White Paper

Exploring Rural/First Generation Retention and Degree Selection at West Virginia University

Dr. John Stewart
West Virginia University
Department of Physics and Astronomy
For the First2 INCLUDES Alliance
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This document examines the major selection patterns and retention to degree of undergraduate students at West Virginia University (WVU). We accessed the course records of all students who were enrolled as undergraduates at West Virginia University's (WVU) Morgantown campus from 2000 to present; 146,000 students. We restricted the dataset to US citizens who were admitted as First Time Freshman beginning after the Fall 2005 semester when WVU began collecting reliable first-generation data. This work only analyzes students who have chosen to enroll in college; it cannot inform the discussion of the decision enroll in college.

Definitions

STEM Classification: For this paper, we divide students into four classes by their declared major: Non-STEM, Agriculture, Life Sciences including biology and health professions, and Physical Sciences including engineering, math, chemistry, and physics.

Rural/Urban Classification: The National Center for Education Statistics (NCES) locale codes were used to code each student's high school. The codes are as follows:

City – Large (11): Territory inside an Urbanized Area and inside a Principal City with population of 250,000 or more.

City – Midsize (12): Territory inside an Urbanized Area and inside a Principal City with population less than 250,000 and greater than or equal to 100,000.

City – Small (13): Territory inside an Urbanized Area and inside a Principal City with population less than 100,000.

Suburban – Large (21): Territory outside a Principal City and inside an Urbanized Area with population of 250,000 or more.

Suburban – Midsize (22): Territory outside a Principal City and inside an Urbanized Area with population less than 250,000 and greater than or equal to 100,000.

Suburban – Small (23): Territory outside a Principal City and inside an Urbanized Area with population less than 100,000.

Town – Fringe (31): Territory inside an Urban Cluster that is less than or equal to 10 miles from an Urbanized Area.

Town – Distant (32): Territory inside an Urban Cluster that is more than 10 miles

and less than or equal to 35 miles from an Urbanized Area.

Town – Remote (33): Territory inside an Urban Cluster that is more than 35 miles from an Urbanized Area.

Rural – Fringe (41): Census-defined rural territory that is less than or equal to 5 miles from an Urbanized Area, as well as rural territory that is less than or equal to 2.5 miles from an Urban Cluster.

Rural – Distant (42): Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an Urbanized Area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an Urban Cluster.

Rural – Remote (43): Census-defined rural territory that is more than 25 miles from an Urbanized Area and also more than 10 miles from an Urban Cluster.

LOCALE code 41 (Rural Fringe) contains high schools that would not be considered rural by most West Virginians (Wheeling, WV). This paper uses LOCALE codes 42-43 as the variable VeryRural, LOCALE 41 as Rural.

First-Generation Status: First generation status was self-reported by the student during admission and is taken from WVU records.

Math Entry Point: The student's placement in the first mathematics class in college is a key predictor of success in retention models. Math Placement Codes are divided into two classes:

Not Calculus Ready
- M122 - For students not ready to take college algebra.
- M126 - College Algebra (requires 3 semesters of remediation)
- M129 - Pre-calculus

Calculus Ready
- M153 - Two semester stretch calculus (Stretch Calculus) taken by students unprepared for Calculus 1
- M155 - Normal Calculus 1 - Preferred entry point for physical scientists
- Advanced - Enters at a class later than Calculus 1 due to AP or Transfer Credit

Major Selection Rates

First, the major selected by all students in the dataset were examined for differences by Rural/Urban and First-Generation Status. First-generation students elect STEM majors at the same rate as other students with higher rates of life sciences and lower rates of physical science and engineering as shown below:

	Non-STEM	Agriculture	Life Sciences	Physical Sciences
First Generation	47%	5%	28%	21%
Not First Generation	46%	4%	25%	25%

