factors explored. Some of the factors are not easily changed, for example the placement of a higher education institution, but there are others that can be changed, such as offering more AP courses at the high schools.

Results from the present study point towards two tasks for future research. First, due to variations among states, this type of process may be investigated for each state and, if possible, on a detailed level. This paper offers a method for doing this. Second, while this study offers a snapshot of West Virginia counties based on the information collected, more factors should be considered. One such factor that is harder to obtain, but very important, is STEM afterschool or informal learning experiences that students take part in throughout the state. Some regions are rich with these experiences and some are lacking. The project is trying to develop a dashboard so that people offering such STEM experiences can log their activities and this will give us a way to track them by county, which can be added to the analyses.

Limitations of the Study

In an attempt to find the most current information about locale, most of the academic and non-academic data was collected in years 2018-2019, while the WVU student data was from the entering years of 2010-2014 and graduating years of 2014-2020. In addition, only data from WVU was collected and there are many other universities in the state. Using this information as a baseline, further research will be conducted on students at other institutions and the students who have participated in the First2 Network to determine if the proposed locale classification clusters are a better way of determining if students will enter and persist in a STEM degree.

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APPENDIX

Table 1
Correlations between STEM Declared and STEM Persisted and RUCC, NCES, and ERS codes.

Correlation (R and R^2)				
	RUCC - R	RUCC - R^2	NCES - R	NCES - R^2
Declared STEM	0.06	.0036	0.05	.0025
Persist in STEM	-0.12	0.014	-0.17	.0289

Table 2
Result of Clustering West Virginia Counties based on Factors

Locale Code 1	Cabell, Kanawha, Monongalia, Ohio, Wood
Locale Code 2	Berkeley, Brooke, Fayette, Gilmer, Greenbrier, Hancock, Hardy, Harrison, Jackson, Jefferson, Marion, Marshall, Mercer, Mineral, Preston, Rutnam, Raleigh, Randolph, Taylor, Upshur
Locale Code 3	Barbour, Boone, Braxton, Calhoun, Clay, Doddridge, Grant, Hampshire, Jefferson, Lewis, Lincoln, Logan, Mason, McDowell, Mingo, Monroe, Morgan, Nicholas, Pendleton, Pleasants, Pocahontas, Ritchie, Roane, Summers, Tucker, Tyler, Wayne, Webster, Wetzel, Wirt, Wyoming

Table 3

Cluster (Locale Code) Centroids

Variable	Cluster 1 Centroid	Cluster 2 Centroid	Cluster 3 Centroid
Number of Libraries	8.4	4.15	2.6
Number of Museums	7.6	3.25	1.7
Number of STEM Museums	1	0	0.03
Public Transit	1.2	0.8	0.47
Number of Advance Ed. Inst.	6	2.15	0.63
Average Number of AP Courses per/HS	5.35	4.74	2.06
Percent Population of HS Grad	89.62	85.81	80.75
Percent Population w/Bachelors	28.8	18.7	11.19
Percent Population w/Advanced Degrees	4.08	1.58	1.37
Percent HS 4-year Graduation	91.01	92.58	92.71
Percent College Going	57.02	49.5	45.75
Median HS Size	1370.4	709.6	481.8
Percent Rural HS (NCES)	44.4	47.4	91.66
Declared STEM WVU	25.7	23.9	29.7
Graduated in STEM WVU	43.5	42.3	29.8

Table 4

Table of Proposed Locale Codes with NCES Codes in Parentheses

Locale Code 1	Cabell (13), Kanawha (22), Monongalia (13), Ohio (13), Wood (13)
Locale Code 2	Berkeley (22), Brooke (41), Fayette (23), Gilmer (33), Greenbrier (42), Hancock (13), Hardy (41), Harrison (32), Jackson (32), Jefferson (41), Marion (23), Marshall (32), Mercer (32), Mineral (41), Preston (42), Putnam (22), Raleigh (41), Randolph (33), Taylor (32), Upshur (41)
Locale Code 3	Barbour (42), Boone (42), Braxton (43), Calhoun (43), Clay (42), Doddridge (43), Grant (33), Hampshire (42), Lewis (41), Lincoln (42), Logan (32), Mason (43), McDowell (32), Mingo (42), Monroe (42), Morgan (42), Nicholas (41), Pendleton (42), Pleasants (32), Pocahontas (43), Ritchie (42), Roane (41), Summers (31), Tucker (43), Tyler (42), Wayne (41), Webster (43), Wetzel (32), Wirt (42), Wyoming (42)

Table 5

Correlation of Factors versus NCES Codes and Proposed Locale Codes

Variable	**NCES (R)**	**Locale Codes (R)**
Number of Libraries	-0.47	-0.61
Number of Museums	-0.55	-0.64
Number of STEM Museums	-0.50	-0.51
Public Transit	-0.23	-0.45
Number of Advance Ed. Inst.	-0.52	-0.67
Average Number of AP Courses per/HS	-0.41	-0.61
Percent Population of HS Grad	-0.54	-0.59
Percent Population w/Bachelors	-0.63	-0.81
Percent Population w/Advanced Degrees	-0.31	-0.35
Percent HS 4-year Graduation	-0.01	0.11
Percent College Going	-0.38	-0.45
Median HS Size	-0.49	-0.67
Percent Rural HS (NCES)	0.59	0.62
Declared STEM WVU	0.05	0.24
Graduated in STEM WVU	-0.17	-0.37

Table 6
Comparison of the Two Counties with NCES Codes 13 and Different Locale Codes and Two Counties with NCES Codes 42 and Different Locale Codes

Factors	Monongalia NCES 13 LC 1	Hancock NCES 13 LC 2	Preston NCES 42 LC 2	Ritchie NCES 42 LC 3
Number of Libraries	7	3	2	2
Number of Museums	6	2	5	3
Number of STEM Museums	2	0	0	0
Public Transit	1	1	1	0
Number of Advance Ed. Inst.	3	2	0	0
Average STEM Related AP Courses per HS	6.25	2.7	7	0
Percent Population of HS Grad	91.6	87.2	91.2	81.9
Percent Population of Bachelors	39.2	18.2	14.6	10.4
Percent Population of Advanced Degrees	8	1.2	1.1	0.09
Percent HS 4-year Graduation	91.5	96.6	91.2	93.62
Percent College Going	59.9	45.1%	35.6	50
Median HS Size	1310	603	1202	436
Percent Rural HS (NCES)	67	50	100	100
Started or Added STEM WVU	17.2	37.7	35	46.5
Graduated in STEM WVU	52.4	29.7	25	20.0

Figure 1

Map of West Virginia with Locale Codes Indicated by Color