Rural students elect STEM majors at a higher rate than urban students, but again with a slight preference for life science majors over physical science majors as shown below. This graph compresses the LOCALE codes into a 12 point spectrum with LOCAL 11=1 and LOCALE 43=12.
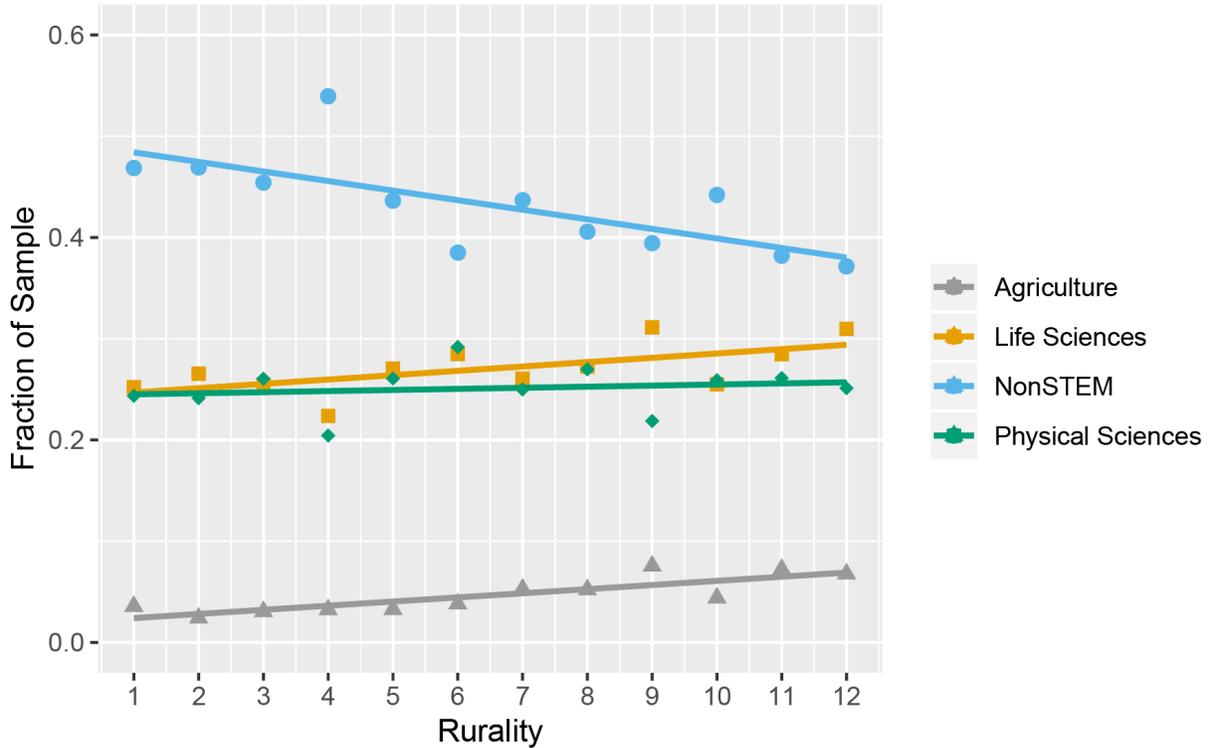
College Preparation

We can also examine differences in the level of college preparation. Rural and non-Rural students have similar high school preparation and college success metrics but tend to take more transfer classes and fewer AP classes as shown below:

	High School GPA	ACT Math Percentile	College GPA	AP Class Taken	Transfer Class Taken
Not Rural (Locale 11-32)	3.4	61%	2.8	16%	38%
Rural (Locale 41)	3.5	60%	2.8	17%	43%
Very Rural (Locale 42-43)	3.6	60%	2.8	11%	53%

First-generation students have somewhat weaker academic metrics; particularly concerning is the difference in college GPA.

	High School GPA	ACT Math Percentile	College GPA	AP Class Taken	Transfer Class Taken
First Generation	3.4	56	2.6	11%	35%
Not First Generation	3.5	62	2.9	17%	42%

College Success

We can also examine whether students ultimately matriculate and earn a degree. Rural students graduate at the same rate as other students (differences are not statistically significant).

	Graduation Rate Non-STEM majors	Graduation Rate Physical Science Majors
Not Rural (Locale 11-32)	60%	67%
Rural (Locale 41)	61%	68%
Very Rural (Locale 42-43)	57%	65%

First-generation students graduate at a lower rate ($p<0.001$). This is overall graduation not graduation with a STEM major.

	Graduation Rate Non-STEM Majors	Graduation Rate Physical Science Majors
First Generation	50%	56%
Not First Generation	62%	69%

Physical Science, Math, and Engineering Majors

We will now focus on Physical Science, Math, and Engineering Majors; a similar analysis will be performed for Life Sciences majors at a later time. For these students, rural students have similar high school preparation and college success metrics, but tend to take more transfer classes and fewer AP classes as before.

	High School GPA	ACT Math Percentile	College GPA	AP Class Taken	Transfer Class Taken
Not Rural (Locale 11-32)	3.6	76%	2.9	36%	43%
Rural (Locale 41)	3.7	76%	2.9	36%	46%
Very Rural (Locale 42-43)	3.7	75%	2.8	22%	55%

First-generation students also have the same pattern of weaker preparation metrics and lower college GPA:

	High School GPA	ACT Math Percentile	College GPA	AP Class Taken	Transfer Class Taken
First Generation	3.6	71%	2.7	26%	40%
Not First Generation	3.7	77%	2.9	37%	45%

Again, rural students graduate at the same rate with STEM degrees as other students (differences are not statistically significant).

	Graduation with STEM Major	Graduation with Non-STEM Major	Does Not Graduate
Not Rural (Locale 11-32)	53%	16%	31%
Rural (Locale 41)	57%	14%	29%
Very Rural (Locale 42-43)	52%	16%	32%

First generation students do not graduate with STEM degrees at the same rate; this is because they do not graduate at a higher rate.

	Graduation with STEM Major	Graduation with Non-STEM Major	Does Not Graduate
First Generation	44%	15%	41%
Not First Generation	57%	16%	28%

Math Entry Point

We define student's Math Entry Point is the first mathematics class they take at WVU. For physical science students, academically prepared for college, the math entry point should be Calculus 1 or a class more advanced than Calculus 1. Math Entry Point is a crucial predictor of college success for Physical Science students as shown below:

	Graduation with STEM Major	Graduation with Non-STEM Major	Does Not Graduate
Advanced	80%	6%	14%
Calculus 1	70%	8%	21%
Stretch Cal 1	54%	13%	33%
Pre-Calculus	38%	26%	36%
Algebra	30%	26%	44%
Pre-Algebra	3%	65%	32%

The math entry point of rural students is significantly different than non-rural students (p<.001) with fewer students calculus-ready.

	Locale 11-32 Not Rural	Locale 41 Rural	Locale 42-43 Very Rural
Advanced	12%	10%	4%
Calculus 1	34%	35%	26%
Stretch Cal 1	20%	21%	19%
Pre-Calculus	5%	5%	7%
Algebra	28%	28%	42%
Pre-Algebra	1%	1%	2%

The math entry point of first-generation students is significantly different than non-first-generation students (p<.001) with fewer first-generation students calculus-ready.

	First Generation	Not First Generation
Advanced	9%	12%
Calculus 1	26%	35%
Stretch Cal 1	22%	20%
Pre-Calculus	4%	5%
Algebra	37%	27%
Pre-Algebra	2%	1%

Non-Cognitive Factors

Factors other than academic preparedness have been shown to be important to understanding college retention. The First2 project is measure a broad suite of non-cognitive factors for students in physics and mathematics classes at WVU. These measurements are being replicated across the First2 Network. For this paper, we will focus on the student's self-efficacy and their sense of belonging. Self-efficacy, the student's belief that they can be successful in class was measured in 5 domains: current mathematics class, other math classes, other science classes, classes in their major, and success in the profession. The student sense of belonging was measured in five domains:

Self-Efficacy toward Stretch Calculus: Rural and First Generation students showed similar self-efficacy toward M153 (Stretch Calculus) as other students (measured on a 5-point Likert scale); First-generation student's self-efficacy was slightly lower.

	Not Rural	Rural	Very Rural
Current Class	3.8	3.9	3.9
Other Math Classes	3.9	3.9	4.0
Other Science Classes	3.9	4.0	4.1
Majors Classes	3.9	4.0	4.1
Functioning in the Profession	4.1	4.2	4.3

Self-Efficacy toward Normal Calculus: Rural and First-Generation students also showed similar self-efficacy toward M155 (Calculus 1) as other students (measured on a 5-point Likert scale).

	Not Rural	Rural	Very Rural
Current Class	3.8	3.7	3.6
Other Math Classes	3.9	3.9	4.2
Other Science Classes	4.0	3.9	4.1
Majors Classes	4.1	3.9	4.1
Functioning in the Profession	4.2	4.2	4.4

Belonging in Stretch Calculus: Rural and First-Generation students showed similar sense of belonging in M153 (Stretch Calculus) as other students **(measured on a 6-point Likert scale**).

	Not Rural	Rural	Very Rural
Current Class	4.7	4.6	4.5
Other Math Classes	4.6	4.5	4.5
Other Science Classes	4.5	4.6	4.5
Major Department	4.8	4.8	4.7
WVU	5.1	5.0	4.8

Belonging in Normal Calculus: Rural and First-Generation students showed similar sense of belonging in M155 (Calculus 1) as other students **(measured on a 6-point Likert scale**). Differences are not statistically significant.

	Not Rural	Rural	Very Rural
Current Class	4.6	4.8	4.7
Other Math Classes	4.6	4.8	4.7
Other Science Classes	4.7	4.8	5.0
Major Department	4.8	4.9	5.0
WVU	5.1	5.2	5.3

Conclusions

Rural students elect STEM majors at a higher rate than non-rural students (physical science is about the same). First generation students elect STEM majors at the same rate as well. Rural students graduate at the same rate as non-rural students, but first-generation students do not. Math readiness is a crucial factor

affecting students college success. Rural and first-generation students are math ready at lower rates than other students. The self-efficacy and sense of belonging of rural and first-generation students is strikingly similar to other students.